

**AN EVALUATIVE FRAMEWORK FOR THE APPRAISAL OF
THE PLANNING ROLE IN SMART CITIES**

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Abstract

Utilising a sequential mixed-method design to investigate the relationship between planning and smart city development; this thesis aims to work toward an integrated response to these challenges through the provision of an evaluative framework for planning smart cities. Such a framework would act as a medium in recommending a future role and direction for the sector of planning and would aim to build upon the opportunities of technology found in smart cities. Such opportunities include improving the weaknesses of traditional-delivery-methods of development in what the thesis broadly views as an analogue approach to the future of cities challenge in a digital world. The thesis employs a grounded-theory approach to data analysis in phase one, before quantitatively analysing planning policy in phase two and comparing these measurements to questionnaire data in phase three to produce an evaluative framework for the role of planning in smart cities.

This linkage via sequential steps for data collection and analysis is reflective of the holistic approach of planning as a profession, whereby a consultative process for expertise in the fields of transport, the environment, heritage and infrastructure combine to form a cohesive system of the built environment; leading this thesis to advocate for an introduction of a digital peer if cities are to be smart about their transformation. In being knowledgeable about this transformation the study's main findings break down the cycle of data in smart cities to data capture, data communication, data processing and data production; before relating these to smart city development principles that combine with the project phases of planning developments to form quadrants, or areas of opportunity, for planning smart cities – building upon the strengths of planning to improve the capacity of cities in operating throughout the new environment of the digital world.

1 Introduction

1.1 Research background

By the end of the current century, it is estimated that ten billion people will inhabit Earth, with 8.5 billion of these people inhabiting cities (World Economic Forum, 2014). The UN (2016), in their *Report of the United Nations Conference on Sustainable Development*, detail the battle cities face in catering for the needs of these people and safeguarding the global society through pressing challenges posed to infrastructure, resources, housing and waste through this increased demand and needs of the growing population. In keeping with the notion of sustainable development, the Royal Town Planning Institute (2017) in their position paper for strategic planning: 'Smart City-Regions' highlight the role of data and technology in supporting local authorities' provision of strategic planning. The paper points to a number of pressing challenges for the UK that include a housing crisis, low productivity, high levels of inequality and the need to transition to a low-carbon economy as issues that can be resolved by strategic planning. As the thesis will later go on to explain, these 'issues' are one part of a larger debate formed by the British Standard's Institute who advocate smart cities as a solution to the future of cities challenge (2014) whereby technological advancements and application in a physical setting help to overcome matters such as climate change, over-population and energy efficiency; while the RTPI examples provided above are specific issues that are subject to specialist requirements of planning and as such help to frame the context of urban planning within the wider ecosystem of thought for smart cities. In achieving such an aim, the RTPI (2017) emphasis the role of technological innovation as a solution for local authorities in calling for leadership of governance in the planning sector to create 'smart city-regions'.

As is discussed by various authors including Angelidou (2017), the present agenda for smart cities has to date been dominated by voices of a

predominantly technological background – and more specifically, technological stakeholders such as IBM; who term their own smart city definition within the chasm of an ‘instrumented, interconnected, and intelligent city’ (IBM, 2011) as the thesis will document in *defining the smart city* (2.1.1). Expanding upon this, the literature review builds upon previous observations of Angelidou (2015) to differentiate between application demands and technology suppliers as large international technology companies, such as IBM and also Cisco, provide the software that underpins projects while smaller-sized companies design and develop smart city projects on more localised regional and national scale.

Localism of course, whereby planning decisions and guidance are focused on more local scales was a key consideration of the Localism Act (2014) that introduced legislation for planning authorities to enable greater degrees of control for citizens of neighbourhoods throughout the United Kingdom. There are two important points to note here, as citizens are pushed toward the centre of smart city solutions by Partridge (2004) and Rios (2008) as drivers for smart city solutions, while Batty (2013) talks about a ‘new guise’ for planning in ensuring local solutions from what are often global smart city stakeholders providing solutions. It is within this context that local authorities are quite often spectators whereby funding from non-governmental organisations often operating at national and international levels decide which initiatives are funded. The European Union’s Horizon 2020 funding programme is an example of this as the primary funding vehicle for smart city solutions throughout the UK, often requiring a partnership approach to bids on an international scale; and while it is accepted that successful bids have been realised from this model of implementation, the thesis will go on to question how appropriate this multi-national model can be for providing localised solutions.

The movement within which the relationship between planning and smart cities are increasingly becoming debated is prevalent when understanding the significance of ‘splintering urbanism’, introduced by Graham and Marvin (2001), who detail the concerning influence technology is having on people’s

lives and question how this occurrence affects the traditional concepts of town planning shaping society through the places within which people live. Again, the private sector is highlighted as the primary tool within which the manufacture of environments is taking place, leading the thesis to again ask what role local governance should have as custodians in this process.

Following on from this, while it is accepted that a free-market society has grown throughout the global economy and thereby UK planning sector, with localism acts allowing for more development to take place without the requirement of local authority input, what the thesis questions is would a more prominent local authority policy be beneficial, especially when considering how governance can ensure investment, through data produced by citizens results in outcomes for citizens. The questions that then arise are how effective is the duty to cooperate in terms of facilitating the smart city? It is not enough for data to be collected in one place and then stopped from crossing an administrative boundary. Suzuki (2015) is a key author in this sense, who introduces the notion of data as an infrastructure of the smart city; detailing the various challenges and processes of smart city stakeholders in navigating the new world of data in traditional sectors. It is in essence within this same view that the thesis observes the pace at which technology is advancing and advocates for a response that requires a planning policy that is as adaptable and flexible as these innovations, applying this thought to the specific sector of planning, within the wider ecosystem of the built environment, debating the various roles of the public and private sectors in achieving the often grandiose visions of smart cities (Angelidou, 2017), as well as asking what role do citizens have in the transformational process.

1.2 Research Aim and Objectives

The following aim and objectives steered the thesis toward the pursuit of answering the research question which was: Is planning policy sufficient in operating throughout the digital age of smart cities?

Research Aim

To provide an evaluative framework for assessing the role of planning in smart cities.

Research Objectives

The following objectives were set in order to ensure the research investigation appropriately meets the research aim highlighted above:

- a) Identify key components of the smart city
- b) Critically assess planning policy in relation to the smart city concept
- c) Probe the relationship between smart city development and planning policy
- d) Compare where planning policy is today and where it needs to be tomorrow
- e) Recommend a path for planning moving forward to develop smart cities

By achieving the above, gaps in knowledge highlighted throughout chapter 1 will be met and the following contributions to knowledge made.

1.3 Gaps in knowledge

As the thesis will later go on to demonstrate, there is at present an 'analogue' outcome of existing planning policy that is inept at operating throughout the digital age of the smart city. However, the research investigation that produced this outcome began with an observation of wider literature that an

absence of appropriate local planning policy creates an absence of coordination between the planning sector of local authorities and smart city solution providers, resulting in lost opportunities for solutions to local challenges (Kitchin, 2015) due to the presently singular approach of smart cities that leads to a narrative unique to the stakeholder, as opposed to the city.

As Mattoni et al. (2014) state, a city is not a single, non-communicating urban structure but it is linked to the various sectors combining to form a linked organism. Mattoni et al. (2015) in a later work expands upon this point to claim there is an absence of planning methodology for smart cities, questioning the role of planning in specific relation to smart city development. Rodriguez and Meijer (2015) meanwhile note the growing role of urban technologies in functioning urban systems, before later going on to make the point that governments need to rethink the role they play in a knowledge-based society thereby forming a consensus that there is a very real juxtaposition between traditional planning and the planning of smart cities.

Kitchen (2014) in earlier work describes how “data is viewed as an essential constituent material to realising the smart city vision... And yet, there has been to date little critical focus on the new forms of data being produced (or not produced), how they are being mobilised by business, government and citizens, and the implications of real-time data analytics” (p. 2-3, 148-3) leading the thesis to put forward the case that planning is a profession that is ideally placed to bring together such big data for the city due to its cross-sectoral approach to development where the importance of such a data model is observed by Suzuki (2015) who notes the increasingly influential role of data in society terming the phenomenon as a ‘data infrastructure’ whereby interconnected devices and city data increase as sources to require a management system that reduces the potential for inefficiency, duplication and unreliability.

Moving the discussion from the city, to data, and now planning of the city through new forms of data; Batty (2013) introduces city planning as needing

a 'new guise' that thinks of cities in a new way - noting most theory with regards to urban studies and planning focuses on the long-term and is not appropriate to support the demands of 'new horizons' of the smart city on shorter timescales as real-time data creates new demands and possibilities – and arguing for 'new theory' that is needed to address such issues. Widening the scope, Belanche et al. (2016) call for 'better city planning' to achieve sustainable development of smart cities just as Afzalan et al. (2015) say planning organisations and communities should consider the adoption of new technologies in the decision-making process - further reinforcing the thesis' view that a planning solution to smart cities is demanded and not at present supplied.

In concluding, the thesis advocates that new policies for sustainable urban planning are required in order to reduce the uncertainty and complexity of the smart city (Taleb, 2013). In calling for these new approaches, Taleb (2013) seeks quantitative solutions to what were previously thought of as qualitative industries (planning being one example) and as such a research investigation was pursued with the aim of targeting a response to the planning system in relation to smart city development that integrated these dynamics – as the sector is responsible for taking a leadership role in shaping the future of cities by stepping out of the 'analogue' age and into the 'digital' age.

1.4 Conclusion

The above chapter has introduced the background to the research, forming the rationale by which the research investigation aims to fill in the gaps in knowledge. The thesis will now go on to provide an overview of literature that highlights the relationship between smart cities and town planning, before going on to introduce the research investigation and concluding with outcomes of the study.

2 Representation of literature highlighting the relationship between Smart Cities and Town Planning

The following chapter is split into sections titled smart cities; data and the smart city; planning smart cities; and analysing smart cities each of which details various paradigms of their own respective domains. Beginning with smart cities (2.1), the literature review presents the wide-ranging definitions of the smart city, before expanding upon this in conceptualising the smart city and understanding the smart city concept. Data and the smart city (2.2) introduces information as the resource of the smart city and links this to the formulation of the knowledge economy – providing a wider-societal view of the impact of smart cities. At this point, the literature review turns attention to the relationship between town planning and smart city development, as planning smart cities (2.3) provides a background to planning as a profession through theory and practice before analysing smart cities (2.4) brings the chapter to a conclusion, focusing on the various academic, public and private smart city initiatives that are identified as influencing the progression of smart city development.

2.1 Smart cities

As the Royal Town Planning Institute (RTPI, 2017) state; technologies have always influenced how we plan the growth and future development of cities through their transformations. And it is perhaps fitting that the tone for the thesis is set with this perspective in that smart cities are debated from a built environment viewpoint - more specifically one of town planning – for which the RTPI are the principal body supporting planning professionals throughout the UK. From rather an alternative perspective then, yet one that is, however, still in keeping with the theme of technologies influencing the development of cities, Angelidou (2017) builds some common ground by highlighting the role technologies, in approximately 20 years of smart city history, have had in shaping varying social and economic developments in cities. As a key author for the subject, Angelidou (2015) in previous works lists variances of such

moulding techniques that it is argued technologies have had, and continue to have, on cities as advancing the knowledge and innovation economy as well as applying smart city products to urgent sustainability and efficiency requirements – an introduction to the notion of timing that coincides with the shaping of smart cities – a concept Batty (2013) introduces as a time and space paradigm for using urban data to plan smart cities.

Before moving beyond this paradigm of the relationship between planning and smart cities, however, the thesis must firstly verify what is meant by the term: smart city?

2.1.1 Defining the smart city

To generally summarise the consensus of much wide literature regarding the subject of defining the smart city, there is no universally accepted definition with many differing views prioritising alternative prospects at the heart of the subject and jostling for position. And this position – whereby there is no universal definition as to what constitutes a smart city – is the viewpoint of the thesis, as smart could have one meaning for one city and a separate meaning for another. This view is neatly summed up by Albino et al. (2015) who note there is some confusion as to what a smart city is.

What is certain, however, is that Information Communication technology (ICT) unifies the majority of attributions to the term, and while it could be argued that the absence of a universally accepted definition as to what constitutes a smart city makes it difficult, if not impossible, to determine if a city is actually 'smart' one should not misinterpret this dilution as an absence of direction, as there is an abundance of aspirational values providing means of objectives for cities in striving for smartness. Vanolo (2014) in fact notes this ambiguity as healthy for the concept, while Abella et al. (2017) point to the extensive use of definitions as the reason why no one definition has arisen to such prominence. Perhaps then we should seek to replace the term 'smart' with that of 'smarter' to reflective the constant evolutionary process of

the city in what is ultimately a journey, as oppose to a destination – after all, ecosystems are never static. To use the term ‘smarter’, however, may in fact require the permission of IBM, who have registered a trademark for the term ‘smarter cities’ along with ‘smarter energy’, ‘smarter traffic’ and ‘smarter water’ amongst others.

Nonetheless, such influence which the technology companies, and the technology agenda more broadly, have had for the introduction of the ‘smart’ to the ‘city’. However, it now seems fitting to begin to work towards defining the concept of the smart city within the context of the thesis so that the reader has some idea as to the angle within which the study regards the scope of the research.

For the purpose of the research investigation then, the thesis adopts the definition of the smart city provided by the British Standards Institute (2014) that smart cities are the:

“effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens” (p. 4 | 2-3).

It is felt that this definition, as opposed to those presented in table 1. below, meet all the requirements for the planning perspective of the thesis. This is due to firstly, the inclusion of the term ‘sustainable’ that is a key planning principle supported by national and international policies. Secondly, the description of multiple systems – physical, digital, and human – highlights the key pillars of which smart cities are built upon. And finally, specific mention of the built environment is made; thereby firmly placing the definition within the scope of the research investigation.

As has been discussed, alternative definitions can be found throughout literature, and the above is by no means the most universally accepted definition. In keeping with the above adoption, however, and in the interest of presenting a representative picture of wider literature, below can be found an

overview of the various smart city definitions that the thesis presents within the systems of physical, digital, and human perspectives:

Table 2. 1 Smart city definitions categorised in digital, physical, and human system ideological perspectives

Smart city definition catalogue	
Digital perspective	
IBM (2011)	An instrumented, interconnected, and intelligent city. Instrumentation enables the capture and integration of live real-world data through the use of sensors, kiosks, meters, personal devices, appliances, cameras, smart phones, implanted medical devices, the web, and other similar data-acquisition systems, including social networks as networks of human sensors. Interconnected means the integration of those data into an enterprise computing platform and the communication of such information among the various city services. Intelligent refers to the inclusion of complex analytics, modelling, optimisation, and visualisation in the operational business processes to make better operational decisions.
Hollands (2008)	Utilisation of networked infrastructure to improve economic and political efficiency and enable social, cultural, and urban development.
Physical perspective	
Hall (2000)	A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better organize its resources, plan its preventive maintenance activities, and monitor

	security aspects while maximizing services to its citizens.
Quwaider et al. (2016)	A city is called smart if it uses information technology for data communication in order to improve the performance and quality of the civil services, decrease the consumption of the resources and involve interactive applications and active services with people
Human perspective	
Partridge (2004)	A city where ICT strengthens freedom of speech and accessibility to public information and services.
Rios (2008)	A city that gives inspiration, shares culture, knowledge, and life, a city that motivates its inhabitants to create and flourish in their own lives.

Presentation within the above systems is an option to highlight the broad and inclusive nature of the definition. It is also an attempt to represent the methodological theory of town planning in that varying interests are balanced in concluding. 'Ideological perspectives' (Hollands, 2008) is another way to describe the above presentation of definitions. Hollands (2008) describes such attempts as 'self-congratulatory' due to their convenience to one specific sector alone – something which cannot be said about the adopted definition provided by the British Standards Institute – the national standards body of the UK that the thesis will go on to use as an example of leading smart city model suppliers in section 2.2.1 *Analysing smart cities*.

In respect of the contents of table 1, and in the interest of validity, it could be argued that the many adaptations of the smart city definition are what creates such a fruitful field of theory and literature. Not only this, but even those placed within an ideological perspective are required to work alongside one another and should not be read in isolation. Human capital requirements are pivotal, for example, to the success of projects characterised by

technological implementations as the ability to take products and provide services to citizens goes further than simply supplying technology.

This notion of human input and skills, that work in tandem with technological innovations, is a concept the thesis supports and will now present within the wider argument for an increased role of planning in smart city development. Angelidou (2017) highlights this stance in the study of smart cities not only by architects and planners but also by alternative disciplines closely related to the subject of the built environment – economists, geographers and engineers for example. Smart cities, it is argued, are now a multidisciplinary interest that is constantly shaped by thinking in urban development, economic growth and urban technology.

2.1.2 Conceptualising the smart city

According to the United Nations (2014), the single greatest challenge facing mankind over the next 50 years is the accelerating growth of cities. To place this statement into context, the global population is forecast to exceed 9 billion people by 2050 (British Standards Institute, 2014) while it is estimated by the World Health Organisation (2010) that 8 out of every 10 people born into the world will reside in cities – this is compared to just 4 out of every 10 in 1990. Such intensifying processes of urbanisation, it is argued, have historically been associated with alternative economic and social transformations of importance (UN, 2014). These transformations have continuously been achieved through meeting the challenges of the society at that moment in time, and the technological innovations of the corresponding era have often shaped the utopian visions of a future society moulded by the scientific innovations of the period; thereby posing the question: how will today's society respond to this modern-day challenge?

Hodson et al. (2017) note how processes of global urbanism provide political-economic conditions of possibility for experimentation. And information communication technology (ICT) as the undoubted scientific

innovation of this modern-day period has produced smart cities as the solution to the future city challenge. ICT's opportunities are primarily non-visual entities whereby software and the accumulation of data are viewed as the answer to the future cities challenge that encompasses the future growth and health of cities and communities on a global scale and incorporates the trends of population and urbanisation (British Standards Institute, 2014) highlighted above. The notion of non-visual significance is reinforced by Angelidou (2015) who believes smart cities as a form of 'urban futures' exceed the inertia of physical structures that define physical space. The thesis views this as a conceptual 'digital layering' of the smart city that works within, around, and beyond the physical dimensions of space and time – something the thesis will go on to describe in more detail in section 2.2 *Data*. Batty (2013) introduces the idea that urban data, while sitting independent of such boundaries, is tagged to the physical layer of the spatial and urban city.

In the absence of such a response to meet these urban future challenges, it is debated that consequences would lead to increased poverty (Department for International Development, 2010), disease epidemics (World Health Organisation, 2005), and climate change (Moir et al., 2014). Gasco-Hernandez (2018) meanwhile states as well as the above challenges, in order to prevent and manage the competitive edge of cities with one another innovation of city governance must become smart, and the setting is therefore set whereby the importance of an appropriately equipped response to the seriousness and diversity of challenges faced is sought. If we concentrate on the example above of climate change then, as this is an environmental challenge firmly placed within the bounds of the built environment and thereby a 'hard' concept – while also admittedly influenced by 'soft' concepts such as population travel habits – there are two avenues that work alongside the technological innovations prescribed and these are adaptation and mitigation. A combination of immediate solutions as well as long-term planning is therefore required alongside the facilitation of ICT. This is, in essence, how many commentators (Angelidou, 2015; Cohen, 2015; and Schaffers et al., 2012) view the role of the smart city – not simply as a novel evolution of city planning, but rather as a serious 'reality' by which a

response to the impending crisis facing cities will have a profound effect on the global community's ability to develop sustainably as more and more people begin to populate an increasing number of the same densely populated places (UN, 2014). Such crises should not, however, define the future city in replacement of the wider building of society. This is reinforced by the European Union's (2011) commission of a shared vision for the future of European cities as places of advanced social progress; with a higher degree of social cohesion; socially-balanced housing as well as social, health, and education services for all; as platforms for democracy, cultural dialogue, and diversity; places of green, ecological, or environmental regeneration; and finally, places of attraction and engines of economic growth. Perhaps in the same 'glass-half-full' tone Schaffers et al. (2012) view smart cities as a 'promise' for the future built upon freedom, creativity, opportunity and prosperity. The thesis would argue though that in order to realise such visions for the future of cities requires more than simply introducing technology to the built environment. Rather a combination of such technological advances coupled with the skill and policy-set to compliment them is paramount.

To summarise, the debate surrounding the challenges we face (the future of cities) and the response to these challenges (smart cities) is viewed by the thesis as a complementary relationship whereby one must separate the 'disease' from the 'remedy'. This analogy implies that the smart city solution will indeed bring with it the emergence of a new symptom – be it perhaps data security and privacy (privacy paranoia) or generational isolation (social seclusion) in a digital world – most certainly there will be some symptoms that are unforeseen at this present time. This symbiotic relationship therefore creates a curative action of a continuously evolutionary process of cities that goes far beyond the smart city concept we are experiencing now. A potential crisis, however, should not be confused with the very real crisis we do face that is documented above. Yet it should be mentioned that within every crisis there is danger and opportunity, and while much of the commentary preceding this point has concentrated on the dangers we face – so as to set the background to the emergence of the concept – it should not be forgotten

that there is also an opportunity to create a lasting legacy via a vision for the future that is the best it can be. And it is on this note that the thesis now introduces the opportunities that smart cities promise to present.

2.1.2.1 Opportunities

In the face of the background to the future of cities debate Stonor (2014) cites the challenges of rapid urbanisation on a global scale as providing the opportunity to create strikingly new forms of city living that are supported by smart technologies. Batty (2013) builds upon this from a practical point of view to describe how city planning in the digital age can become a 'new guise' whereby previously impossible opportunities to plan on smaller and smaller time periods are realised via technological advancement – where previously we may have planned over years or decades, as demonstrated through the 20 year period for local plan planning policies, Batty (2013) notes how smart cities can become plannable over a sense of minutes, hours and days with real-time data.

Technologically-literate organisations are grasping the opportunity of the explosion of data (Stoner, 2014) to operate differently in their behaviour by building databases on urban performance, analysing patterns within the data, and creating future plans in a more robust manner. In essence, a new, evidence-informed analytical approach to planning is emerging that reduces uncertainty and limits risk in future decision-making on many levels.

To realise such opportunities, however, Roseneberg (1982); Bresnahan and Trajtenberg (1995); Helpman (1998) and Powell and Snellman (2004) all call for organisational and social adaptations as requirements. And while these older aged of literatures may have been written at times of immaturity for society to the opportunities of technological advancement, the theme reoccurs as Cader (2008) states: "the proliferation of information along with technology development has highlighted the need for an appropriately trained labour force capable of managing and manipulating both the

technology and the information thereby available” (p. 3, l 93-97) leading the thesis onto the negative observations attributed to smart cities transformations to date within a wider motivation to constructively criticise the concept for its greater good.

2.1.2.2 Criticisms

Perhaps most appropriately highlighting the gap between the above promise and the present reality are Salvati et al. (2013) who note the vague contribution of smart cities to sustainable development; an observation that reinforces the thesis’ conception that there is a valley between current smart city development and urban planning. Hollands (2008) views this absence of contribution as a form of ‘urban-labelling’ (attributed to the term ‘smart city’) that is more of a marketing technique as oppose to a justified urban solution to city challenges. Such use of the label ‘smart city’ utilised by city administrators and politicians is therefore an urban promotion (Van Den Bergh and Viaene, 2015) as oppose to a replicable approach providing solutions to localised challenges. Perhaps in an attempt to justify this void, Glasmeier and Nebiolo (2016) highlight the lack of documentation and metrics as hindering the replication of such smart interventions and thereby stalling the wider smart city development approach.

‘Urban promotion’ as introduced above is the culmination of marketable products in the form of smart technologies (Van Den Bergh and Viaene, 2015) that enhance business arguments for investment in the competitive market of the West. This business-led urban development (Hollands, 2008) showcases smart city initiatives that are increasingly driven by business imperatives (Angelidou, 2017). And while one could argue that the capitalist free-market of the West ultimately is symbiotic with the policy frameworks within which the international community of national governments regulate their environment, as can be seen through the Paris Climate Accord 2016 that ultimately places more of a monetary value on environmentally friendly commercial practice, it leads the thesis to question whether this vision has

yet filtered down to national policies in planning. Certainly, sustainability is at the forefront of the planning, but this is supported, at least within the UK, by the National Planning Policy Framework that sets sustainable development at the forefront of the development agenda; and the same cannot be said for smart city initiatives as there is an absence of such planning methodologies.

This observation is something Marvin and Luque-Ayala (2013) pick up on in their scrutiny that the commercial-led approach to smart cities limits the range of social and environmental priorities and furthermore, is resulting in a failure in the capacity of cities to engage with their citizens, to which planning has a statutory obligation to pursue through consultation and public scrutiny within the democratic framework of UK society and structure of civilian planning oversight – a concept that is expanded upon in greater detail throughout section 2.3 *Planning smart cities*.

Such domination of the smart city environment by commercial enterprise is not, however, through want of trying by public bodies. The European Parliament (2014) for example, embarked upon what is regarded, certainly by this thesis, as one of the largest research investigations into building partnerships across stakeholders' interest and sectors throughout the smart city domain in their study titled; *Mapping Smart Cities in the EU*. And while sustainable development may be a pillar of urban planning, Bencardino and Greco (2014); Kominos (2011); and, Mosannenzadeh and Vettorato (2014) all cite citizen engagement as a pillar of the smart city thereby leading the thesis to form the view that the planning sector is ideally placed to facilitate the relationship between such fundamental democratic rights for development and the wider contribution of smart cities to the future of cities challenge discussed previously. The European Commission (2012) make note to the democratic right of citizens in smart city development through the concept of 'smart communities' and in support of such, Salvati et al. (2013) call for exactly this type of behavioural change from national governments in order to achieve such sustainable development priorities within the smart city domain.

To highlight wider research, Angelidou (2017) lists five criticisms of smart cities as: 'conceptual and methodological ambiguity' whereby a multitude of sectors, stakeholders and perspectives have muddied waters in providing a definition and vision for the smart city; 'ICT and corporate driven utopian visions' whereby the technology sector has dominated the conversation to date and are pushing their technologies by business-driven ambitions; 'overlooking citizen and stakeholders potential' as the volume of potential participants overwhelms the often small-to-medium companies set out on entrepreneurial missions; 'splintering urbanism' (Graham and Marvin, 2001), unequal representation, privacy and security concerns of separation between physical and digital divides throughout cities; and finally, lack of a long-term vision for sustainable urban development adapted to local needs resulting in a one-size-fits-all approach arising to meet the many challenges and issues cities face.

To bring the criticisms of smart cities to a constructive close before moving onto the challenges faced, Papa et al. (2015) highlight the omission of long-term visions for smart cities. This, in contrast to the opportunities of short-term planning that Batty (2013) previously introduced, however, only serves to justify the thesis' position in that variations in practice of urban planning are ideally placed to facilitate such a gap. This is further reinforced by the observation of Kitchin (2015) who links the presently singular approach to a narrative for smart cities to the omission of local and unique characters of cities in such smart solutions. This singular approach, Glasmeier and Nebiolo (2016) argue is encompassed by the one system or one-size-fits-all approach of smart city solutions. In contrast, a holistic approach is pursued by the authors and justified by the research of Zubizarreta et al. (2015) who confirm smart city applications as isolated tools that do not contribute to wider sustainable development.

2.1.2.3 Challenges

Perhaps in an attempt to account for the above, Angelidou (2017) proclaims that smart city initiatives are ineffective at working across development areas such as energy and transport. This insight could be viewed as related to the work of Pierce and Anderson (2017) and Vanolo (2016) who comment upon existing smart city models in their failure to identify stakeholders and produce a coordinated approach to technological innovations. Previous work of Angelidou (2014), as well as Greenfield (2013), Townsend (2013), Datta (2015) and Hollands (2015), also note weak stakeholder engagement in smart cities as leading to an under representation of citizens democratic rights and it is within such a role that the thesis views planning as an alternative approach to the current model. Hollands (2008) in fact notes the role of democratic processes in providing a voice to citizens who otherwise would be subject to negative implications of development through privatisation of public space, social polarisation and gentrification. Within the scope of this viewpoint, the thesis asks to what extent can data collection via technological hardware and software throughout the built environment infringe upon public space? And what rights do private, commercial companies have for the ownership of such data? Is this a form of digital gentrification?

The answer to the above questions is open for debate. However, of certainty to the thesis is the potential role of planning in coordinating a larger vision for the ecosystem (see section 2.1.3.1 *Ecosystem of the smart city*) of smart city solutions and initiatives.

2.1.3 Understanding the smart city

The concept of digital systems providing the mechanism to efficiently match physical and social resource demand (BSI, 2014) has been established throughout the wide array of literature documented above. However, in order to truly form an understanding of the smart city, one must comprehend how to effectively combine the digital, physical, and human systems within the

smart city that is not a static destination, but a continuous ecosystem of moving parts.

2.1.3.1 Ecosystem of the smart city

The interrelation between the physical sense of place, the people who populate such spaces, and the digital technologies that are becoming a very real ‘part’ of the place is highlighted below in figure 1.

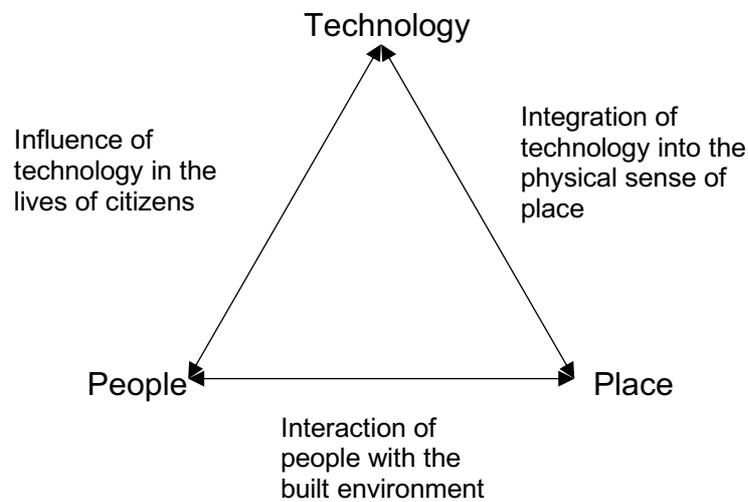


Figure 2. 1 Effective combination of technological, physical and human systems in the smart city (Source: Self Study)

The successful synergy of the above is a summary of the kaleidoscope of literature surrounding smart cities, produced by the thesis, yet influenced by the British Standards Institute’s (2014) definition of the smart city. It is described a successful in that each inter-relationship has a co-equal whereby technology is integrated into the physical environment, these integrations form interactions with people who populate that environment thereby creating a form of influence of technology in the daily life of citizens.

A system of instrumentation that “enables the capture and integration of live real-world data through the use of sensors, kiosks, meters, personal devices,

appliances, cameras, smart phones, implanted medical devices, the web, and other similar data-acquisition systems, including social networks as networks of human sensors” (IBM’s smarter planet cited by Harrison et al., 2010 p. 2, l 14-22) goes some way to explain the vast and far-reaching possibilities that digital technologies have in the domain of the city. The aforementioned devices, however, represent only one half of the digital component described here within; as there is also software that complements the hardware as described above. Hardware is visual, we can see it, however, software is the technology that ultimately designs the project within the scope of servicing user needs and thereby creating a ‘pull factor’ (Angelidou, 2015) whereby data is produced.

In recognition that technology alone will not create a smart city, the British Standards Institute (2015) argue the key challenge to the realisation of the smart city is not technology, but people; while similarly, Angelidou (2017) argues human and social capital are characteristics of smartness within the context of cities. Glaeser and Berry (2006) in fact observe that smart cities become stronger if underpinned by a strong human capital base – supplementing previous views that generational technological skill and ability of professionals is an important factor in smart city development.

Each of these views highlights the importance of people in the smart city. After all, why do cities exist? They exist to accommodate people, or are in existence because of people’s needs to congregate. This view provides the scope within which Mattoni et al’s (2015) words that ICT, while holding a prominent place within the smart city as the predominant enabling factor of such visions, should not represent the ultimate goal. As such, a digital system as discussed above serves no purpose without the engagement and willingness of people to collaborate – whether this collaboration be of public institutions, private organisations, the voluntary sector or citizens themselves (Lindskog, 2014).

Such interaction of collaboration serves the purpose of pursuing transparent governance, strategic and promotional activities, networking and

partnerships (Odenhaal, 2013) within a wider purpose for the application of technology to facilitate such dialogue. These instances of human systems utilising technology for everyday tasks and development was foreseen by Bangemann et al. (1994) who discussed the societal impacts of information communication technologies on the lives of people and their daily activities.

Batty (2013) applies the earlier logic of Bangemann et al. (1994) to society today when noting that such data, and particularly big data, is enriching the experience of the functioning city and is offering new ways to socially interact and engage, while also providing more information for more informed decision-making. The utilisation of data as a resource in the city is therefore a key area that the thesis will now discuss.

2.2 Data and the smart city

Building upon the view of Suzuki (2015); data and the smart city introduces information as a resource of smart cities. The section begins with an introduction to the various types of data, providing definitions of their characteristics and values. The thesis then directs focus to the role of data in making decisions in smart cities, linking this to the formulation of the knowledge economy. The role of cities in the knowledge economy concludes the chapter, setting the foundations for planning smart cities (2.3) that is the first attempt by the thesis to theorise as to the present and potential role of town planning in smart city development.

2.2.1 Data

IBM (2011) claim 90% of the world's data, at the time of writing, had been generated in the previous two years alone, with an estimated 2.5 quintillion bytes of data being added daily to this quota. Cisco (2016) meanwhile released information stating mobile data grew 74% in the year. Couple this with the UN's (2008) projection that the world's population is to increase 70% by 2050, one must make the inference that data production is an exponential

process that will continue to grow in such a pattern from now into the future. Of primary interest to the thesis then is what role cities have in such an accumulation of data? How can cities utilise this data to become a truly 'smart' city?

The World Health Organisation (2010) estimate 8 out of every 10 people born into the world will reside in cities leading the thesis to question what processes are in place to utilise the accumulation of 'urban data' in cities. Urban data (Batty, 2013) – this being data that is tagged by space and time is the currency by which cities link sensory technology to geographic areas of the built environment – thereby making the link between physical and digital settings. However, this is just one (uniformalised) type of data. So, what other definitions are there?

2.2.1.1 Defining data

Batty (2013) is a key author presented throughout the thesis for the subject of data within the domain of the city. Attributing the 'unprecedented' quantities of data generated today, and documented above, Batty (2013) notes the 'digital miniaturisation' of computers that can now be embedded into any type of object conceivable – and this includes furnishings of the built environment – such as lampposts, bricks, roads, bus-stops and benches (see section 2.4.1.3 *Smart city initiatives*) to name a few.

And so as to highlight the many various types of data and apply their characteristics to the research scope, the thesis adopts the United Kingdom Government's (2012) White Paper, titled: *Open Data – Unleashing the Potential*, to define data as:

“Qualitative or quantitative statements or numbers that are assumed to be factual, and not the product of analysis or interpretation.” (p. 7, | 12-

13)

Table 2. 2 Data definitions (Open Data – Unleashing the Potential, UK Government, 2012)

Data definition catalogue	
Anonymised data	Data relating to a specific individual where the identifiers have been removed to prevent identification of that individual
Data	Qualitative or quantitative statements or numbers that are assumed to be factual, and not the product of analysis or interpretation
Data sharing	The transfer of data between different organisations to achieve an improvement in the efficiency and effectiveness of public service delivery
Information	Output of some process that summarises, interprets or otherwise represents data to convey meaning
Linked data	Described by an identifier and address to permit linking with other relevant data which might not otherwise be connected, improving discoverability. It may contain embedded links to other data
Open data	Data that meets the following criteria: <ul style="list-style-type: none"> • accessible (ideally via the internet) at no more than the cost of reproduction, without limitations based on user identity or intent; • in a digital, machine readable format for interoperation with other data; and • free of restriction on use or redistribution in its licensing conditions
Personal data	As defined by the Data Protection Act (1998), data relating to a specific individual where the individual

	is identified or identifiable in the hands of a recipient of the data
Public data	Anonymised, non-core-reference data on which public services are run and assessed, on which policy decisions are based, which is collected or generated in the course of public service delivery

The above definitions are by no means comprehensive in that they exhaust all complexity and diversity of data throughout the digital age. And nor are the above to be seen as ‘universally accepted’ in the same way that smart city definitions aren’t.

To highlight this, the Oxford Dictionary (2016) defines big data as “extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions” thereby offering an insight as to the pattern that is emerging throughout the digital age whereby the very same concept of filtration of definitions, meanings, opportunities and possibilities of ‘realities’ is enhanced by technology. The thesis believes this emerging pattern is important in understanding the societal change that is bound to the advancement and introduction of technology into the world and highlights the importance with which the thesis views the requirement for planning to adapt with this change.

To highlight yet another definition of big data, Batty (2013) describes the entity as “any data that cannot fit into an Excel spreadsheet” (p. 1, l3-4). Kitchin (2014) meanwhile introduces volume, velocity and variety of big data before Fan and Bifet (2015) follow up with the following ‘V’s’ of data management:

- Volume: referring to the size of data that has been created from all sources

- Velocity: referring to the speed at which data is generated, stored, analysed and processed
- Variety: referring to the different types of data being generated
- Variability: referring to how the structure and meaning of data constantly changes
- Value: referring to the possible advantage of big data offering business based on good data collection, management and analysis

Such metrics lead Al Nuaimi et al., (2015) to measure big data as growing at a projected rate of 40% per year globally, while comparing this to a 5% growth in global IT spending. The resultant factor, therefore, is that governments are turning to the utilisation of big data to support development and sustainability of cities by reducing costs and improving efficiencies – elements of which have led Hollands, 2008 (see table 1) to define smart cities as achieving in their aspirational values.

2.2.1.2 Using urban data to inform decisions in the built environment

Wu et al. (2014) proclaim the fundamental challenge for data as being how to explore the large volumes of big data to extract information for knowledge that can then be used for future actions in decision-making. Such value, Khan et al. (2014) claim as achievable through the performance of data analytics, by using various methods and techniques of data mining, machine learning and statistics. But to what ends are these actions performed?

Kitchin (2013) believes the potential of data lies in more efficient, sustainable, competitive, productive, open and transparent cities. Bertot and Choi (2013) meanwhile discuss the impact of data in fostering collaboration, creating real-time solutions to challenges, and ushering in a new era of policy and decision-making leading the thesis to conclude by agreeing with Khan et

al. (2015) that there is a requirement for better planning and collaborative decision-making at a local level, in which cities make better use of their data, transform data into knowledge, and implement a system whereby data can be utilised for knowledge.

Such data is collected through the introduction of advancements in technology. It is a cause of the effect described previous whereby ICT is a solution to future challenges of the city. Deloitte (2017) describe this relationship as disruptive technology creating data that each together drive the smart city. Such ICT initiatives are substantiated by Nijkamp and Cohen-Blankshtain (2013) who support their capabilities to tackle a broad range of challenges set within urban settings. In highlighting the equilibrium required to realise such smart cities as debated through the literature review; the thesis documents the two elements which produce such realities as technological hardware and digital software.

An increased capacity and capability to acquire, organise, and process vast amounts of data (Angelidou, 2017) brings with it a responsibility to ensure personal data is private. Al Dairi and Tawalbeh (2017) split the notion of security in smart cities into the two distinct aspects of infrastructure security and data/information privacy. This distinction is particularly useful when framing the discussion within the presentation of the thesis whereby technological hardware is separate to the supplying of digital software. The argument presented is as smart cities deal with huge quantities of data in real-time (Al Dairi and Tawalbeh, 2017) the importance of security is reinforced (Stonor, 2014) due to need for support of future planning of cities whereby citizens have historically reacted to professional failures that create public concern with negative effects to confidence in political governance. Security is therefore paramount and according to Al Dairi and Tawalbeh (2017) cyber-physical infrastructure is urban infrastructure such as energy supply, water distribution, streets and buildings that are incorporated with newly advanced technological capabilities such as cameras, communication networks, building and transport management systems and sensors.

According to Stratigea et al. (2015), the currently available tools and technologies that are commonplace in smart cities fall within three distinct categories: (1) tools and technologies for city-wide, geo-data collection and management (location-based services, cloud computing, the Internet of Things, sensor networks, data warehouses, Geographic Information Systems, geo-visualization, mapping, etc.); (2) tools and technologies for public participation (web-based participatory tools, crowdsourcing platforms, Living Labs, social media), and (3) sectoral applications (e.g., transport, energy, environment, etc.). What the thesis observes here then is the common factor in such instances whereby technological advances, primarily ICT, are utilised and applied to alternative service areas.

These technologies are primarily hardware, which through scientific innovations are allowing for implementation to the built environment. Winner (1986) introduces the concept of technology as a form of life to describe the previously introduced notion that technology alters the social fabric of society by stating: “what appear to be nothing more than useful instruments are, from another point of view, enduring frameworks of social and political action” (p. 1 , I1-3) thereby adding another dimension to the smart city landscape and providing the lens by which the thesis can theorise as to the role and impact of technologies in the built environment.

2.2.2 The knowledge economy

Not only does the advancement of technological hardware, integrated with digital software, produce new forms and vast amounts of data; but Cader (2008) further notes that “technological advances in electronics, the revolution in software applications, and the expansion of telecommunication infrastructure have altered basic economic functions and agent interactions” (p. 1, I3-7) thereby constituting an evolution of the environment within which organisations operate, bringing forth implications to the provision of services and sectors throughout the world, including those of cities themselves. Perhaps highlighting the homogeneous view that the knowledge economy

and cities are synonymous, Batty (2013) also resembles 'smart cities' as 'intelligent cities' and 'information cities'. Furthermore, Angelidou (2017) lists knowledge, intelligence, and creativity as pillars of human and social capital.

Again in keeping with the pattern there are various methods that have been adopted to measure the knowledge-based economy, i.e. knowledge assets (Machlup, 1962); value of labour in knowledge intensive sectors (Eliasson et al., 1990); labour qualification (Burton-Jones, 1999); and the sharing of knowledge workers (Beck, 1992). Finally, "there is neither a standard criterion to characterize the influence of advanced technologies on the economy, nor measures of its penetration and performance." (Cader, 2008, p. 2, 19-12).

The current evolution of economic factors manipulating the structure of the existing environment is branded as the 'knowledge economy' and is bound by the philosophy that theoretical knowledge is a source of innovation (Bell, 1973). This core idea unifies all strands of work regarding the information society that is also commonly known as the 'new' economy or 'digital' economy – again showcasing the recurring pattern that there is a multitude of definitions describing the same similarly characterised 'realities' in the digital age. The concept of the knowledge economy, perhaps reflecting the enormity of the concept itself, has gradually been introduced over more than a century as the economist, Alfred Marshall in 1890, substantiates when proclaiming that "knowledge is our most powerful engine of production", before Schumpeter (1911) suggested that a 'new combination of knowledge' is important for innovation and entrepreneurship – factors that are highlighted today as principles of smart city implementation and development.

Cader (2008) states that although knowledge is important for economic development, it is not sufficient alone to bring about change in the absence of the necessary infrastructures. This view mirrors that of Shapiro and Varian (1999) who noted the influence of technology in economic development when saying "today's breathless pace of change and the current fascination

with the information economy are driven by advances in information technology and infrastructure” (p. 54 , 6-8).

In more recent work, highlighting the age of the concept and observation that technology is now perhaps realising this previously envisioned reality, Antonelli (1998) branches the concept into two categories: generic knowledge (codified technological knowledge with direct scientific content) and tacit knowledge (learning processes based on the specific experience of the innovator). Critics meanwhile, such as Powell and Snellman (2004), claim much of the growth in the knowledge economy is in the selling of IT, however, this is simply viewed by the thesis as a stepping-stone to an influx of alternative service providers applying this technology within settings, including that of the domain of the smart city.

Adaptation then is what is required and Antonelli (1998) describes the penetration of new ICT affecting the conditions of information in terms of exchangeable parts, separating new information from the technical expertise to generate such information, providing an opportunity for business service providers to store and market knowledge, as well for business service users to better access and purchase such services. In this process then, social organisations play a pivotal role in information or knowledge-based economic development. Governments and universities, for example, disseminate information while private organisations tend to utilise this knowledge in production of goods and services (Cader, 2008). Moving forward then, the thesis questions the role of cities within this wider knowledge economy, and more specifically theorises as to the role of cities in such a transformation.

2.2.2.1 The role of cities in the knowledge economy transformation

Regarding the knowledge economy, Sahal (1985) introduces the notion of geographic regions and the aggregation of organisations based upon the necessity of infrastructure; while Schumpeter (1939), as previously introduced, highlights knowledge as a factor of production and these two

observations lead Cader (2008) to argue that the knowledge economy takes place on two levels or categories that go hand-in-hand as “the latter embodies the former, and the former embodies the latter” (p. 3, 172-75) thereby linking the concept of knowledge as production and the geographic place – a similar notion to the thoughts of Batty (2013) documented previously in terms of time and space linking to data to create urban data. As Sohn (2002) points out, telecommunication infrastructure is a key factor in the location of firms, as those formerly located in the urban centre have begun to relocate to the urban periphery. This response to the provision and quality of infrastructure highlights the role of cities in providing the environment in which organisations can operate throughout the knowledge economy. The importance of this is therefore prevalent in the competitiveness of cities in provision of funding as well as the decisions of organisations in the geographic location of their offices – highlighting the linkages between the knowledge economy and a land-use-based planning system.

Batty (2013), whose perspective is one of smart cities being ‘manifestly spatial and urban’, thereby meaning that his perspective is on that is aligned with that of the thesis, whereby a geographic planning paradigm should have more of a prominent role in discussion, views data as valuable in understanding how cities function. As has previously been introduced, Batty is specifically relating to urban data here – that is, data that is tagged by space and time thereby creating a link between sensory technology that becomes a part of the built environment and a geographic and physical setting. A similar concept is distinguished in *Smart cities of the future* (2012); a paper that makes strides towards a constitution of a smart city. Such a linkage of a physical setting and digital apparatus (sensors, algorithm development, data analysis techniques) will have an impactful effect on long term planning goals as data becomes more prevalent and available in the digital society, as cities are in a competitive pursuit for funding.

A geographic perspective that manifests spatial and urban data within large cities is envisioned by Batty (2013) and this will allow for what were

previously only long-term planning solutions to become more focused planning processes on much shorter timescales. Availability of real-time data is one such example. The growing complexity of smart cities, it is argued, therefore presents a shift in emphasis toward a deeper understanding of how cities function on a short-term basis. Taleb (2013) and Anderson (2008) adopt a quantitative view of how data can be used for smart city planning whereby data collations reduce qualitative theory to redundancy. West (2013) and Batty (2013) meanwhile argue for a theoretical input from people – reinforcing the earlier argument of the thesis that a human input is one component of the smart city; ‘big data requires big theory’ (West, 2013) is how one puts it, while Batty (2013) claims “cities only become smart when people are smart” (p. 276, 129-30).

For such confidence to be placed in planning using data, cities must ensure those who benefit from data are people – citizens themselves – in line with the previous observation of Stonor (2014) that political confidence is key to smart city success. Data ownership, termed by Cader (2008) as ‘tactic knowledge’ is private data that becomes the intellectual property of the organisation. Such data is wide-ranging in the field of data, and the thesis believes particularly so when applied to smart cities. Should data produced in the city be the ownership of the citizen who produces it? The city where it is produced? The organisation integrating the technology? The person who owns the building? These are the questions that have not been answered. There have been attempts, however, as Locke (1924) believes it to be the organisation while McFarland (2004) and Buchanan and Campbell (2005) believe data should be shared and communicated with the public.

2.3 Planning smart cities

Planning smart cities signifies the first attempt by the thesis to conceptualise the role of urban planning in smart city development, providing an overview of the planning system before theorising as to the role planning should have in shaping smart cities. The section comes to a close by presenting the view

of the thesis in the role of urban planning for smart city development, before moving onto the concluding section of the chapter (2.4) analysing smart cities that looks toward the wider array of smart city practices and initiatives that are shaping the direction of the sector.

2.3.1 Urban planning

The Royal Town Planning Institute (2017) notes how technology has long influenced how we plan the growth and future development of cities throughout society. As an example, Le Corbusier's modernist utopian cities were heavily influenced through the introduction of the technology of the automobile – with out-of-town residential areas complimented by road infrastructures. While technological hardware is often viewed as the tool by which smart cities happen, there is a wider ecosystem of layering whereby software creates a new form of application pull (Angelidou, 2015), producing data that can then be used to inform decision-making. Information Communication Technology (ICT), as the scientific innovation of our time, is therefore a new paradigm within planning and provides the basis on which smart cities are viewed as the solution to the future of cities challenge (BSI, 2014), thereby leading this thesis to question the role of planning in development of the smart city and defining the scope within which the future sustainable development of cities is based. The wider-societal picture firmly places smart cities within the mitigation of, and adaptation to, issues of humanity (WHO, 2005) that include disease epidemics, over-population, migration and climate change.

As is stated by the *Plain English Guide to Planning*: “planning ensures that the right development happens in the right place at the right time, benefitting communities and the economy. It plays a critical role in identifying what development is needed and where, what areas need to be protected or enhanced and in assessing whether proposed development is sustainable” (Department for Communities and Local Government, 2015 p. 4, 18-12) therefore leading the thesis to pose the questions: what is the role of

planning in smart city development? And what are the implications of digital development to the current role and impact of planning development?

As French et al. (2015) note, urban areas consist of a number of systems that include infrastructure and transport networks, and these are underpinned by a tapestry of urban development that comprises a mix of land uses. The UK manages this development within a land-use based planning system that is coordinated by the primary legislation of the Town and Country Planning Act (1990) as amended. To facilitate the transition to smart cities, Batty (2015) argues that the shaping of such a land pattern over time requires a theoretical underpinning to understand how the various systems relate to each other, and how external factors, such as the introduction of technology, affect such development over time.

2.3.1.1 Purpose of planning smart cities

Town planning exists to make places better and more sustainable and is for the good of everyone to live, work and enjoy (Royal Town Planning Institute, 2014) leading the thesis to theorise as to the reason why planning should play a role in the development of smart cities before later discussing the possible role of planning in cities' pursuit to becoming 'smart'.

In reflection of this attempt to provide a purpose of planning smart cities, the thesis sides with Angelidou (2017) who presents the view that there is at present a lack of theoretical literature as to how smart cities can be planned strategically. This is a view further highlighted by Hollands (2008), Kitchin (2015) and More et al. (2017) who all note that this situation, whereby there is an absence of appropriate planning methodology for smart cities, is holding back the transformation of much theory regarding smart cities into practice.

This observation highlights the gap between smart city theory and smart city practice that entails the often-rigid development practice and planning policy

of national legislations. Komninos et al. (2013) and Schaffers (2012) each substantiate this observation by arguing for smart cities to be planned strategically and thus implemented through the necessary processes and tools that facilitate such development of cities. It does have to be said, however, that there are smart city practices and projects that have successfully navigated the planning system and it is perhaps more so the lack of democratic representation in development of smart cities, highlighted by Angelidou (2017), Datta (2015), Greenfield (2013), Hollands (2015) and Townsend (2013), that leads the thesis to conclude that planning is the sector of choice within the built environment to provide such a tool that both adheres to democratic rights and provides the necessary development tool to achieve such a reality of the smart city. A prime example of this facilitation through an implementation framework is provided by the Localism Act (2011) that provides communities with the powers to negotiate development in their area through neighbourhood plans.

More wide-ranging concerns offered by Hollands (2008) and (2015) relate to the negative implications of smart cities for public space and social gentrification while Elmaghraby and Losavio (2014) provide more quantifiable issues such as privacy and security. The authors who possibly best and certainly first associate the relationship between smart cities and urban planning, however, are perhaps Graham and Marvin (2001) who introduce the phenomenon of 'splintering urbanism' to describe the effect of technology on the experience of urban living - alternative terms coined for similar situations are that of Kitchin (2015) who talks of 'networked urbanism' and Crang et al. (2006) who introduces 'urban digital divides'. While the descriptive names may differ, what unifies these terms is the notion of technology fundamentally altering the way within which people and citizens experience the city.

Town planning which historically pursued with aspirations to ensure defensive capabilities through means of fortification and positioning, however, has evolved to a point of now focusing on constructions of society through environmental, social and economic principles of sustainable development.

Within these 'end-zones' of town planning are also paradigms such as transportation which have influential impacts upon trade and commerce thereby forming strategic objectives for the economy and it is perhaps within this 'building-block' of factors that planning has become renowned for place-making of towns and cities alike.

2.3.1.2 History of planning

Historically, planning in its earliest forms was orientated around ensuring the defensive capabilities of a city through fortification and positioning. Civilisations required this level of planning for survival and safety, however, as society has evolved so too has the planning of settlements. Coinciding with this defensive capacity then grew the economic and strategic principles of transportation, trade and commerce with many of the largest cities throughout the ages being established and built from the water-line as coastal towns and cities along rivers and seas.

Hippodamus was perhaps the first well-renowned town planner who invented the orthogonal layout (also known as the Hippodamian grid plan) in the 5th century BC. Aristotle (Politica II, 4th Century BC) attributed the term 'father of city planning' to Hippodamus who was also a physician, mathematician, meteorologist and philosopher. Such a varying skill-set and background of somebody as influential as Hippodamus is perhaps why planning is now the multi-disciplinary profession it is today. Certainly, the idea that city planning is not something to take in isolation from problems of cities and their administration, or indeed society itself, is something the thesis advocates and applies to the smart and digital evolution of the city.

If we compare the work of Hippodamus then to the work of the thesis now, a time when land was divided up into three (sacred, public and private) spaces so as to segregate the three classes of soldiers, artisans and husbandmen is now layered into physical and digital spaces upheld by vastly different interpretations of security and privacy. In observing these ideals, the traits of

societies throughout the ages becomes somewhat prevalent in that the same insecurities of humans in planning for defence can be witnessed at the heart of Greek and Roman society as well as today.

Certainly, however, the difference in social dynamics of these societies is there for all to witness today as segregation is replaced by inclusiveness and accessibility for all. Aspects of Hippodamus' work can still be found today in the grid-layout format of New York City, however, it is underpinned by an evolved notion of why and how we plan responses to the constantly changing society of the our time. Shaping the modern world, while somewhat different to the planned cities of Roman, renaissance and medieval Europe, is essentially motivated by the very same insecurities of humans in their habitats. This simultaneous shaping of, and shaping by, society is similar to the analogy provided earlier of the disease and remedy of the smart city and theories for planning have thus emerged that aim to direct how we plan.

2.3.1.3 Theories of planning

There are three different types of theories regarding urban planning of towns and cities. Firstly, there are normative theories that give regard to what end planning ought to be focused. Secondly, there is disciplinary theory that relates to what means there are to achieve the desired ends. Thirdly, there are procedural process theories that determine how planners act. Strategic urban planning, however, is viewed as a response to planning that incorporates all of the above within one coherent strategy for the planning of urban places and spaces.

It could be argued that strategic planning combines all of the above theories of planning and the United Nations (2007) introduced strategic planning as a management tool for cities that determines the direction in which an organisation is moving and how it will get there. In canvassing the current landscape of literature regarding smart cities the thesis concludes that the present wealth of knowledge is dominated by normative theories that focus

on to what ends planning ought to be orientated. There are many desired outcomes that are often ideologically influenced whether that be through the technological, human or environmental aspects. There are, however, vast opportunities for disciplinary theories of planning that utilise technology as a means to achieve the desired ends. Technology as a form of life touches on this to discuss the possibilities that technology brings to altering the 'given' way of doing things. What is certainly lacking, and what this research aims to provide, is a procedural theory for planning smart cities that introduces a framework for planners to adapt to the digital environment of the smart city.

2.3.1.4 UK Planning systems overview

The planning system in the United Kingdom is land-use based and as such there is national legislation that directs national policy thus directing the formulation of local policies in a devolved structure of Government. The four countries of the UK each produce their own national planning policy frameworks that aim to simplify planning policy and streamline guidance for the delivery of achieving sustainable development – a resolution set out by the United Nations General Assembly (42/187) that advocates “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. In response to this, the UK produced the UK Sustainable Development Strategy Securing the Future introducing five ‘guiding principles’ of sustainable development in “living within the planet’s environmental limits; ensuring a strong, healthy and just society; achieving a sustainable economy; promoting good governance; and using sound science responsibly”.



Figure 2. 2 Levels of UK planning policy (Source: Self-study)

Development of planning policy in the UK filters down from national legislation that takes the form of Acts of Parliament and Statutory Instruments. The Town and Country Planning Act (1990) is the primary act that drives the agenda for planning and supplies the instruments for delivery of planning policy. Secondary legislations, such as that of the Town and Country Planning (Local Planning) (England) Regulations 2012 consolidate the primary act to make provisions for the Localism Act (2011). This approach typifies the process of planning legislation whereby delivery and alternative acts later introduced are in order to accommodate the political agenda and changing requirements of the sector.

Acts of Parliament form legislation and the most recent is the Town and Country Planning Act 1990, updated through a series of amendments since introduction. The development of planning policy is supported through legislation that predominantly takes the form of Acts of Parliament and Statutory Instruments. The Town and Country Planning Act (1990) is the primary act that drives the agenda for planning and supplies instruments of delivery. An example of a secondary piece of legislation are the Town and Country Planning (Local Planning) (England) Regulations 2012 that

consolidate the Town and Country Planning Act 1990 in order to make provisions from the Localism Act 2011. This approach typifies the process whereby planning legislation is delivered and alternative acts introduced in order to accommodate for political agenda and the changing requirements for the sector.

National planning policy frameworks were introduced with the aim to simplify and streamline documents and provide guidance for the delivery of achieving sustainable development as set out through resolution 42/197 of the United Nations General Assembly in 1989 “meeting the needs of the present without compromising the ability of future generation to meet their own needs” that implemented the notion of sustainable development as conceived in the Brundtland Report of the World Commission on Environment and Development (WCED, 1983). From these five guiding principles were formed for the UK through the UK Sustainable Development Strategy Securing the Future (2005) to meet the resolutions as follows:

- Living within the planets environmental limits;
- Ensuring a strong, healthy and just society;
- Achieving a sustainable economy;
- Promoting good governance;
- Using science responsibly

Each of the four countries incorporated these guiding principles in the formation of their individual planning frameworks.

The National Planning Policy Framework (NPPF) sets out the Government’s planning policies for England and provides guidance as to how these are expected to be applied (Department for Communities and Local Government, 2012). The NPPF acts as a material consideration in planning decisions and must be considered for the preparation of local and neighbourhood plans.

A key outcome of the document is the presumption in favour of sustainable development, described as the “golden thread running through both plan-making and decision-taking” (NPPF, 2012). Sustainable development can be defined by the following three dimensions:

- Economic – contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; by identifying and coordinating development requirements, including the provision of infrastructure;
- Social – supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high-quality built environment, with accessible local services that reflect the community’s needs and support its health, social and cultural well-being; and
- Environment – contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

Three dimensions as documented above courtesy of the National Planning Policy Framework (2012).

The Strategic Planning Policy Statement for Northern Ireland (SPPS) was introduced in 2015 and is sub-titled ‘Planning for Sustainable Development’ thereby reinforcing the overall view of the thesis that UN resolution 42/187 has filtered down through the UK Sustainable Development Strategy to national planning policy as described in the opening section of planning in practice.

The National Planning Framework (NPF) 3 is Scotland’s long-term vision for development and investment across Scotland for the next 20 to 30 years. It is described as the spatial expression of the Government Economic Strategy. The Planning Policy Wales (PPW) released its 9th edition in November 2016 integrates national strategies for social inclusion, the economy, health, transport and the environment within one spatial framework.

National planning policies set out how local authorities should prepare their local plans. A local plan sets out local planning policies and identifies how land is used, determining what will be built where. According to the National Planning Policy Framework (2012) local plans must be positively prepared, justified, effective and consistent. Upon adoption, the local plan provides the framework for each local authority district boundary and directs officers and developers in their locations.

The Localism Act (2011) introduced neighbourhood planning as a right for communities to shape development in their area by setting planning policies through a plan and granting permission through Neighbourhood Development Orders.



Figure 2. 3 Stakeholders of UK planning system (Source: Self-study)

The Department for Communities and Local Government is the relevant ministerial department responsible for the planning system. The role of the department is to create great places to live and work, and to give more power to local people to shape what happens in their area.

The Planning Inspectorate is an executive agency, sponsored by the Department for Communities and Local Government (and the Welsh Government), who deal with planning appeals, national infrastructure planning applications, examinations of local plans and other planning-related and specialist casework in England (and Wales).

A local authority is an administrative body in local government who provide care and support to their residents.

- Planning committee members – A committee of local authority councillors that sit as the local planning authority in determining the outcome of planning applications.
- Planning officers – Can take the form of many roles in delivering a planning service such as policy, development management, conservation and urban design. Assess applications based on their merit and make recommendations for approval.

The principle body that represent planning professionals throughout the UK. The institute was founded in 1914 and gained Royal Charter in 1959. The primary role of the body is to promote and develop policy for planning and the wider built environment. The RTPi (2012) describes planning as the “process of positively managing the development of our villages, towns, cities and countryside” (p. 4, 11-4).

A group directly funded by the Department for Communities and Local Government, PAS provide consultancy and peer support through learning

events and online resources to local authorities in the aim of helping to understand and respond to planning reform. Operating on the opposite side to the public sector, private developers design and implement development projects via submission of planning applications. As such there is a wide range of professions holding an interest in the planning system such as surveyors and architects as well as planning professionals. With the development of smart city projects, it is likely that this will broaden to include digital professionals. Neighbourhood groups have the opportunity to create a neighbourhood plan and are usually led by a parish or town council; a neighbourhood forum; or a community organisation such as a resident group. Planning is a democratic process and citizens are encouraged to get involved in the planning process.

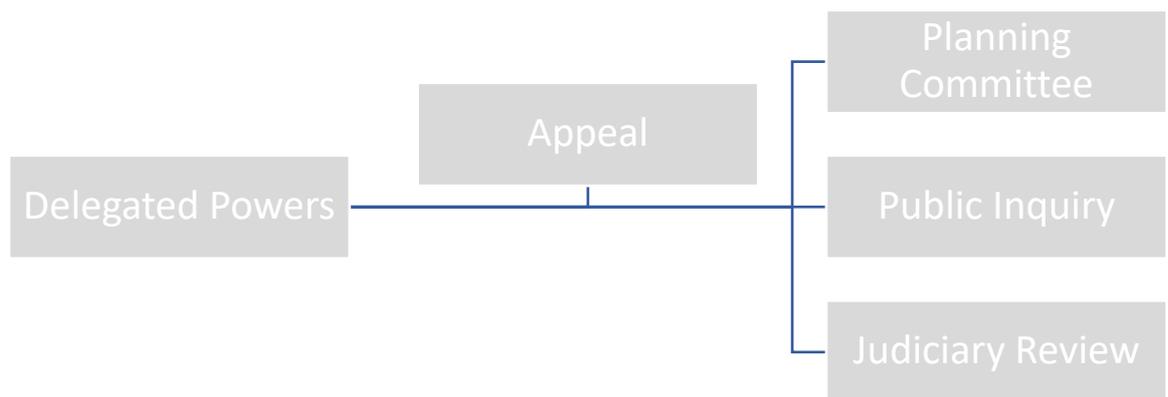


Figure 2. 4 UK Planning process (Source: Self-study)

The NPPF (2012) states that local planning authorities should approach decision-taking in a positive way in order to deliver the target of sustainable development. Early engagement is highlighted as having significant potential to improve the efficiency and effectiveness of the planning system. The

procedures that operate throughout the planning system and thereby create the planning process can be found below.

Planning officers throughout the UK are given delegated powers to determine planning applications without having to be put before the planning committee (see below). The local authority will impose a scheme of delegation that prescribes the requirements for an application to be determined under delegated powers. Applications that are deemed minor, or of no wider public interest are generally appropriate to be determined under delegated powers.

A committee of local authority councillors determine planning applications that are put forward to committee. Advice is provided by planning officers who will put forward their recommendation and justification for such. Meetings are usually held every few weeks in a pre-defined cycle that allows both stakeholders in the project and members of the public to speak. A planning appeal can be submitted if the applicant is unhappy with the outcome of a decision attributed to any planning application. Appeals can be made on the grounds of a refusal for planning permission, or against any conditions that have been imposed as part of a planning permission. There are different procedures for each of household, enforcement, listed building, lawful development certificate, tree preservation orders and high hedges as well as other types of appeal.

The planning inspectorate hold public inquiries for a range of major and lesser land use developments. This procedure is ultimately the determining decision in many applications unless the appeal goes on to the Minister of State for Housing and Planning.

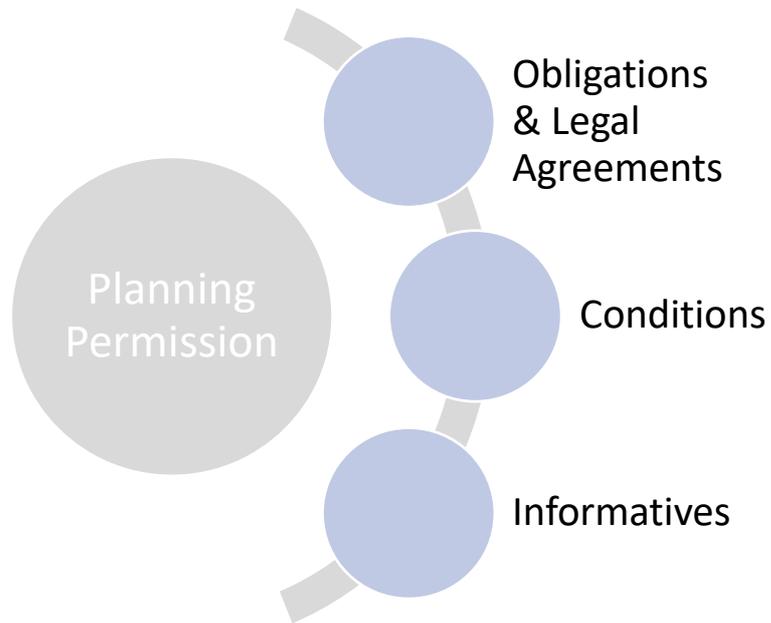


Figure 2. 5 UK Planning procedures (Source: Self-study)

Each of the primary planning procedures that make up the planning process will now be introduced. These processes are bound by legislation and occur through the design and production of policy and guidance on an initial national, and later, local level.

Planning permission is the legal process of determining whether proposed developments should be permitted. A planning application is submitted to the local authority and assessed against policy and guidance that has been produced as a response to legislation from Parliament. Permission can come in various types of form depending upon the application.

Planning obligations are private agreements made between the local authority and developers attached to a planning permission to make a development acceptable which would otherwise be unacceptable in planning terms. The land itself, as oppose to the person or organisation that develops the land, is bound by the Section 106 agreement – this means that future owners will need to take this into account.

Planning obligations are used for the following purposes:

- Prescribe the nature of development (for example, requiring a given portion of housing is affordable)
- Compensate for loss or damage created by a development (for example, loss of open space)
- Mitigate a development's impact (for example, through increased public transport provision)

Paragraph 204 of the NPPF supplies the following tests as to whether planning obligations should be sought:

- Necessary to make the development acceptable in planning terms
- Directly related to the development
- Fairly and reasonable related in scale and kind to the development

Further guidance sets out the requirement for local authorities to consider future changes in market conditions over time and should also be flexible in preventing planned development to go ahead.

The NPPF defines a planning condition as: 'A condition imposed on a grant of planning permission (in accordance with the Town and Country Planning Act 1990) or a condition included in a Local Development Order or Neighbourhood Development Order.' Planning conditions are usually used as an alternative to refuse the application. The NPPF further goes on to state that conditions should only be imposed when they meet the test as being 'necessary', 'relevant to planning', 'relevant to the development to be permitted', 'enforceable', 'precise', and 'reasonable in all other respects'.

A planning informative does not establish mandatory requirements with which an authorised development must comply. It is therefore, non-statutory, however, is considered good practice regardless of the absence of a statutory basis. Informative's are often designed to draw attention to matters

of importance to the development and do not have a direct bearing on any decision notice.

2.3.1.5 The role of urban planning in smart city development

While Angelidou (2017) argues the criticism point of conceptual ambiguity stems from the diffusion of corporate driven smart city visions and weak stakeholder engagement results in 'splinterisation', it is the view of the thesis that planning can provide a solution due to its democratic process within the built environment thereby providing a tool for smart city development that brings together all of the sectors. Stonor (2014) meanwhile proclaims the enthusiasm of architects and planners should be set against the backdrop of recent urban history therefore forming a sober reality of the tasks ahead.

There are, however, also critical commentaries of the relationship between planning and smart cities as Cowley and Caprotti (2018) state smart cities are actually 'anti-planning' and to be a smart city there must be a resistance to the 'standardised' processes that city governance tries to instil to the built environment. Stead (2016) builds on this to observe the appeal for policy-makers to do so, and not therefore learn lessons from the immediate outcomes of past scenarios that bring stagnation – something the thesis recognises would be counter-productive and somewhat 'at-odds' with technology and digitally enabled smart cities.

In assessing the relationship between urban planning and smart city development, there are two sides which the thesis observes this with. The first is one of smart city projects supporting the enhanced role of planning, while the second is one of urban planning supporting the development of smart cities. For smart city projects that enhance the role of planning, this is done through the introduction of technological solutions that provide greater communicative capacities - commonly referred to as e-government (Das and Misra, 2017). On the opposing side of the relationship, however, the thesis

argues there is a role for planning in supporting the development of wider smart city aspirations while also making capacity for the above.

The two paradigms of the symbiotic relationship do, however, vary greatly in their characteristics. In a sense the juxtaposition replicates the application pull and technology push described by Angelidou (2015) in that each combines to create an overlap, or reality, that is essentially the smart city in practice – a combination of challenges to the future of cities comprised with solutions of technological advancement and digital capabilities within the setting of the built environment. This ‘reality’ then is a representation of smart cities in practice, and there is wide-ranging work, both academic and practical, assessing such development.

One must also consider the role of data in urban planning as previously discussed. As French et al. (2015) state: “the world has rapidly moved from a data poor environment to a data abundant environment (p. 2 |14-15). Harris (1999) meanwhile notes how complex urban areas are and uses this point to justify the claim that optimisation approaches are inadequate for design and planning of development due to the requirement to trade values among conflicting priorities that are simultaneously competing with each other throughout the process. Big data, for all its positives in building and testing theories about cities, cannot achieve such determination.

Bretagnolle et al. (2016) support using big data within an urban setting to build, test and advance theoretical frameworks of city growth and development. French et al. (2015) introduce *leveraging big data for urban planning decisions* by noting the opportunity for big data to monitor building occupancy, distribute energy efficiently and provide real-time information to environmental parameters before going on to note how all of these examples are of ‘short-term management applications’ while stating there are few examples of these applications for the same big data in long term planning.

While the first chapter (urban big data) of the paper is framed within the automobile sector and seems to document utopian visions for unlimited

amounts of data providing opportunities unimagined before, by using words such as 'imagine', 'now' and 'think'; factors such as these are all put forward as reasons for such absence of abstraction of big data for such urban planning purposes providing some useable substance to the paper beyond blue sky thinking fuelled by recycling of alternative technologies and applications created and introduced by private sector organisations such as Mercedes-Benz.

As French et al. (2015) state there is an unwillingness to surrender our ability to shape the urban environment solely to a set of algorithms and as such a role for human decision-making in the built environment must be re-imagined in order to realise the opportunity presented by big data. French et al. (2015) later go on to state the smooth running of urban systems can be the best urban planners can hope for, however, Klosterman (1997) rejects this to argue this approach is not adequate for the planning of uncertain futures.

French et al. (2015) note how historically, urban planning decisions have been made by communities with limited information producing some failures (Dyany and Plater-Zyberg, 2001) such as social isolation, increased energy use and detrimental environmental impacts. Such information made available, however, within the form of big urban data, provides opportunities to understand the systems of cities, through correlation and causality that goes beyond simply sampling – and this is used as a demonstration of how technology can improve the quality and quantity of data collected while also enabling greater efficiencies in time, money and accuracy.

According to French et al. (2015) planning for the future is more challenging when compared to short-term management that are the primary examples for smart city initiatives due to the number of external factors such as policy interventions that change the landscape for development. However, the authors do not view this as a reason to stop, rather as a challenge to be met as they concede later that big data will become indispensable for long-term transportation planning.

In order to realise the benefits of big data beyond operational phases; French et al. (2015) make recommendations that encompass the need to make data sets publicly available for urban planners, as it is argued commercial entities at present are the biggest beneficiaries – perhaps this is because of the flexibility such enterprises have in altering the way they operate, when compared to public sector bodies. Furthermore, stakeholders, including those who set goals and policies for urban development not only require access to data but also need an understanding in place to use the data. French et al. (2015) go on to then introduce the visualisation and tools for data analysis, as well as integrating data with new and existing models. Such instances provide the opportunity for machine learning, deep learning, forecasting and algorithms in a data rich environment – and as the authors state; planners may not be familiar with such methods.

In conclusion, French et al. state that urban planners should use big data to understand the structure and function of urban areas, in an argument that says recognition should be given to the usefulness of data beyond simply operation and management – a notion Batty (2013) reinforces when stating concern for how data is used to focus specifically on short-term issues. Such better access to big urban data, alongside the appropriate analysis tools and privacy protections are also required if urban planning is to realise the potential of big data.

2.4 Analysing smart cities

To begin on a practical level, yet still embedded within the larger theory-practice debate, the British Standards Institute is certainly leading the field in terms of attempts to publish best-practice for smart cities and planning. In their *Guide to the role of the planning and development process* (2014) the institute pushes guidelines for the sector in adapting to the smart city domain.

While Albino et al. (2015) highlight rating systems through synthetic quantitative indicators as receiving increasing attention among city managers and policy makers for measuring performance of smart cities. The thesis presents three examples below of smart city initiatives, which have been documented so as to provide examples from the public sector, NGO initiative and private sectors.

2.4.1 Smart city initiatives

Branded as a SMART (sense/survey, map, analyse, react, test) approach to urban planning, design and governance, Space Syntax is an example of an academic/private partnership providing digital tools to analyse urban design and planning considerations such as connectivity and accessibility. The operation is a prime example of how transport considerations can be assessed and integrated into planning solutions and decisions through design.

The Future Cities Catapult is a UK Government supported centre for the advancement of smart cities. According to their website the mission of the Future Cities Catapult is to advance urban innovation, to grow UK companies, to make cities better. A global review of smart city strategies (The Future Cities Catapult, 2017) is useful as a resource when discussing the role of planning in smart city development. This is because one of the recommendations to arise from the report is the inclusion of city planning thereby introducing the sector to the digital environment of the smart city and substantiating its role as a key industry within the domain.

The study was structured around five key themes of how the smart city concept is changing, what smart city strategies are aiming to do and why, how such strategies are being made, and how these strategies are being implemented. The following recommendations were produced as an outcome of the report:

1. Establish strong leadership to develop capacity within local government
2. Embed the smart city strategy within statutory frameworks and wider city planning
3. When creating a strategy, consider a collaborative approach, coupled with strong political support
4. Tap into core city funding by regularly scanning existing city assets and budgets
5. Create a plan for private sector engagement and long-term collaboration

Of particular interest to the thesis is principle 2 that highlights the role of wider city planning in embedding strategies within established statutory frameworks. Building upon this is the recommendation to implement a single strategy for smart cities that is a separate entity in its own right – such as the Smart London Plan – and importantly, over a long-term embedding this smart city strategy within the wider city plan so as to achieve cross-departmental cooperation for using digital technology. In some cases, embedding the strategy within the wider city plan makes it statutory and thus ensures that it is implemented and funded. More fundamentally, the regulatory and policy framework of the city should proactively address the opportunities and challenges of the city - a city plan that proposes new smart city ideas without addressing the challenges raised by technological transformation is incomplete.” (p. 30, 115-31).

The Future Cities Catapult is an example of a successful partnership of public and private practice, that is forward-thinking in its approach to smart cities and planning – with the Future of Planning project aiming to de-risk and prove demand for data-driven and digitally enabled products and services fit for a 21st century planning system. Examples of this support include the resources; City Data Sharing Toolkit, CleanAirTech White Paper and Digital Planning CFC. A key strength of the Future Cities Catapult is its ability to coordinate the built environment with wider sectors – Neuroscience for Cities

being a prime feature of this strength forming the view of the thesis that planning is ready for its own digital evolution.

Moving the discussion now onto the work of academia, there are numerous papers from key authors who each associate sectors within a wider smart city strategy, as can be seen from the varying titles of: Batty's (2013) 'Big Data, Smart Cities and City Planning'; Paul et al's. (2015) 'Urban Planning and Building Smart Cities Based on the Internet of Things using Big Data Analytics'; Hao et al's. (2015) 'The Rise of Big Data on Urban Studies and Planning Practices in China'; Stratigea et al's. (2015) 'Tools and Technologies for Planning the Development of Smart Cities' or finally, Pappalardo et al's. (2016) 'Planning in the Era of Information and Communication Technologies'. However, perhaps the biggest criticism for the above is the absence of planning theory within the scope of debate.

An absence of key stakeholders and their roles in development of the smart city is something Harrison (2017), Pierce and Anderson (2017) and Vanolo (2016) all highlight in their various literatures regarding the subject. Angelidou (2015) attributes such instances to the supply-driven dominance of smart city initiatives that leads to ideological stances that are subjective to the particular background of authors. Kitchin (2014) and Luque-Ayala and Marvin (2015) each reflect upon such absence to promote 'smart-urbanism' whereby an integrated and participative urban growth model, driven by a bottom-up approach, drives forward the development of the smart city.

As the thesis presents the below models that vary in their observation and approach to smart cities, it is worth noting the point of Angelidou (2017) who introduces the notion of evidence-based arguments for smart cities that is beginning to create maturity phases for projects thereby inferring that the outcomes are very much a journey and by no means as yet a destination.

2.4.2 Academic models

As Komninos (2011) provides an inclusive overview of the areas that are addressed through smart city applications via: (1) economic activity: manufacturing, commerce, businesses and finance, education, research, health, and tourism, (2) city infrastructure and utilities: transport, energy, water, waste, ICTs, (3) quality of life: social inclusion, social care, safety and security, environmental alert, (4) city governance: city hall services, citizen participation, informed top-level decision-making, monitoring, and benchmarking the thesis again views this model as an example of how planning can play a role in bringing these various sectors and industries together when assessing the appropriateness of development against local plan policies. By Komninos (2011) addressing these areas as those that are eligible for smart city applications, the author is recognising the role of technology in the various domains of public life, however, does not come up with a solution for reaching these aims, rather bringing the areas to the reader's attention.

Pierce and Andersson (2017) in 'Challenges with Smart Cities Initiatives' take the view from a municipal decision makers perspective within the paradigm of two domain challenges – technical and non-technical – for producing a framework visiting 12 mid-sized European cities in their smartness. Again, as per previous attempts to evaluate smart city models there is no inclusion of the planning system, and instead it focuses on the challenges in this instance. The thesis does, however, find the work useful to support the view of the thesis whereby splitting the challenges into technical (security, interoperability and privacy) and non-technical (collaboration, financial, governance, contextual and political) presents planning as a profession within the democratic system of the United Kingdom which is ideally placed to facilitate coordination amongst sectors for developing smart cities and thereby overcoming the challenges highlighted by the authors as considerations for the practical implementation of smart cities.

Fernandez-Vazquez and Lopez-Fornies (2017) in 'Analysing and Comparing Smart City Initiatives' concludes with the role of citizens in smart city initiatives, producing citizen-centred design methodologies that again support

the view of the thesis that planning is a profession that could potentially accelerate the role of citizens in smart city development as it is a statutory democratic tool for development in the UK. Ojo et al. (2014) meanwhile compare 10 smart city programmes just as Neirotti et al. (2014) analysed 70 smart city programmes, however, they do not highlight the opportunity of planning to facilitate a response to the challenges and areas for improvement exposed by such studies. Perhaps it is the international scope of the above studies that differ from the approach of this investigation which is UK-centric and therefore UK-focused whereby planning is highlighted with potential for such an influential role in smart city development due to its democratic, statutory and shaping characteristics. As another example of this international nature, Heo et al. (2014) explore the requirements and challenges of smart systems integration using case studies as examples from multiple countries. This is not to say it is a specific weakness of such studies, rather to highlight the unique characteristics of this study within wider literature.

There is of course Graham and Marvin (2001) who are two who may somewhat pre-date the above literature, however, can be viewed as the best for associating the relationship between smart cities and urban planning theory, leading the thesis to question whether the absence of following literature regarding planning theory and smart cities is as a result of the technology-orientated and dominant literature landscape.

Yet the phenomenon of 'splintering urbanism' (Graham and Marvin, 2001) does still resonate in the work of later authors today. Kitchin (2015) coins the term 'networked urbanism' while Crang et al. (2006) term the situation as 'urban digital divides'. Nonetheless, each is an example of terms that describe a process of disruptive technology fundamentally changing the lives of people and citizens within the domain of the city. Relative to such a topic, there are more wide-ranging concerns highlighted by Hollands (2008, 2015) relating to negative implications for public space and social gentrification, while there are more quantifiable issues raised by Elmaghraby and Losavio (2014) regarding privacy and security.

2.4.3 Assessment of a practical smart city planning project

The thesis will now attempt to apply academic thought to the assessment of a 'real-world' project. Smart city development and democratic representation, within statutory duties for development, is a subject Angelidou (2014), Datta (2015), Greenfield (2013), Hollands (2015) and Townsend (2015) all note. Such absence of democratic representation in development of smart cities is prevalent throughout literature and the thesis is somewhat unfamiliar in observing such a unified voice for matters in smart cities.

Nonetheless, the BT InLink UK initiative is an example of a smart city project working within the statutory framework of development, thereby showcasing a motivation for more democratic representation of smart city initiatives within the scope of planning as a tool. Comments to have arisen from the project include that 'smart cities and their features and functionalities need to be more standardised, 'city planners need help' before the company concludes by calling for a faster planning process, with recognition at government levels that planning officers require support in determining such applications with digital aspects.

2.5 Conclusion

The advancement of technology has led to exponentially increasing numbers of people having access to a smartphone, which they carry around with them, allowing them to become sensors for data that freely move around the city. This relationship, between user and technological hardware, can be known as technology push or application pull (Angelidou, 2015). As people have access to hardware (often through the form of mobile phones) they begin to be 'pulled' towards uses and applications of this technology. A market is thereby formed and, in a market-led economy this brings more solutions to the market. An opportunity then has arisen whereby technology companies are pushing their solutions into the market of the built

environment, and what has been termed 'smart cities'. The predominant way in which this is done is through integration of technology into the built environment. Here, data that is produced by citizens as has been described above (through their daily activities and doing so with a technological hardware device) is then captured by these technologies that are integrated into the built environment. The example above is just one; there are many different types of data that can be and are collected. Another technological advancement that people use (and was a prime motivator in the development of planning theory previously) is the automobile – again this is another stream of data that can be produced. Such technologies are sensors that are integrated into roads, buildings and lampposts – how and why they collect the data they do is down to the design of the project and software that is uploaded to the hardware.

As these technologies are continuously integrated into the built environment the interaction of these technologies with citizens, via software, provides us with connectivity levels. What this connectivity allows is for the seamless communication of data between sources. Data communication, however, does not stop there and must go either to an alternative source (i.e. the data owner) or a third party. Often this data is communicated to the cloud whereby concurrent communication and storage takes place. It is seemingly growing practice that cities have their own data platforms too, as a means to communicate with their citizens and enable easier and simpler interaction.

Once we have this data it must be analysed in order to provide insights. This data processing relies upon the expertise of the stakeholders. However, it also comes down to how and why the project was designed in the first place. While at this stage it is given that the project will have already been implemented and will be under continuous monitoring. The processing of this data and subsequent insight results in decisions being made. This could be through the form of adapting the project itself through hardware or more likely software updates, however, it could also provide data and insight to inform decision-making. This decision-making, certainly if taken by the local authority and thereby governance, affects people's lives and therefore

influences their actions, habits or mind-set (i.e. activities). These activities produce a new set of data, and the cycle begins again. The question then is on what level of frequency does the above occur? Systems have to be in place in order for the above to be effective. If the cycle takes place via minutes, hours, daily etc. is the policy in place to support decision-makers? Is the system in place to allow for the above? In the case of planning the thesis presents the argument that no it is not and calls for a strategy of data accumulation that builds upon the above to bridge the gap from the smart city explanatory model to a strategy for application of the model to the local requirements of the city achieved through the planning of the city. The first step to realising this is in analysing the existing planning system to evaluate the role of town planning in development of the smart city.

Such an evaluative tool would go some way to working toward the evolution of the planning system, advancing upon the opportunity highlighted in this literature review to recognise the role of planning as a way to coordinate the many various areas and sectors that have their own potential to utilise technology to advance their own challenges. This is perhaps the key finding to take from the literature review – the observation that while much literature regarding smart cities presents analysis of cities, as can be seen from the work of Pierce and Andersson (2017), Fernandez-Vazquez and Lopez-Fornies (2017), Ojo et al. (2014) and Neirotti et al. (2014) there is a gap in analysing the role of specific sectors within this wider development – and more specifically the role of planning.

In linking this to another key finding regarding the role of citizens in smart cities; the thesis advocates that planning is ideally placed as a profession to facilitate this influence as a statutory tool of democratic development within the UK. Batty (2013) is a key author in advocating the role of data in planning, alongside those of Angelidou who is also a prominent contributor to the field, thereby highlighting a primary example of how technology can improve the role of planning in a digital world. The role of data in this age of society is a key consideration, supported by French et al. (2015) and Bretagnolle et al. (2016), to name a few, thereby firmly placing the role of

planning within that as a system for development of the city that combined with the knowledge economy, observing data as a key component for competition and insight, brings together the literature review to present a picture of a landscape whereby technology is a very real option for meeting challenges that cities face, and city governance should realise the opportunity presented to utilise this technology within the sector of planning, coordinating between various sectors to produce new forms of data that can be used to inform decision-makers of the city toward the goal of improving citizens' lives.

3 Research strategy

The following chapter documents the research design by firstly presenting the research philosophy before following with the research strategy and concluding with an explanation of the three research phases that combined to form the full research investigation. The research philosophy begins with an introduction to the philosophical background of research, detailing how ontology and epistemology shaped the beliefs of the researcher and wider research investigation. The research strategy provides a more structured outline of the implementation of the research investigation, explaining how a mixed-methodological approach to the study formed three phases of research, each of which is expanded upon through the lenses of data collection, data analysis and interpretation in the concluding section of the chapter.

3.1 Research philosophy

“Research is a species of finding things out” (Gregory, 2003, p. 6). The research methodology, comprised of both the Research philosophy (4.1) and Research strategy (4.2), therefore should aim to most appropriately and accurately obtain Gregory’s ‘truth’.

In the following chapter section 4.1 Research philosophy presents the “philosophical stance of worldview that underlies and informs the style of research” (Sapsford, 2006, p. 175) and section 4.2 Research strategy is the process of ‘finding things out’ that focuses on the methods by which we discover the ‘truth’ through techniques of collecting and analysing data.

The structure of the relationship between research philosophy and methodology can be seen below:

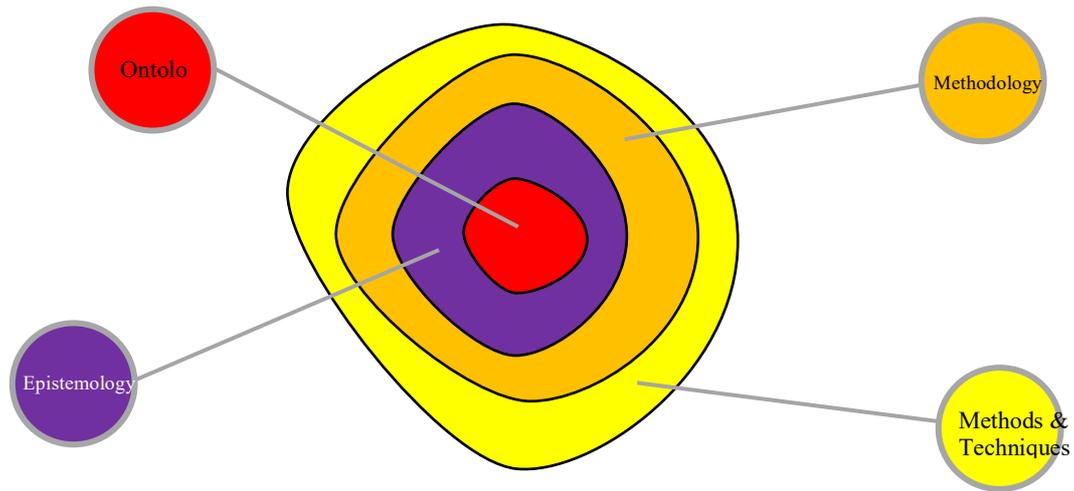


Figure 3. 1 Smith et al.'s (2012) icon for illustrating the relationship between research philosophy (ontology & epistemology) and research structure (methodology & methods/techniques).

Rather helpful is the analogy provided by Smith et al. (2012) with regards to figure 3.1 above. Here the icon represents a tree, with the methods and techniques of data collection and analysis representing the outermost layer of visibility: bark. Meanwhile equally as important yet below the surface operate the structures of methodology, epistemology and forming the core; ontology. Table 3 below summarises each of these terms:

Table 3. 1 Ontology, epistemology, methodology and methods & techniques (Smith et al., 2012).

Ontology	Philosophical assumptions about the nature of reality
Epistemology	A general set of assumptions about ways of inquiring into the nature of the world
Methodology	A combination of techniques used to inquire into a specific situation
Methods & techniques	Individual techniques for data collection, analysis, etc.

According to Chia (2002) the primary concern of philosophy is to establish, regulate and improve the methods of knowledge-creation used in all fields of intellectual endeavour. Throughout this process of philosophical enquiry, it is important to bring together and weigh the facts, theories, alternatives and ideals of each philosophical position - eventually forming the philosophical stance that is upheld throughout the research methodology, implemented through methods and techniques.

3.1.1 Ontology

Ontologically the thesis accepts the existence of an objective reality, however, denies the existence of such once the act of observation has occurred. For example, one cannot deny that regardless of the observation of the transformation of cities into smart cities they still exist as a 'reality' but once that 'reality' is observed it becomes akin to the individual's observation of that reality. The reality therefore becomes subjective and is bound by the social construct of the mind. In terms of the creation of knowledge and understanding then a subjective stance is taken, as in order to pursue the desired results, observations must take place. The ontology of the research is therefore one of relativism (Smith et al., 2012) whereby there is an acknowledgment of many 'truths' and facts are construed by the observer's viewpoint of the world. This view mediates between those of nominalism, whereby there is no 'truth' as facts are all human creations (Smith et al., 2012) and realism, whereby there is a single 'truth' to which facts exist and can be revealed (Smith et al., 2012). The philosophical paradigm associated with relativism is that of social constructionism, which will be discussed in greater detail below, but stems from the subjectivism mentioned earlier.

3.1.2 Epistemology

The epistemological paradigm of social constructivism opposes that of positivism, however, and was developed as a reaction to it by social science

researchers in the last half-century (Smith et al., 2012). Whereas the ontological perspective of realism would bring forth the idea of positivism, the perspective of relativism brings forth constructivism. At this point of the epistemology, however, the ontological perspective can be broken down again to reveal alternative degrees of relativism.

A nominalist perspective aligns with a strong constructivist stance and would usually be associated with invention and critique, the outcome of which is new insights and actions. However, the relativist perspective aligns with that of a 'normal' constructionist stance resulting in convergence of aims and questions, the outcome of which is theory generation.

It is interesting to note that at this point the methodology between phase one and two diverges whereby the relativist constructivist philosophy of phase one is replaced by a nominalist strong constructivist phase two. The outcome of each then converge to form phase three – a realist strong positivist methodology pursuing discovery through hypothesis, the outcome of which is confirmation of theory via verification/falsification.

3.2 Research design

Now that the research philosophy has framed the investigation within a wider philosophical context, the means by which the research was investigated will be presented through the research strategy. The methodology opens the section before the thesis introduces the research phases that made up the strategy.

As has previously been discussed there are three phases to the research, each of which holds its own unique research philosophy and we will now introduce each phase in further detail throughout the research methodology. The first phase pursues a relativist constructivist process aimed at convergence for theory generation. Phase two is shaped by a nominalist strong constructivist view aimed at invention to provide new insights and

actions. Before finally phase three adopts a realist strong positivist philosophy aimed at discovery through the confirmation of theory.

The outcome of the research investigation is ultimately aimed at providing a framework for the adaptation of planning departments to the smart city and this satisfies belief one. It was therefore just as integral to the design of the research that organisations operating throughout the smart cities domain were involved in the conceptualisation of the smart city model, while it was equally important that planning officers and professionals were involved in the development of the evaluative framework – each of which ensures belief two is also held. The basis of the research then is that the action of the framework changes the behaviour of planning departments now operating outside of the ‘original’ city model and inside the ‘smart’ city model.

3.2.1 Mixed method

A mixed method approach to research was employed to best investigate the research question. There are, however, disagreements among theorists as to what classes as mixed method research. For example, Cronin et al. (2007) argue mixed method research applies to any study bringing together two different methods, either of the quantitative or qualitative strands. Creswell (2006) meanwhile proposes that mixed method research extends only to any study that combines both quantitative and qualitative methods. In terms of the study proposed throughout this thesis the combination of both qualitative and quantitative strands combined with multiple methods from each satisfies the requirements of both parties, and certainly applies to the observation of Newman and Ridenour (1998) that mixed methods lie between the middle of a qualitative-quantitative continuum.

The angle of the mixed method approach towards research is one of a complementarity developmental nature. Complementarity, a term attributed to Greene et al. (1989) reveals different dimensions of a phenomenon and enriches the understanding of what is deemed a multi-faceted, complex

nature of the social world – therefore reflecting the subjectivist philosophical underpinning of the project. The development angle meanwhile refines the use of research instruments (Greene et al., 1989) to provide a more accurate account of the subject area. An example of how this approach has framed the project can be found in the application of a survey in phase three of the project that seeks to expand upon the focused, yet rich data collected from the interviews carried out in phase one and achieved via an analysis of planning policy bridging the gap in phase two. The larger sample size and research question meant that the survey was deemed most appropriate, while the necessity to do so arose through initiation (Greene et al., 1989), whereby the ‘puzzle’ of how the duty to cooperate extends beyond local authority boundaries with regards to data, shaped just one research question decision to pursue the development of the mixed method approach in this way.

The design of the mixed method approach is sequential meaning that different sequences (Creswell, 2003) form the overall design in relation to the aim. In this sense then the qualitative interview method was used to generate the concept of the smart city before the questionnaire-based survey sought to expand upon this concept to incorporate the role of the planning sector in facilitating smart city development. The results of the first stage therefore had to be analysed before the second stage could commence (Gilbert, 2008) as the content of the questionnaire was informed by the qualitative study in phase one and qualitative/quantitative phase two. Following on from this, the status accorded to each of the methods in terms of weighting (Punch, 2005) was considered as equal with regards to the overall project yet found to be separate for the different phases as can be seen below:

Therefore, as we can see phase one prioritised the qualitative interview data, while phase two equally prioritised the qualitative/quantitative analysis of planning policy before the survey data finally used phase three as solely relying on quantitative data. This overall priority structure formed the priority decision (Bryman, 2012) while the sequence decision (Bryman, 2012) is structured as follows:

- Qual > Qual/Quant > Quant

(As adapted from Bryman, 2012's sequence diagram)

Phase one was therefore weighted to qualitative, while phase two is balanced as qualitative and quantitative and finally, phase three is quantitative. However, due to the specificities of the research project it was deemed that the investigation was weighted toward a primarily qualitative method as the model for phase one influenced the progression of the research. Although equal weighting is more often associated with parallel studies (Gilbert, 2008) the output for each stage (smart cities concept model for phase one and assessment framework for phase two) meant that each was co-dependant on the other to form any type of actionable insight through the combination of models and therefore the whole of the investigation.

3.2.2 Mixed method design

A multiphase mixed methods design (Creswell, 2006) was conducted whereby several mixed method projects formed a larger approach towards the common objective. If we work with the weightings above to break this down, then an emergent mixed method research strategy was implemented through an initial exploratory sequential design. Within the exploratory paradigm of mixed method design Creswell (2006) is one in which qualitative data and analysis produces findings that inform the second quantitative phase. Relating this design to the thesis, the predominantly qualitatively produced smart cities conceptual model informed the design of questions for the quantitative phase of survey data in phase three. As Creswell (2006) puts it, 'the researcher analyses the two databases separately and uses the findings from the initial exploratory database to build into quantitative measures' (p. 227) meaning the theoretical model produced variables that were tested in the second predominantly quantitative phase and integrated to a linear qualitative process.

Research Question: Is planning policy sufficient in operating throughout the digital age of smart cities?

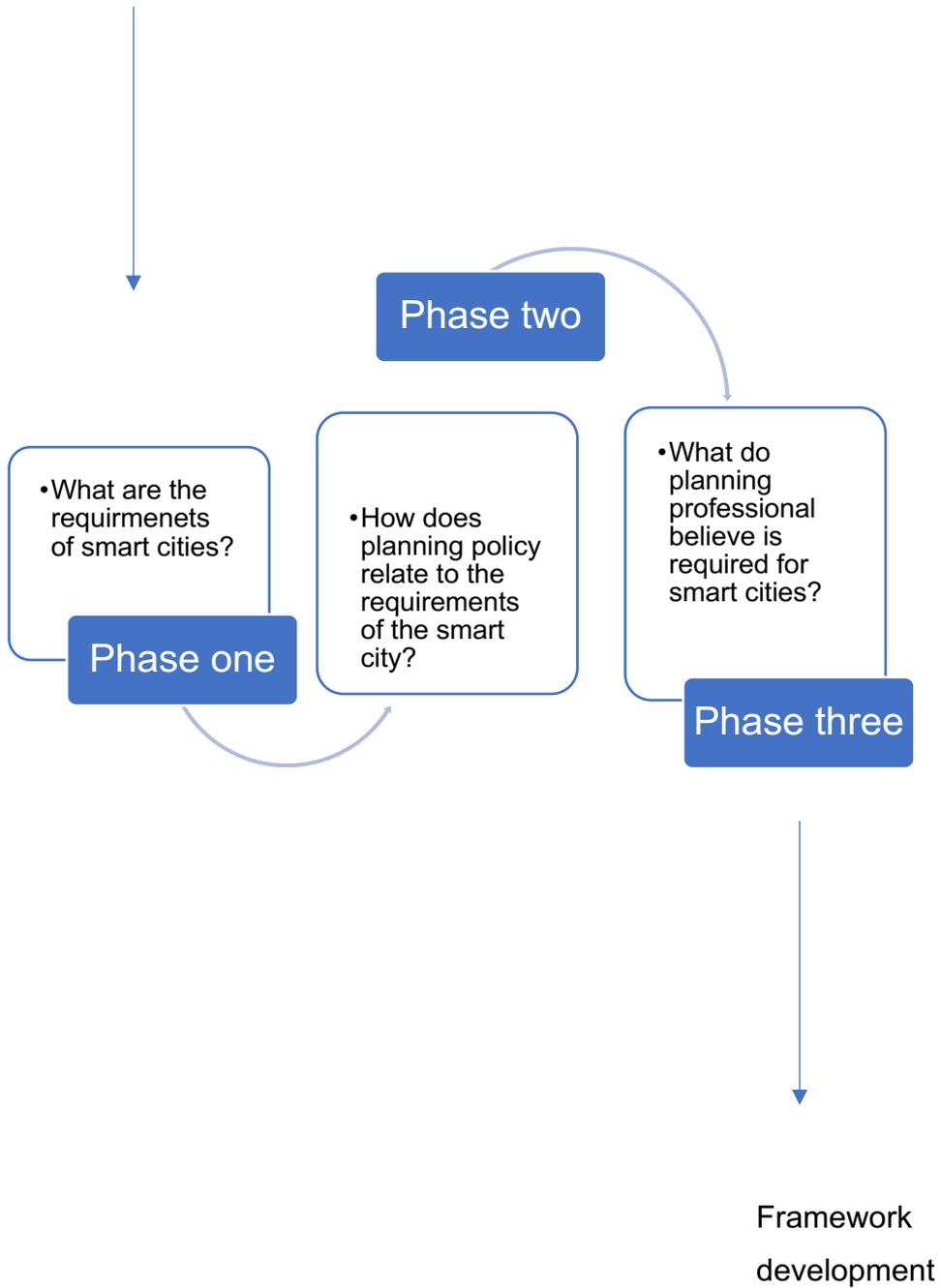


Figure 3. 2 Sequential research question implementation framework

3.3 Research approach

Saunders et al. (2012) highlight three factors as to why it is important for the research approach to be understood as;

- Enabling the researcher to make an informed decision on the research project
- Helping to identify which strategies and methodologies work for the research as well as which don't
- Enabling the researcher to adapt the design of research to allow for constraints

In carrying out the research, according to Elder and Paul (2009) inference is effectively the conclusions that we come to whereby the researcher applies the following three elements of critical thinking to research:

1. The elements of thought (reasoning)
2. The intellectual standards that should be applied to the elements of reasoning
3. The intellectual traits associated with a cultivated critical thinker that result from the consistent and disciplined application of the intellectual standards to the elements of thought

Earlier work from Paul and Elder (1997) differentiates from two essential dimensions of thinking for researchers in firstly, their need to identify the 'parts' of their thinking, and secondly, the need to be able to access their use of these parts of thinking.

The "parts" or elements of thinking are as follows:

1. All reasoning has a **purpose**
2. All reasoning is an attempt to **figure something out, to settle some question, to solve some problem**

3. All reasoning is based on **assumptions**
4. All reasoning is done from some **point of view**
5. All reasoning is based on **data, information and evidence**
6. All reasoning is expressed through, and shaped by, **concepts** and **ideas**
7. All reasoning contains **inferences** or **interpretations** by which we draw **conclusions** and give meaning to data
8. All reasoning leads somewhere or has **implications** and **consequences**

Good critical thinking requires having a command of these standards. According to Paul and Elder (1997 ,2006), the ultimate goal is for the standards of reasoning to become infused in all thinking so as to become the guide to better and better reasoning. The intellectual standards include clarity, accuracy, fairness, significance, logic, precision, depth and breadth and the consistent application of the standards according to Paul and Elder (2006) is in thinking in the development of intellectual traits of:

- Intellectual Humility
- Intellectual Courage
- Intellectual Empathy
- Intellectual Autonomy
- Intellectual Integrity
- Intellectual Perseverance
- Confidence in Reason
- Fair-mindedness

Habitual utilization of the intellectual traits produces a well-cultivated critical thinker who is able to: raise vital questions and problems, formulating them clearly and precisely; gather and assess relevant information, using abstract

ideas to interpret it effectively; come to well-reasoned conclusions and solutions, testing them against relevant criteria and standards; think open-mindedly within alternative systems of thought, recognizing and assessing, as need be, their assumptions, implications, and practical consequences; and communicate effectively with others in figuring out solutions to complex problems (Paul and Elder, 2007). The application of the intellectual standards to the elements of thought resulted in a consistent and well-cultivated critical thinker who showed the traits highlighted above throughout each of the research phases to be introduced here after.

3.3.1 Deductive

Bryman (2012) lists deductive theory as the most commonly used approach for social research. As Saunders et al. (2012) describe, deductive research involves the exploration of literature to explain relationships whereby collection of data is used to test a hypothesis. This approach is ‘top-down’ (Creswell and Plano-Clark, 2007) and the aim of the approach is to add to existing theory (Saunders et al., 2012).

3.3.2 Inductive

Collis and Hussey (2009) describe inductive theory as the development of a conceptual structure through which observation creates theory. The outcome of an inductive approach is theory generation whereby a ‘bottom-up’ approach (Creswell, 2013) identifies patterns in data forming observation of themes as abstract pieces of information come together in a structural format.

3.3.3 Abductive

Abductive theory moves between induction and deduction (Saunders et al., 2012) combining the approaches as a creative inference involving the integration and justification of ideas to develop knowledge (Mirza et al.,

2014). According to Bryman (2016), it is crucial to understand perspectives and meanings of the study population in order to account for their views. Quite often a deeper understanding of research is formed through the development of hypotheses, theories and explanations (Mirza et al., 2014) as an all-encompassing approach to the identification of themes, patterns and generation of new theory (Saunders et al., 2012).

3.4 Research methodology

The research strategy enables the researcher to reach their goal through implementation of a plan (Saunders et al., 2012). For the purposes of the following section, while Cresswell (2009) insists that research methods consist of how the researcher collects, analyses and interprets data in a study; for the purposes of this thesis, data collection is also described as 'methods', while data analysis is also known as 'techniques'.

3.4.1 Literature review

As with most research, the study begins with an investigation into what is already known and what remains to be learned about a topic (Cresswell, 2009). Thus an in-depth literature review of the areas of interest should be conducted to examine previous and current work from experts within the field (Johnston, 2014). This process highlights other researchers for the topic, related studies and alternative research findings. Magee et al. (2006) explain that the literature review process also provides valuable information in the determination process of what research is currently being conducted and how the investigation complements these on-going studies. A literature review is an objective and thorough summary in critique of analysis for the relevant and available research regarding the topic area (Hart, 1998) and as such is an important step in the research process of understanding the subject area so as to implement research of worth. Cronin et al. (2007) highlight the gathering of information from many sources as a key attribute of a good literature review and regard structuring as essential to the work, while

Colling (2003) highlights the importance of referencing. There are generally two types of literature review as observed by Cronin et al. (2007) and the thesis employed the traditional/narrative review, the purpose of which is to provide the reader with a comprehensive background and understanding of current knowledge, as opposed to the systematic literature review which is regarded as being more rigorous and defined in its approach (Parahoo, 2006) and is used to answer focused questions without straying from the central theme too much.

3.4.2 Data collection

Research methods in social science are an essential part of any research project as they determine its success, validity and reliability (Alshenqeeti, 2014). The heart of any research design is the collection of data (Bulmer, 2004) and the following section will introduce the two sources of data – primary and secondary – used throughout the various phases of research development. The combination of research methods is something that has been practised by alternative researchers throughout various studies with Brookhart and Durkin (2003) and Lai and Waltman (2008) being examples of using questionnaires and interviews. Kendall (2008) in describing these situations says questionnaires can provide patterns of data from large populations while interviews provide more in-depth data of attitudes and thoughts.

As will be presented below, the thesis employed the use of semi-structured interviews to provide a detailed and in-depth analysis of smart cities, so as to provide a framework for the analysis of planning policy in relation to the framework of the smart city before a structured interview tested this framework on a larger population of planners so as to provide insight and recommendations for the future role of planning smart cities within an evaluative framework.

Day et al. (2008) and Smith (2008) are just some academics who provide support for the use of mixed methods research and Lois and Brown (2010) describe how the paradigmatic differences between qualitative and quantitative methods is not incompatible and at times can even be appropriate. In terms of maximising the successful completion of these mixed methods of research, Lois and brown (2010) provide the following recommendations:

1. Ensure interview prompts and questionnaires are structured similarly
2. Separate data collection by only a short period of time
3. Present the object of interest in a highly concrete and specific way
4. Focus on psychological objects that have simple internal structure
5. Estimate agreement between methods, albeit cautiously in light of data distributions, using consensus and consistency procedures

However, in support of such research, the main attraction is alternative methods overcoming the weaknesses of others within one research study and as Antaki and Rapley (1996) explain, pairing structured interviews with structured questionnaires is unlikely to provide a rich data set thereby leading the thesis to implement the following phases of research as can be seen below.

3.4.2.1 Methods

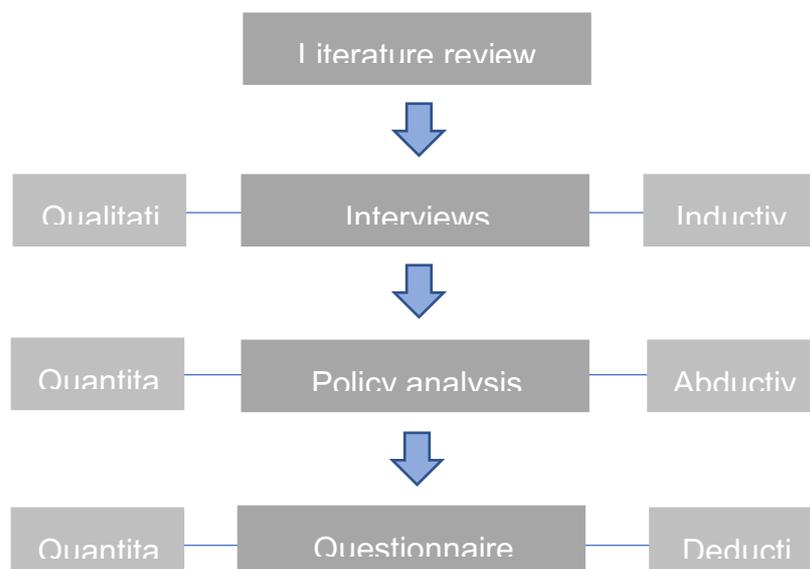


Figure 3. 3 Research method framework

Interviews

As Alshenqeeti (2014) explains, interviews use non-numerical data to explore and describe the quality and nature of how people behave, experience and understand. Brown (2005) builds upon the notion of people's actions and their beliefs by adding that one of the greatest strengths of qualitative research is its potential to form hypothesis. Cohen (2007) states that interviews are a valuable method for exploring the construction and negotiation of meanings in a natural setting, while Kvale (1996) cites the method as an efficient way to investigate people's views in great depth – certainly when compared to questionnaires. Berg (2007) advocates interviews as they allow the participant to “speak in their own voice and express their own thoughts and feelings” (p. 96).

The interactive nature of interviews (Alshenqeeti, 2014) means that the researcher can push for more information in certain areas or divert the subject of the interview in an alternative direction - this is known as probing and can help to broaden the investigation as a less structured collection tool. This leads the thesis onto the type of interview employed for the study. According to the research of Marshall and Rossman (2006) there are four different types of interviews: structured interviews whereby a set of predetermined questions require formulated responses within a 'frigid' setting (Berg, 2007); open-ended unstructured interviews whereby greater flexibility and freedom is found for both sides (Gubrium and Holstein, 2002); semi-structured interviews allowing more flexibility than structured by allowing “depth to be achieved by providing the opportunity on the part of the interviewer to probe and expand the interviewee's responses” (Rubin and Rubin, 2005 p. 88) and finally, focus groups that are a sample of a population brought together in a focused topic (Barbour and Schostal, 2005), although

according to Alshenqeeti (2014) these can often be a time-consuming process.

Policy analysis

According to Gill (1970) the main task of policy analysis is to explore the dynamics of a problem and the effects of policy, as well as the implications of the policy to the situation. It is important, however, at this stage to distinguish between the two different types of policy analysis as introduced by Enserinck et al. (2013) as analysis for academic reasons (i.e. explanatory, descriptive, interpretive) and policy analysis for policy-making. This type of public policy-making has been described by Enserinck et al. (2013) as 'interventionist' and 'prescriptive' and as such for the purposes of the study, the thesis employed the first policy analysis which aimed to achieve an understanding of public policy of planning in relation to smart city development. This therefore meant that the policy research studies aimed to analyse the content of policy with the goal to understand the generic theories behind the policy processes, so that recommendations could be produced as a side-effect – a notion known as being 'loosely-connected' (Enserinck et al., 2013) to the intentional design of the policy analysis. In order to provide meaning to the term of policy analysis, the thesis constructed paradigms (Rein and Schon, 1996) through which to provide the framework for analysis. This conceptual model helped to 'make sense' of the structure and provide a certain logic to what would become a very rigid systematic method of research collecting data in both qualitative and quantitative formats in descriptive and evaluative modes of research.

Walker (2000) meanwhile states the purpose of policy analysis is to assist policy makers in choosing a preferred course of action by clarifying the problem, outlining alternative solutions and displaying trade-offs between consequences. Policy analysis in essence examines alternative options that can be utilised to implement strategies toward a final goal. For the purposes

of research the thesis employs this method of analysis to evaluate planning policy in relation to smart city development. Asking questions such as which planning policy is most appropriate for smart city development?

Patton and Sawicki (1986) call for simple methods of policy analysis and planning as a result of often 'fuzzy' policy analysis that has the following attributes:

1. Not well defined
2. Solutions that cannot usually be proven as correct before application
3. No problem solution is ever a guarantee to achieve the intended result
4. Problem solutions are seldom both best and cheapest
5. The adequacy of the solutions is often difficult to measure against notions of the public good
6. The fairness of solutions is impossible to measure objectively

Underlying most of these approaches is a systematic procedure, however, some would argue that the variety of problems facing public policy is so great that no one method of systematic procedures could be used to identify all problems (Patton and Sawicki, 1986) and implement strategies to appropriately deal with these problems.

In distinguishing between 'basic analysis' and 'research analysis', Patton and Sawicki (1986) claim researchers seek the truth behind problems and provide either non-intuitive or counter-intuitive solutions. Such analysis is expected to be complex, elegant and precise whereas with basic analysis the goals are much more practical. Basic analysis is not, however, necessarily more simplistic as the name would suggest. Patton and Sawicki (1986) state that basic analysis still requires the researcher to understand the role of the research within a wider implementation framework as seen below in the example for quick and basic policy analysis identified as a rationalist model that follows the cycle:

1. Define the problem

2. Determine the evaluation criteria
3. Identify alternative policies
4. Evaluate alternative policies
5. Select the preferred policy
6. Implement the preferred policy

Alternatively, Walker (2000) provides the following 8 steps for performing policy analysis:

1. Identify problem
2. Specify objectives
3. Decide on criteria
4. Select alternatives
5. Analyse alternatives
6. Compare alternatives
7. Implement chosen alternative
8. Monitor and evaluate results

Such research analysis is well codified and there are routine steps to follow for exploration (Patton and Sawicki, 1986) and there is a larger role for planning ahead. In terms of the mode of procedure and technique the thesis employs, however, policy analysis was framed by the following set of characteristics of an inventory or search phase, limited in scope and directed at a particular issue; and a constrained search for alternatives, which are then all usually evaluated and displayed.

In performing the research, it is important to follow the applied framework and analysis so as to provide the most accurate data collection as possible. This is because of the admission by Patton and Sawicki (1986) that there is no such thing as absolutely correct, rational and complete analysis – so to provide valid and accurate results to the factors of analysis it is important for the researcher to perform data collection with the guiding principles of good research as documented in the research strategy.

Surveys

Secondary data

Secondary data offers many methodological benefits that can contribute to research through generating new knowledge (Heaton (2008) and Johnston (2012). Smith (2008) explains a prime advantage of secondary data is the cost and convenience it provides in terms of allocation of time and resource. Secondary data has therefore grown as a viable option for researchers who may have limited time and resources (Johnston, 2014) as an empirical exercise applying basic research principles. Johnston (2014) later goes on to highlight the lack of literature defining relevant processes for the method and introduces a system that begins with the development of research questions before identification of the relevant datasets and evaluation of those datasets. The larger the sample, the more valid the dataset (Smith et al., 2008) and as online planning portals provide all submissions for the local authority in question the use of these sets of existing data provided a measurement tool (Doolan and Froelicher, 2009) so as to accelerate the pace of research while also ensuring validity of the information used to later investigate a research paradigm of the study in understanding the role between planning and smart city development.

While primary data is collected from the respondent, secondary data is otherwise published or unpublished material (Bulmer, 2004) and the thesis employed the collection of secondary data in the form of data that had already been published through online planning portals that are publicly available databases of planning applications. The fact that this information had been available to view online is an example of earlier evolutions in what could be argued as a smart city process in itself as Johnston (2014) explains technologies have led to vast amounts of data being collected, compiled and archived. Secondary analysis is flexible, and it is also an empirical exercise

performed via a systematic method with procedural and evaluative steps (Johnston, 2014) just as with primary data collection methods.

In applying Johnston's (2014) systematic process for secondary data collection as a research method, the first step is to define the research question(s). As such the following was formed to guide this part of the study:

- How many planning applications are there with smart city elements?

Following on from this initial point, the relevant datasets were highlighted as being online planning portals for each of the local authorities included in the study and as Smith (2008) and Stewart and Kamins (1993) each point out, evaluation of the dataset is required in order to ensure the information within meets the requirements in order to appropriately address the research question.

Stewart and Kamins (1993) provide the following evaluative steps in the process:

- a) What was the purpose of this study;
- b) Who was responsible for collecting the information
- c) What information was actually collected
- d) When was the information collected
- e) How was the information obtained;
- f) How consistent is the information obtained from one source with information available from other sources

Upon implementation of the above steps, the research was thereby provided with a dataset suitable for the purposes of the research question that could later be used to provide insight through analysis.

As Doolan and Froelicher (2009) observe, secondary data analysis is flexible as an approach as it can be utilised in many different ways, however, much

like primary data analysis is still underpinned by procedural and evaluative steps. Secondary data analysis is analysis of data that has been collected by a third party for a primary purpose different to that of the current research in question (Johnston, 2014) and as stated by Schutt (2011) and Smith (2008) is thus becoming more prevalent as the amounts of data collected through technological advancement is improving the practicality of such research methods.

There are also, however, limitations to this method of data collection as Boslaugh (2007) notes, the data may have been collected for another reason. However, in employing secondary data as a method it was not thought that the thesis was confronted with this problem as the reasons for data collection aligned in that an inventory of planning applications was sought in order to develop an overview of development within a specific geographic boundary of a local authority, and while the thesis did not collect the data, a requirement of local authorities to maintain an online inventory, ensured through legislation, resulted in confidence in the data that it would be accurate and valid in terms of procedure and process.

Questionnaire

A computer questionnaire was employed by the thesis in order to provide an inexpensive and time-efficient means of data collection that also allowed for a target group of respondents based on their professional background. According to Adams and Cox (2008) a questionnaire is a tool for data collection, however, in order to work, the design of the questionnaire must be easy for the reader to understand, interpret and complete. The importance of this is linked to the response rate of which a higher return provides more reliable and valid results. These two concepts are important for the tool of the questionnaire (Adams and Cox, 2008) with reliability referring to the consistency of measure while validity refers to the ability to measure. The length and structure of questionnaires are also important as you require the participant's attention in order to ensure the return of their questionnaire that contributes to the response rate. As such the structure of the questionnaire

should promote usability and effectiveness (Adams and Cox, 2008) in terms of design and wording of questions. Questions should be unambiguous and have the same meaning for everyone (Aiken, 1996) and as such the thesis employed the use of a briefing note to describe the terms associated with questions throughout. Adams and Cox (2008) state there to be four main types of questions available to use: simple factual questions requiring yes/no answer; complex factual questions requiring interpretation and analysis; opinion and attitude questions requiring alternative options and deeper concentration; and open-ended questions requiring full attention and focus from participants. For the purposes of the research investigation the thesis employed primarily complex factual questions in order to ensure the appropriate data was collected while also maintaining the attention of participants so as to ensure a high response rate that was also reliable and valid in its results.

3.4.2.2 Sampling

The process by which the thesis determined the population and therefore generalised the research finding is called sampling and this was achieved by employing various sampling methods throughout the three phases of data collection. There are generally two main sampling method techniques that are known as probability sampling and non-probability sampling. If the interest of the research is in generalising the findings of the sample to a wider population, probability sampling is more precise, however, the process also comes with added time and cost (Lammers and Badia, 2004).

The thesis therefore employed a non-probability sampling technique throughout all three phases of research, and the thesis presents these within the detailed chapters for each phase; introducing the population definition, construction list and sampling method for each phase of data collection and a definition of these terms is provided below.

Before a sample is taken we must first define the population we want to generalise (Lammers and Badia, 2004) however, the population of interest differed between the three phases. Each population of interest, however, had a clear point and worked towards achieving various research objectives throughout the phases in pursuit of the research aim. Lammers and Badia (2004) highlight the point that the generalisability of sample data depends on the study area and inferences within the design of the research in terms of data collection and analysis.

The construction of a list narrowly defined the population of interest for each phase of research. Lammers and Badia (2004) state that the list from which the sample derives must be both recent and exhaustive. Therefore, all potential participants of the sample must appear on the list and as such the larger the population the more difficult the exercise becomes. In some cases, it is simply not realistic to complete a list and this is why the sampling method is of such importance.

Sampling methods, as highlighted above, can be of probability or non-probability techniques. Webster (1985) describes the sample as a finite part of a statistical population whose properties are studied to gain information about the whole. While it would be ideal to include the whole population within the research this in many cases is simply not possible due to the expenditure of time, money and energy. The sample should, however, be representative of the population to ensure that the thesis can generalise the findings from the research sample to the population as a whole.

3.4.3 Data analysis

Marshall and Rossman (1999) describe analysis of data as a process that brings order, structure and meaning to data that has been collected and there are two forms within which this takes place. Qualitative data analysis is a process that seeks to reduce and make sense of vast amounts of data, often from different sources, so that impressions can shed light on the

research question and qualitative data uses words to construct an essence of what the data can reveal (Vosloo, 2014); quantitative data meanwhile is numerical and can be collected in many forms while analysis very much depends upon the structure of the study and research questions producing variables. According to Pope et al.'s (2000) approach to qualitative data analysis, a pre-defined framework can be applied to the data reflecting the aims, objectives and interests of the study so as to align the procedure with the frame of scope of the study. An exploratory perspective meanwhile advocated by Attride-Sterling (2001) is to code data and allow for new interpretations and directions to develop.

3.4.3.1 Techniques

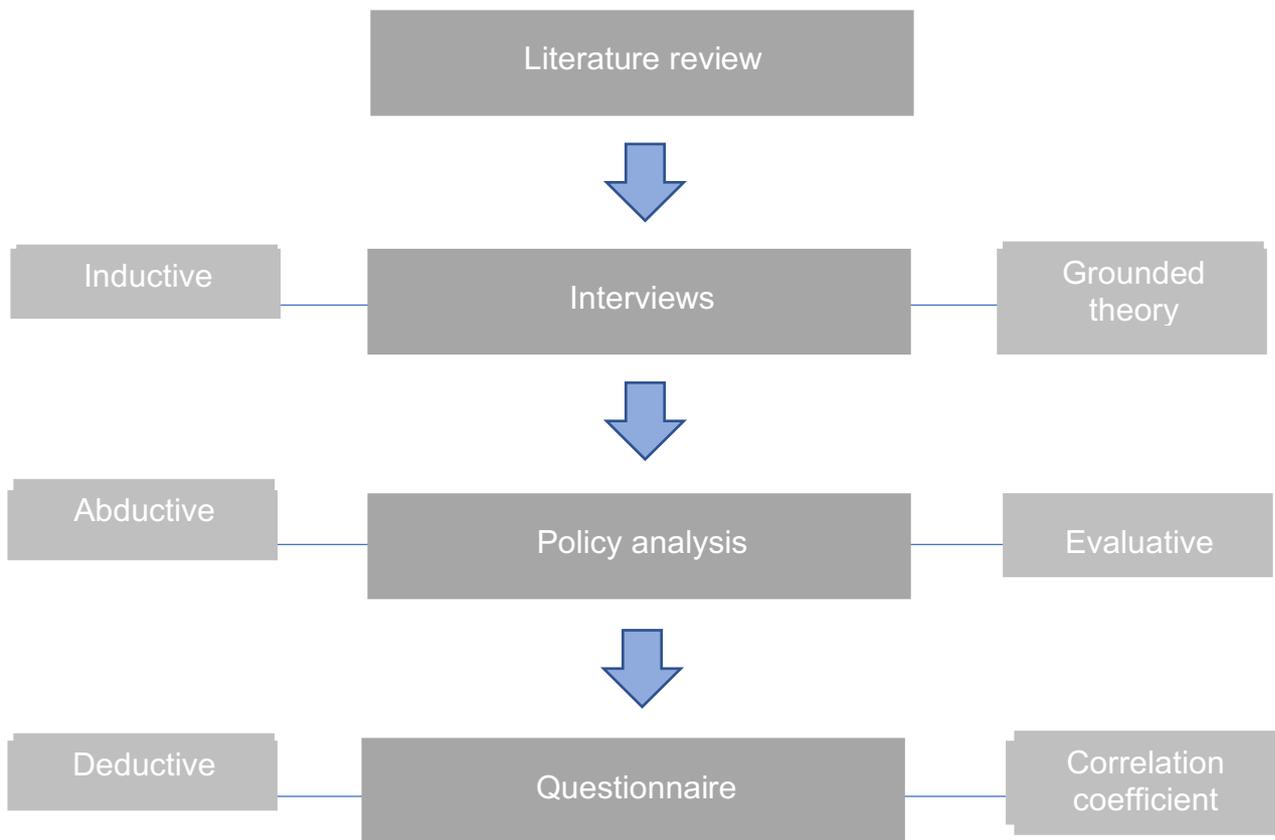


Figure 3. 4 Research technique framework

Interviews

Kvale (1996) describes how interviews allow for a conversation with the participant that provide their real-world views allowing the researcher to interpret these meanings in 'described phenomena'. Such 'in-depth' conversation (Schostak, 2006) provides information about the topic in question and overtime accumulates meanings for interpretation through data analysis.

Policy analysis

In a linear progression of research, the second phase aimed to apply the smart city framework developed in phase one, to planning policy of study cities in the UK, so as to provide a benefit-analysis in a similar form to that of the Climate Change Policy Analysis as described by Kelleher and Wagner (2018). As such the framework was of importance to the study as it provided the philosophical-lens for the research. In distinguishing between qualitative and quantitative content analysis of policy it is useful to provide definitions so as to understand the differences. Berelson (1952) defines quantitative analysis as a research technique that is objective, systematic and quantitative for the manifestation of content communication. Krippendorff (2004) meanwhile describes qualitative content analysis as a research technique that makes replicable and valid inferences from texts. Downe-Wambolt (1992) meanwhile provides a definition linking the two processes as a research method that provides a systematic and objective means to make valid inferences from verbal, visual, or written data in order to describe and quantify specific phenomena" (p. 314) – the inclusion of 'quantify' describing the quantitative process and 'inferences' describing the qualitative procedure.

It is worth noting, that while the thesis presents the study as descriptive (qualitative) and evaluative (quantitative), alternative literature, such as Rose et al. (2015) present such paradigms as descriptive and predictive. With

description, the focus is on describing features of the data content (Jain et al., 2010) while with prediction the aim is to predict the outcome or effect of the data analysed (Rose et al., 2015). Nonetheless, each of the separate phases, in their transition from the qualitative to quantitative stages of research within the mixed-method approach, employed different research skills that each combined to create the insight sought through the investigation. Patton (2012) claims the main issues of research choice are financial resources and time and effort, which combine to determine how the team can understand the phenomena of the study. As such, content analysis of policy was deemed not only appropriate, but an asset, in allowing for desk-based research and production of primary data from analysis as below.

Quantitative techniques are more likely to illuminate if the data analyst is guided in methodological choices by a substantive understanding of the problem (Tufté, 1967). Good procedures in this process involve techniques that help to answer the substantive question, ensure all the relevant information is drawn from the data, and learn something new about the world (Tufté, 1967). Causal explanation Tufté (1967) introduces the notion that all enquiry begins with the problem and variables (respondent and dependent) are utilised to provide causal statements of theory to the problem in relation to the research question. Important in the descriptive process is the use of language, with good researchers refraining from elaborate words. According to Tufté (1967) the best practice of a good researcher in this field of causal hypothesis is to present evidence along with an assessment of the respected causal hypothesis as opposed to letting the quality of the data determine the language of the explanation.

Surveys

Secondary data

Hinds et al. (1997) define secondary data analysis as that using existing data, collected for the purposes of a previous study, in order to pursue an

original research interest that is distinct from the analysis being carried out. Novack (1996) claims research should always begin with a review of secondary data and the thesis employed the use of secondary data reviewed through a systematic form as providing a baseline to compare with the primary data collection of results – a technique advocated by McCoston (2005) who later goes on to stress the importance of creating a statement of purpose to ensure the process is as well-defined and clear as possible in order to appropriately assist the study. It is within this role of the secondary data that Popay et al. (1998) observe secondary data analysis differs to meta-analyses as the aim of the latter is to compile and assess evidence relating to the area of concern, whereas the technique employed by the thesis is to support insight by combining this secondary data with primary data of the research.

Questionnaire

According to Bulmer (2004), questionnaires are designed for data collection when large, diverse and widely scattered groups of participants are required. It is within this scope of time, resource and communication that the strengths of the questionnaire over the interview prevail as the requirement to be present for each individual interview is no longer required. Further advantages also include the anonymity of the research participant when comparing online questionnaires to interviews, it is still essential that the data collected is relevant (Bulmer, 2004) to the study and this requires critical thinking and theory in the design of the questionnaire while there should also be sufficient checks in place for the reliability and validity of the responses. Further according to Bulmer (2004) the ingredients of a good questionnaire are:

- a) Clarity
- b) Brevity
- c) Unambiguity
- d) Reliability
- e) Communicability

In providing advice for the steps of the process, Sellitz et al. (1964) list the following six steps:

1. Deciding what information should be sought
2. Deciding what type of questionnaire should be used (structured or unstructured)
3. Writing the first draft
4. Re-examining and revising questions
5. Pretesting
6. Editing the questionnaire and specifying procedures for its use

3.4.4 Discussion

The discussion of data presented will interpret the results of inference that took place at the end of each of the phases that together formed the research investigation. Phase one was qualitative and the outcome was a framework of the smart city that aimed to explain what a smart city is. Phase two meanwhile applied the smart city framework to the analysis of planning policy so as to provide an assessment of planning policy in relation to smart city development. Phase three brought together inference from the previous two phases and combined this with the data collection and analysis of questionnaire data to provide a decision-making framework for planning smart cities.

The interpretation of results aims to explain why the results say what they do. The thesis therefore employs an interpretive mind-set influenced by theory accumulated throughout the research process, including the literature review, which was the starting point for the investigation and formed the basis of theory behind the study of planning policy, process and procedures in their relation to the development of smart cities.

4 Phase one data collection, analysis and results

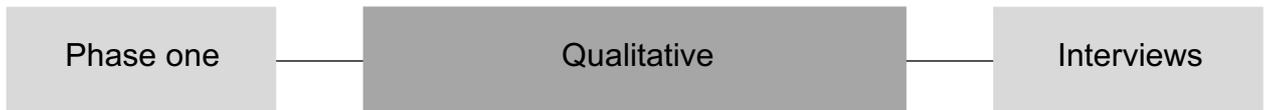


Figure 4. 1 Phase one data collection overview

The first phase of research was qualitative in its nature and worked toward objective (a) to identify key components of the smart city. The research was weighted in terms of time and energy attributed to the investigation in phase one as it would lay the foundations by which the following two phases were shaped as the outcome of phase one, categories and codes (together being concepts), provided the framework for analysis by which phases two and three assessed planning policy in relation to smart cities and their development.

4.1 Data collection

A combination of interview techniques was employed throughout the course of the research. Semi-structured interviews formed the majority of data collection, however, an on-going participatory field observation resulted in informal interviews while attending the Urban Mobility Action Network meetings for Liverpool City Region. Silva et al. (2015) highlight that in planning and other professional disciplines these opportunities to collect data in this way occur naturally provided the researcher is within the correct research settings. The meetings therefore provided an excellent environment within which to observe how practice develops with regards to smart cities while also enabling networking opportunities with key stakeholders operating throughout the smart cities field. Field notes replicated from the meetings, combined with memos of experience, can be found in the appendix and contributed throughout the on-going research investigation.

4.1.1 Exploratory interviews

In contrast to the data provided through informal interviews of participatory field observation, the semi-structured interviews provided more detailed and focused insight (Silva et al., 2015) to the participant's perception of the subject area. Thematic questions formed the basis of the interview protocol whereby the pre-interview design of themes guiding questions ensured the correct amount of theoretical saturation (Glaser and Strauss, 1967) throughout the process. It is in this sense that the coding and analysis of interviews provided new lines of enquiry emerging from the data and directed the research into specific avenues that required further attention. A naturalistic setting (Silva et al., 2015) was achieved through open-ended questions operating on a more conversational level. The role of the researcher then was to facilitate the introduction of topics for conversation organised around the specific themes and topics in order to adhere to the theoretical saturation of the pre-defined strategy. Interview probing (Silva et al., 2015) guided the free-flowing nature of the exchange in a flexible and adaptable approach to the interview. Probing followed up the series of 'grand-tour' questions (Silva et al., 2015) set out through the guide in a logical sequence to the interview that allowed for emerging key questions to perform the role of way points toward a larger overall vision for the journey of the conversation.

Silva et al. (2015) introduce four issues as requiring the researcher's attention prior to conversation taking place. These are the requirement to decide how to contact the potential interview participants; the preparation of materials for data collection; how one comports themselves during the conversation; and what to do immediately following the experience. The thesis employed the use of email to approach potential participants. Within the email an advance letter detailing the primary aim of the study and objectives of the research was sent to professionals operating throughout smart city sectors. This process was at times frustrating due to the juxtaposition between potential participants' willingness to engage and their

practicalities in regard to work commitments. As previously highlighted, the preparation of research materials included the creation of interview protocol that listed key questions and probes for following up in order to create a free-flowing experience. Eye contact was held throughout the exercise to form engagement between the researcher and participant. The aftercare of the interview was orientated around a follow-up email to thank the participant for their time and inform them of future plans for the research. This ensured a professional courtesy while also forging an opportunity for future collaboration should the opportunity arise.

4.1.2 Sampling

The thesis employed sampling as a means of opportunity for the method for the interviews, however, at the same time ensuring participants of the study involved included those from the three areas of private, public and political sectors and was therefore representative of the population of smart city professionals. These principles formed the groups of the sampling and from this point the investigation worked on the basis of opportunity as it was a challenge to obtain participants willing to participate in the study. However, the tri-perspective ensured the validity of the study within a representative sample of potential participants.

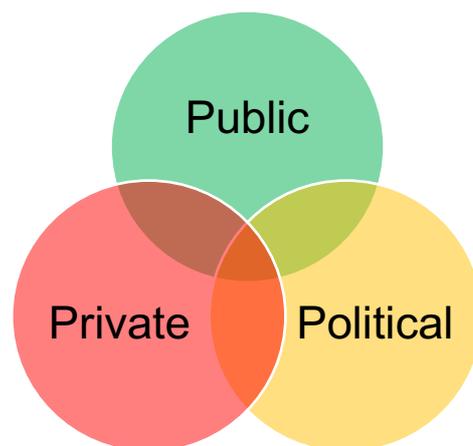


Figure 4. 2 Interview participant background



Figure 4. 3 Interview participant organisation

4.2 Data analysis

The following section introduces the logic of analysis for data before introducing in more detail the technique of content analysis that formed the analysis of interview data collection.

4.2.1 Content analysis

A valid form of theory development requires following two rules that Glaser and Strauss (1967) set out: firstly, that categories should emerge from the data as opposed to being forced upon it, and secondly that theoretical sensitivity should be applied to the process whereby reflection of empirical data forms the ability to discover relevant data relating to theoretical terms.

With regards to the theoretical sensitivity of the content analysis, a background in planning theory as well practice provided the basis for application of knowledge to the subject area. While smart cities are generally

regarded as a technological solution it is grounded within the setting of the city. While the literature review provided the basis for forming a conceptual idea of the smart city phenomenon the practical experience of working in a public-sector planning authority, coupled with a master's degree in planning allowed for the fruition of a dynamism in parallel between planning and smart cities. This in many senses characterises the research project and thesis in that it attempts to encapsulate the generation of new theory regarding the emergence of smart cities and planning's role in the context of its development and implementation through analysis of content and a coding mechanism for achieving this.

4.2.2 Constant comparison

Initial coding line-by-line took place in order to familiarise the unit of analysis case by case. While this process was long and at times tedious it did provide a crucial role in terms of developing a baseline understanding of the themes and phenomena mentioned throughout. This was particularly helpful when stepping up into the focused coding as constant comparative analysis of codes emerging throughout provided a more focused account of coding in the second phase whereby more prominent initial codes produced the basis for more detailed focus. Coding related to actions of meaning provided by each participant allowed for the explanation of meaning behind the units of analysis. Charmaz (2006) provides a code for coding in the initial phase that highlights the importance of remaining close to the data, staying open to new developments, producing simple and precise codes, preserving actions, comparing data with data and moving quickly through the data to create a free-flowing rhythm.

As a note, a few 'in vivo' codes emerged throughout the process of initial coding referring to symbolic markers (Charmaz, 2006) of the participant's speech and meanings. One example from the thesis is the use of the in vivo code 'house of cards' to explain the various political philosophies and personalities of politicians (on local and national levels) affecting specifically

the open ethos towards data, which plays a role in the wider formulation of the smart city. Another code to emerge was that of the 'guinea pig' that referred to the operation of the implementation of early smart city projects playing the role of the guinea pig in reference to learning how and why we should pursue alternative smart city projects.

Prominent initial codes then formed the basis of more focused detailing of codes in a second stage of coding. Glaser (1978) describes this second major phase of coding as more directed, more selective, and conceptual than line-by-line therefore building upon the initial codes to a higher level of abstraction. Bearing in mind of course that the subjectivist philosophy of the researcher brought the abstraction through one of what could have been many existing realities should other researchers have studied the same units of analysis. The process of focused coding determines the adequacy (Charmaz, 2006) of the earlier developed codes. The earlier codes emerging initially forwarded the analytical direction of the coding process, while the focused coding placed decisions upon the codes to categorise the data incisively.

The concentrated and active involvement in the process (Charmaz, 2006) ensures the validity and strength of the grounded theory development. Thus, the researcher acted upon the data rather than allowing it to passively flow through simple reading. This results in interactions of events in the data and an applied perspective that embodies the subjectivist approach to research highlighted earlier in this research design chapter. The use of language in the focused coding exercise was extremely helpful in creating insightful observations of the data that formed concepts. Specifically, the use of words ending in 'ing' as proposed by Charmaz (2006) was particularly helpful in bringing the codes to a higher level of abstraction forming concepts - the use of this technique is described as presenting verbs as nouns.

The categorising of concepts that arose throughout the focused coding phase formed the basis of theoretical coding that followed and formed a sophisticated level of coding (Charmaz, 2006). Glaser (1978) explained this as 'how substantive codes relate to each other as hypotheses to be

integrated into a theory' (p. 72). The thesis describes this process as the relationships between the categorising of concepts that arose through the focused coding stage that preceded.

4.3 Results and discussion

The smart city framework was an explanatory framework that aimed to provide an overview of the smart city to communicate the functioning of the concept to planners. As the aim of the framework was to explain the theory, a descriptive format was used. The data collected through semi-structured, open interviews was analysed using grounded theory and the smart city framework can be seen below in figure (4.4). Meanwhile, however, the thesis expands upon and interprets each of the categories and codes formed within to provide a detailed explanation of the concept. While the smart city framework is designed with the role of planners in mind, this insight comes later and the framework can be used for all professionals within the digital and built environment sectors interested in smart cities as a concept.

4.3.1 Data as a resource



Figure 4. 4 Data as a resource coding concept

Data as a resource of the smart city is a concept introduced widely by various works in the literature (Suzuki, 2015) which each describe data as holding value to people and organisations of cities whether it be for ideological (open data), currency (business models) or informative (information) purposes. Through the grounded theory approach to the

analysis of data the thesis collated three ways within which data has value for smart cities as well as picking up on the notion of private data that is not available for value extraction but still included within the section as a form of data that is not only a right of citizens but also conveys trust in the use of data as a resource.

This aspect of ensuring the security of people's private data is integral to the success of smart cities that utilise data as a resource to provide insight for decision-makers, as without the trust of citizens the role of data would devalue. The notion is that more people connected to digital technologies that produce data results in more accurate pictures of society. In terms of the values of data for smart cities, a timing aspect builds upon the work of (Batty, 2013) to explain how accountable, efficient and innovative values can be extracted from data through analysis to enable greater options for decision-makers of city governance. In immediate terms, accountable is ensuring transparency as citizens can ask for real-time updates on services and decisions; in being efficient cities can use data to inform decision-making while being innovative provides cities with the opportunity to develop algorithms for future innovative priorities. In specific reference to the public sector; interview participant (D) highlighted "the key is in the terms of strategy, policy, vision" (p. 281) thereby reinforcing the view of the thesis that there is a role for planning in smart city development, specifically within local authorities.

4.3.2 Data-cycle

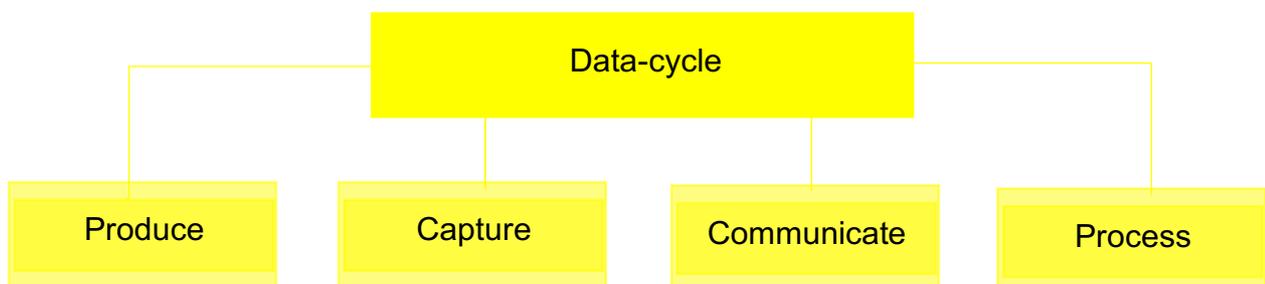


Figure 4. 5 The data-cycle coding concept

The accumulation of data in the smart city is not a rigid nor static system and forms more of a constant cycle of data that is streamed through various parts of the process ranging from data collection, to data communication and data processing. In talking about the role of open data, interview participant (E) stated “I think cities need to open data up, by the city I don’t just mean public sector but private and academic as well” (p. 307). To begin, however, data must firstly be produced and this takes place with the daily activities of the city – ranging in categories from the sector of interest whether that be the environment, mobility, economy etc. In response to the role of data; interview participant (D) highlighted how their organisation is trying to “capture some projects that will create particular data and then understand how that data can be used for a variety of purposes” (p. 275).

If we take a step-back and look at smart city projects, the thesis observes how smart city projects are designed with the production of data in mind whether that be for informative purposes or that of the business model. The following processes of data collection, data communication and data analysis thereby form a process in which the decision-making capabilities of the decision-makers, usually local governance, are enhanced by this resource. In reply to a question asking about the generation of data, interview participant (D) responded “but also there really needs to be a specific purpose as opposed to people generating data for the sake of it” (p. 278).

Of particular interest to the thesis then is what strategies are in place for the use of this data as a resource, at the specific point of the decision-makers, as these choices often create new ‘realities’ from which new data is produced – whether for examples this be the production of transport data of mobility trends due to a new cycle route, or location of a new development thereby forming newly used transport routes by citizens. The data produced has in some ways always been created, however, it is that now the scientific innovation of our time is being utilised that we can begin to collect this data. In probing interview participant (E) further as to their collection of data (p.

306), the research found that prior to implementation of technology, data was collected manually thereby highlighting the evolution of the process in terms of the digital environment of the smart city – this theory was something that was also prevalent in interview (A).

4.3.3 Smart city characteristics

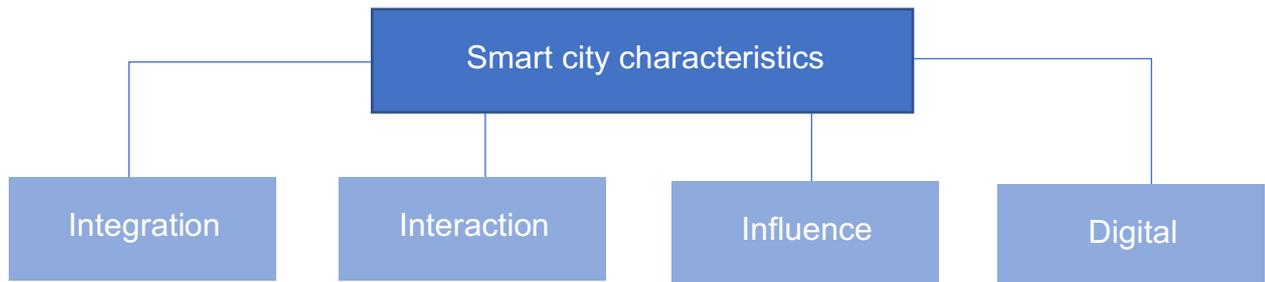


Figure 4. 6 Smart city characteristics coding concept

Integration of technology to place, influence of technology in people’s daily lives, and interaction of people with place are aspects of smart city characteristics for the development of smart cities. It is within these results that we can begin to dissect the role of planning in smart city development (through integration of technology to the physical sense of place) and role of smart city projects and initiatives in the role of sustainable development – a key consideration of planning as per UN resolutions and national policy.

In analysing these relationships deeper, we can see how technology has the potential to influence the social, environmental and economic fabrics of development and the built environment. Connectivity therefore becomes a consideration as the interaction of people with the physical sense of place enables new opportunities in terms of data collection, insight and information for decision-makers and service providers. Implementation of strategies to facilitate smart city development via using data as a resource and the data cycle are growing in importance as the new environment of the smart city, characterised by the application of digital technologies to traditional forms of

development, is demanding new forms of business models and viability appraisals – all of which require thinking at the design stage of projects.

As an example of the changing environment of the smart city, when asked about the emerging smart city community across the UK, interview participant (D) responded with: “if the public sector does not engage then it is not going to be able to address key issues” (p. 273).

As planning is the authoritative sector in the determination of planning applications for proposed development throughout the UK it is in the view of the thesis that an adaptation of existing planning policy and thereby practice directing all stages and sectors of the development process is essential for cities in operating throughout the competitive market of smart cities.

4.3.4 Project phases

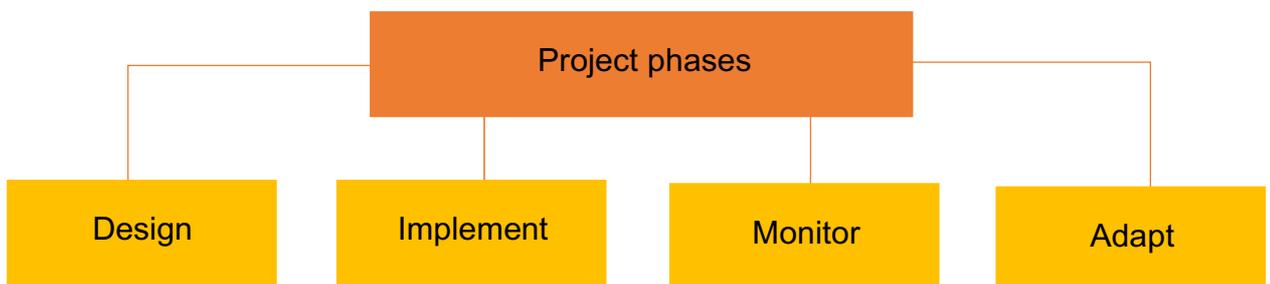


Figure 4. 7 Project phases coding concept

Design, implementation, monitoring and adaptation form phases of smart city projects within the built environment and provide a descriptive view in analysis of the development process forming the journey for smart city development. It is important to recognise that the characteristics of smart city initiatives go beyond the implementation of the project as digital software has the ability to be updated remotely – thereby providing means beyond the construction of the project by which developers and/or owners/third parties with interest in the development can adapt the solution in terms of its collection of data.

Expanding upon this, it is possible for varying levels of monitoring to take place – and by this it is meant in terms of the data produced as remotely served software could potentially alter the types, frequency and volume of data that is collected. This alternative model for development represents the new environment of the smart city in that digital layers are formed on top of the ‘traditional’ physical layer of the built environment.

The question thereby arises as to what role planning can have with existing planning policy in the phases for projects, as well as what role planning should have in such instances. There are also opportunities for the application of these phases in existing planning systems via process and procedures such as enforcement and monitoring of conditions that are required in most instances of planning permission being granted. Finally, to highlight this position, in responding to the direct question of does more data mean smarter decisions, interview participant (E) replied “that is a good question. I would say yes. I think in any decision you have to make whether it is your boring domestic decisions based on how you run your house or life, taking out to running a company, to a department or a city, from a personal point of view the more data I have got on things the better decision I can make” (p. 313).

4.3.5 Summary

To bring together the first phase of research, the investigation produced four key categories with their own individual concepts through the production of coding from the grounded theory approach to the analysis of qualitative data collected through interviews with professionals from throughout the smart city sector. The subjective philosophical mindset of the researcher from a town planning background influenced the design of the interview questions and furthermore held some influence upon the coding mechanism thereby providing the thesis with some degree of certainty that the research objective to identify key components of the smart city was met and furthermore, was

relevant for the future phases of research that aimed to apply these concepts to the area of planning.

5 Phase two data collection, analysis and results

The second phase of research was qualitative and quantitative in its nature (see figure 5.1) and bridged the gap from a fully qualitative first phase to a fully quantitative final phase for data collection and analysis within a mixed-method approach to the research investigation.

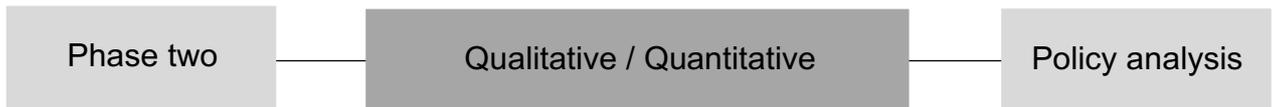


Figure 5. 1 Phase two data collection overview

The phase worked toward objectives (b) to critically assess planning policy in relation to the smart city and (c) to probe the relationship between smart city development and planning policy. From this point in the sequential-mixed-method research design it is clear how phase one influenced the data collection of phase two in what was a progressive study designed to produce an evaluative framework for appraising the role of planning in smart cities.

5.1 Data collection

The second phase of research applied the outcome from phase one to analyse planning policy in relation to the smart city by analysing factors of the smart city framework. A combination of policy analysis techniques were employed through the form of description and evaluation.

Huberman and Miles (2002) as key literature for phase two of research in a data analysis approach to applied policy research. Importantly, the authors define how a 'framework as a method of qualitative analysis' (p. 310) is a mechanical approach consisting of a systematic and disciplined (Huberman and Miles, 2002) approach to data analysis that is firstly enforced through the data collection. In this sense then, the thesis set the background to a quantitative second stage of analysing data that identified a thematic

framework for indexing – a process referred to by Huberman and Miles (2002) as whereby the thematic framework or index is systematically applied to the data in the textual form. Importantly, “indexing references are recorded on the margins of each transcript by a numerical system which links back to the index, or by a descriptive system based directly on the index headings” (p. 316, 16-9).

Applying this concept to the work of the thesis in analysing planning policy in relation to the smart city codes arising from the grounded theory approach to data analysis of phase two, the study essentially utilised the codes (formed of concepts and categories) as the thematic framework, and applied an indexing based on the level of oversight planning in relation to the thematic framework. This process provided a ‘familiarisation’ of the data through a method of ‘mapping and interpretation’ (Huberman and Miles, 2002).

As Huberman and Miles (2002) relate: “the method, of course, needs to be adapted to suit the aims and coverage of a specific piece of research” (p. 328, 110-12) and in the view of the thesis this was achieved by taking the smart city thematic framework and applying this to planning policy so as to produce insight into the role of town planning in smart city development.

5.1.1 Policy analysis

This framework for the analysis of factors was orientated around the principles of work being open and explicit, objective and empirically based, consistent with existing knowledge and verifiable (Walker, 2000). The purpose was to assist the research in determining which planning policies provided best practice, and what alternative approaches were available to provide the greatest planning results for smart city development.

As Walker (2000) suggests, a major difficulty remains in synthesising the numerous and diverse impacts and presentation of results in a way that facilitates the ranking and comparison tactics. An aggregate approach was

employed whereby the qualitative descriptive stage was complemented by a quantitative evaluative stage weighing factors for their prevalence in planning policy. A consequences table was therefore used to present the result in the following formats of description and evaluation. In justifying the role of quantitative and qualitative sections for the policy analysis, Oppenheim (1992) provides clarification in the coding of analysis of data whereby the quantitative numeric evaluation of policy is objective and the qualitative descriptive method allows for the researcher to interpret the sample and as such this process of inductive coding can easily be influenced by subjectivism (Bryman, 2008) leading the thesis to provide justification for the subjectivist philosophy previously mentioned by saying the objective evaluation phase was very much placed within a framework that was created through subjectivism and as such it was the research skills that were displayed in the evaluation phase that ensured these objective results (as oppose to specifically an objective philosophy).

The above assessment and data analysis formed a SWOT analysis of planning policy in relation to the concept of the smart city. The SWOT analysis is effectively made up of two separate components. Firstly, a comparative analysis is made whereby the content of planning policy is compared to the environmental scanning of the smart city. The outcome was therefore an assessment of planning policies' appropriateness in operating throughout the new environment of the smart city.

By means of defining for terms for the exercise:

- Strengths – Attributes, characteristics and factors that give competitive advantage to the city
- Weaknesses – Attributes, characteristics and factors that weaken the competitive advantage of the city
- Opportunities – Favourable situations and factors that can strengthen competitive advantage of the city

- Threats – Unfavourable situations and factors that could create problems for the city compromising its competitive advantage

Quantitative analysis

Table 5. 1 Analysis of factors for evaluation scoring, description & explanation

Score	Development	Explanation
-1	Regulated	Obstacles are placed to the analysis of factors
0	Neutral	Neither positive or negative analysis observed
1	Facilitated	Commentary is made as to the analysis of factors
2	Standardised	Standards are provided for the analysis of factors
3	Guided	Advice is provided as to the analysis of factors
4	Directed	Aims & objectives are formed as to the analysis of factors
5	Promoted	A vision is provided as to the analysis of factors

5.1.2 Sampling



Figure 5. 2 Policy analysis sampling diagram

As it would have been too difficult, in terms of time attributed to the process, to collect and data from all local authorities throughout the UK, the thesis sampled the larger populations to develop theory and build knowledge on a manageable group (Wienclaw, 2013). The selection bias was an influencing factor in this part of the research specifically, and the investigation worked on a larger view of the UK to choose cities from each of the four countries of England, Wales, Scotland and Northern Ireland (see figure 5.2) so as to provide a greater means of analysis with each nation having their own national planning policies. In order to do this, the thesis first defined which characteristics were of most importance to the study and therefore would be important in the target population. The sampling method was therefore one whereby core cities defined the target population so as to provide the greatest means of comparison as these cities had already been grouped together and therefore had closely aligned growth principles, working together on a practical basis with each other. As the means of analysis, as stated above, was important to the study, London was included to coincide with the greater authority of Manchester – thereby providing some comparable insight of similarly formed governance structures. The key consideration was to determine whether the sample was representative of the larger population and therefore the inclusion of cities from all four countries, coupled with those of the core cities ensured that the thesis was confident of the validity of the study.

5.2 Data analysis

5.2.1 Descriptive

The descriptive policy content analysis was qualitative in nature and as such formed a qualitative comparative analysis (QCA) of planning policy. As Ragin (2008) explains, QCA is grounded in the analysis of relations as oppose to correlations and provides a link to theory than cannot be achieved through conventional quantitative methods. This part of the data analysis was

important as it would provide the theory and base-level of knowledge for discussion of data post-evaluation. It is within this sense that the qualitative and quantitative parts of the planning policy analysis combined to provide insight within a comparative analysis of the relationship between planning policy and smart city development.

As Bengtsson (2016) explains, the purpose of content analysis is to organise and elicit meaning from data, drawing conclusions that are realistic to the subject area. In carrying out this form of analysis, there are two approaches of a broad nature (manifest analysis) and deep structure (latent analysis). Greneheim and Lundman (2004) state each of these approaches requires interpretations that vary in their depth and level of abstraction. Coming back to Bengtsson (2016) meanwhile, there are four stages to each approach constituting that of de-contextualisation, re-contextualisation, categorisation and compilation. As Bunard (1995) introduces, the self-reflection of the researcher in the analysis of content of policy, within the qualitative stage, was important in applying the theory of smart cities to planning policy.

Following on from this point, Elo et al. (2014) prescribe that the researcher must take into consideration their 'pre-understanding' of the subject in the planning and analysis processes in order to minimise individual bias. As the thesis's philosophical paradigm was one of social-constructivism influenced by a subjectivist viewpoint, this was in some way an issue for the content analysis of policy. However, given that the framework within which analysis took place was already produced via the above mind-set, it allowed for the actual carrying out of data analysis to be objective in its stance, as the framework provided the means by which analysis took place and by being truly objective to the application for the framework as a tool, the carrying out of the research technique was objective in itself and its nature. This is not necessarily a negative point, as to have preconceived knowledge of the subject and to be familiar with the context can be an advantage so long as this does not affect the interpretation of results (Bengtsson (2016). As Silverman (2001) goes on to explain, qualitative research is centred around interpretation, and these interpretations vary in depth and their level of

abstraction depending upon the ability of the researcher to distance themselves from the technique of analysis.

It is important at this stage to differentiate between qualitative research methods and qualitative content analysis. Bengtsson (2016) states that the latter is not linked to a particular science, and as such the risk of confusion with philosophical concepts is reduced - of importance rather is that the researcher adheres to a qualitative perspective of rigor and credibility resulting in trustworthiness – described by Patton (2002) as staying ‘true’ to the text.

5.2.2 Evaluative

The application of the smart city framework to the planning policy content analysis, within the evaluative sense, was quantitative and required an objective and systematic approach to data analysis, so as to ensure the results were as accurate and reliable as possible. The technique for data analysis aimed to construct a mathematical function whereby streams of themes throughout planning policy were assigned a numerical value. As Kelleher and Wagner (2018) observes in the Optimal Growth Theory of cost-benefit analysis, this technique aims to construct a function where values assigned to factors can place themes from best to worst, and an ‘optimal’ theme prevails within a ranked-order.

This technique for data analysis is very much in keeping with the social constructivism as introduced earlier. However, it is important to note that the subjectivist philosophy produced the framework for analysis and objective research skills which ensured this part of the research produced the results in an accurate and valid manner – distinguishing between the social-constructivism with subjective philosophies and objective research undertaken with researcher skills is important in understanding the approach to the investigation and pragmatic mindset of the researcher.

In building upon this picture of quantitative content analysis, according to Rose et al. (2015), quantitative content analysis involves drawing conclusions from the classification of parts of text through the application of a structured, systematic coding scheme. This coding scheme was formed through the outcome of phase one in the form of a smart city framework and means that the research could easily be reproduced by alternative studies and researchers.

When viewing in relation to the carrying out of data analysis in a descriptive and predicative approach as earlier introduced, the thesis formed a reliability and testing procedure with the evaluative stage that quantified the descriptive and qualitative results preceding. The application of the smart city framework from phase one to the earlier qualitative phase ensured a continuation of the research and provided the framework (within a subjectivist philosophy) that could be applied to the research question utilising objective research skills, thereby not compromising the philosophical viewpoint and integrity of the researcher while also appropriately meeting the requirements of the research investigation.

As Insch et al. (1997) point out, development of the coding scheme involves interpretation and thus has risks involved, however, it is in the view of the thesis that the research progression for phase one providing the framework for analysis of content in phase two is in line with the subjectivist philosophical viewpoint of the research. And while critics of content analysis claim that as a technique it can struggle to provide explanations for particular findings it is again in the view of the thesis that the combination of qualitative and quantitative techniques for the analysis of content of planning policy in relation to the smart city framework covers this point as each works in tandem with each other to firstly quantify the descriptive findings while also explaining and expanding upon the evaluative results in a symbiotic relationship.

5.3 Results and discussion

In assessing planning policy in relation to the smart city framework a quantitative analysis provided the evaluative measurements that provided an overview in ranking of the policy with regard to one another. The descriptive qualitative assessment thereby elaborated upon these measurements to provide insight and details of strengths, weaknesses, opportunities and threats.

The smart city framework provided an overview of the new environment of the smart city, and in assessing planning policy in relation to the concept, an evaluative outcome provided a view of the gap between planning policy and smart city development. The purpose of planning smart cities is a question that arises when factoring in the purpose of sustainable development, as the fundamental role of technology, either through physical hardware or digital software, in smart cities, as described previously through technology as a form of life, has the potential to affect economic and social structures. Regarding the environment, there is wider theory and literature as to the opportunities technology presents in meeting the challenge of climate change, and much of the debate in advocacy to date for smart cities stems from this concept.

In the new environment of the smart city, where the production, capture, communication and analysis of data provides decision-makers with new insights and possibilities, there is also the factor of the remote update of digital software constituting a material change in development of smart city solutions, perhaps through sensors. In a world that is flexible and dynamic in this way, adaptable planning policy is required and as can be seen from the introduction of new planning policies, the journey of adoption within the statutory framework of the democracy of the United Kingdom brings with it a time frame that does not allow for this dynamic process. In some ways this leaves a gap, whereby there is a grey-area where development has been approved, yet changes as time progresses and in the view of the thesis, the

planning system in its current format or process and procedures is not fit for purpose in responding to the scientific innovation of our time – and this is an avenue for research in phase three as the study investigates the role of planning procedures and process throughout the smart city framework.

5.3.1 Evaluation of planning policy in relation to smart city characteristics

Table 5. 2 Smart city characteristic evaluative analysis of UK planning policy

Overall evaluative analysis of UK planning policy	
Component & variables	Average evaluative score(s)
Characteristics	1.03
Integration	1.6
Interaction	0.25
Influence	0
New environment	2.3

The theme of smart city characteristics returned an average evaluative score of 1.03 (facilitate) across the four concepts of influence (0 – neutral), interaction (0.25 – neutral), integration (1.6 – facilitate) and digital environment (2.3 – standardise). When comparing this average to the other four themes (see figure 5.2 for overview), it is highest and therefore represents the most-attributed theme in planning policy. The concept with the highest score was the digital environment, of which it is fair to say the score of 2.3 went some way to improve the overall average of the theme in relation to alternatives. Integration (1.6) was the second highest score and was primarily represented by the integration of fibre networks as planning policies moved to implement the strategy of the NPPF in securing high-connectivity-broadband for communities, as opposed to what would be viewed as technology such as sensors and application solutions of the smart city domain.

5.3.2 Evaluation of planning policy in relation to using data as a resource

Table 5. 3 Using data as a resource evaluative analysis of UK planning policy

Overall evaluative analysis of UK planning policy	
Component & variables	Average evaluative score(s)
Using data as a resource	0.8
Privacy	0
Accountability	0.43
Efficiency	1.16
Innovation	1.62

The theme of using data as a resource returned an average evaluated score of 0.8 (facilitate) across the four concepts of privacy (0 – neutral), accountability (0.43 – neutral), efficiency (1.16 – facilitate) and innovation (1.62 – standardise). When comparing this average to the other four themes (see figure 5.3 for overview), it is second highest and therefore represents a theme that is attributed in some part throughout planning policy, however, still has quite a low score in terms of how much the theme is attributed. Innovation (1.62) returned the highest score for a concept within this theme and was primarily a result of using data to inform future decisions, specifically with regard to climate change which was the primary contributor to the evaluation of this theme. This was especially true for the NPPF, a national level framework that instructs local plan policies, and this was therefore reflected in the local plan policy evaluations.

5.3.3 Evaluation of planning policy in relation to project phases

Table 5. 4 Project phases evaluative analysis of UK planning policy

Overall evaluative analysis of UK planning policy	
Component & variables	Average evaluative score(s)
Project phase	0.07
Design	0.83
Implementation	0.04
Monitoring	0
Adaptation	0.17

The theme of project phases returned an average evaluated score of 0.07 (neutral) across the four concepts of monitoring (0 – neutral), implementation (0.04 – neutral), adaptation (0.17 – neutral) and design (0.83 – facilitate). When comparing this average to the other four themes (see figure 5.4 for overview), it is second lowest and therefore represents a theme that is not attributed throughout planning policy, especially when considering the low score in terms of how much the theme is attributed. The concept making the largest contribution in representation to the theme was design (0.83), constituting a reflection of planning as a sector and profession in terms of input to development. However, the low score is a result of the specific assessment of design for smart city factors and as such an assessment for design of ‘traditional’ developments would likely return a higher score.

5.3.4 Evaluation of planning policy in relation to the data-cycle

Table 5. 5 Data-cycle evaluative analysis of UK planning policy

Overall evaluative analysis of UK planning policy	
Component & variables	Average evaluative score(s)
Data-cycle	0
Production	0
Capture	0
Communication	0
Processing	0

The theme of data-cycle returned an average evaluated score of 0 (neutral) across the four concepts of production (0 – neutral), capture (0 – neutral), communication (0 – neutral) and processing (0 – neutral). When comparing this average to the other four themes (see figure 5.5 for overview), it is the lowest and given the scores of 0 across all concepts within the theme, the thesis can say with certainty that the theme is not attributed throughout planning policy. When carrying out the assessment, there was no representation of the concepts that make up the theme, representing an area for improvement of planning policy on a national scale and local scale.

5.3.5 Summary

The question also arises as to what oversight or role planning should have in smart city development. The thesis advocates that sustainable development should recognise the role of technology and as such planning should have a prominent role as the authority within the built environment, capable of bringing together a wider range of sectors toward one goal. Whether it be through an authoritative role or consultative role, there is scope for more influence of planning in the role of technology within the aspect of place.

The present model is that electronic code communicators should be registered with OFCOM. However, the thesis suggest that planning should go further to either place conditions or informatives to permissions stating that the digital software must be up to date, safe and secure – this is if it is not determined that technology should be a material consideration that is.

The role which planning should have in smart city development is something that is investigated further in phase three. There are examples within which planning departments are coordinating with Smart Plans. The example of London is primary in this with the Smart London Plan.

6 Phase three data collection, analysis and results

The third phase for research (summarised in figure 6.) was fully quantitative and worked toward objective (d) to compare the evaluation of planning policy and professional practice opinion to form insights as to the role of planning in smart city development. The final phase completed the mixed-method research approach for data collection and formed a test-bed for a future case study approach to investigating in detail the approach of individual planning of cities for smart city development in what was the national study of this thesis.

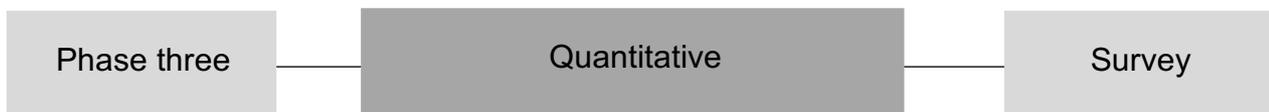


Figure 6. Phase three data collection overview

6.1 Data collection

6.1.1 Secondary data collection

A keyword search of smart city characteristics in planning application descriptions was performed. The search was performed across all study cities for 'data', 'sensor' and 'technology'. The results can be seen below. The reasoning behind the choice of these words was found in the literature review whereby a sensor is a form of technology that aims to collect data. A systematic search was performed as below. Also see the decision map.

The search was performed across all study cities for 'data', 'sensor' and 'technology'. Once an application was deemed as qualifying due to the description, it was then placed within a category as to the type of development proposed. The categories were as follows:

- Support: Application proposes a development that is an enabler/supportive to products/solutions of the smart city e.g. air conditioning/layout
- Facilitation: Application introduces a development that facilitates smart city development through provision of facilities e.g. extension to/new building/change of use
- Solution: Applications introduces a development that is a solution/product that contributes to the smart city e.g. telecommunication equipment/data receiver

6.1.2 Questionnaire

6.1.2.1 Questionnaire design

The thesis employed a structured questionnaire that populated questions in a definite, concrete and preordained manner. The avoidance of long, complex, personal, suspicious and leading questions should be ensured as Bulmer (2004) states questions should be few, short, clearly worded, simple and easy to reply so as to ensure the highest response rate as possible.

In terms of the sampling of data, the method of sampling, as described by Mathers et al. (2007) is of a population to gain data that is representative of the target population. As such, Liverpool City Council planners formed the sample, while the target was the wider network of public planners throughout the United Kingdom, and more specifically, within the cities included in the policy analysis.

6.1.2.2 Questionnaire construction

Asking questions is the form of the questionnaire and the thesis included content that was narrow in its focus and in-keeping with the research

investigation throughout phase two. Mathers et al. (2007) claim there are two main considerations relating to the construction of the questionnaire firstly, the wording of questions and secondly, the visual/interactive aspects of the questionnaire i.e. its presentation. As the questionnaire was web-based it was important that the survey correctly communicated the intended content so as to provide the highest validity and reliability of results possible. As Mathers et al. (2007) go on to explain, web-based questionnaires do not have the reasonable benefit of participants asking the researcher to clarify a question, however, it could be said that such a need should be mitigated with the application of a pilot questionnaire as previously introduced by Selitz et al. (1964) earlier. As the sole researcher for the study, the thesis was not required to negotiate the wording of questions and rather the researcher had to apply reasonable judgement and testing to the process of question formulation.

With regard to the presentation of the questionnaire, or visual/interactive aspect, the use of Bristol Online Surveys sufficiently provided the template from which the questionnaire would be accessed by the respondent.

6.1.2.3 Questionnaire deployment

The deployment of the questionnaire was achieved through using the internet in a web-based questionnaire (Davis, 1999) to which there are advantages of reduced cost, ease and speed of administration (Buchanan and Smith (1999) as well as other improvements in relation to population and sampling targeting (Smith and Leigh, 1997) arising from electronic mail as a tool. In terms of recruitment of respondents, a full population of planning officers in Liverpool City Council was targeted. The questionnaire was administered throughout the planning department of the organisation using e-mail. The data-gathering exercise was completed within one month and the researcher utilised their position within the organisation to ensure a high response rate. All questionnaire responses, however, were anonymous ensuring this relationship did not prejudice the collection of data.

6.1.3 Sampling

The target population was directly built environment professionals, as opposed to smart city professionals, and was specifically designed so as to provide a representative example of the judgement of professionals within the sector for the comparison of planning policy. In order for the results to be valid, the thesis ensured participants were only from the built environment sector by asking specific questions in the introductory stage of the questionnaire. This ensured the data set would be representative of the target population. Due to practical constraints, the sample was withheld from cities included in phase two, so as to provide the means for comparison and analysis. However, the resultant participant sample was made up of Liverpool and therefore formed a case study example that could be used as a framework for a wider investigative study.



Figure 6.1.1 Questionnaire respondents

6.2 Data analysis

Phase three of research formed a validation procedure for using the evaluative framework within the setting of planning as the questionnaire design implemented the framework, following on from the analysis of factors

of planning policy. This continuation of the research design provided a clear strategy for investigating the role of planning in smart city development.

6.3 Results and discussion

The results provided an answer to the research question of what role planning should have in smart city development, by engaging with planning professionals and comparing these results to those of the objective policy analysis that evaluated planning policy in relation to the evaluative framework for assessing the role of planning in smart cities.

6.3.1 Comparison of planning policy evaluation and questionnaire response

In comparing the evaluation of planning policy to the questionnaire responses, the investigation gained an insight into how the evaluative model for assessment can be used, by validating the relationships in the framework in its application to planning specifically. The target population of built environment professionals ensured the responses were of value and would be accurate to the role of planning in smart city development.

6.3.1.1 Comparison of smart city characteristics

Table 6. 1 Smart city characteristics evaluation of planning policy & questionnaire responses

Comparison of planning policy evaluation and questionnaire responses			
Factor	Evaluation	Questionnaire	Result
Smart city characteristics			
Integration of technology	1.6	3.1	Standardisation > Guidance
Interaction with people	0.25	2.7	Neutral > Guidance
Influence of technology	0	2.0	Neutral > Standardisation
Digital environment	2.3	2.4	Standardisation > Standardisation
Average	1.03	2.55	Facilitate > Guidance

When compared to the average evaluation of planning policy for smart city characteristics (1.03 - facilitate), the questionnaire responses scored 2.55 (guidance) thereby representing an increase in the deemed role for planning that outweighs the evaluation of planning policy. Within this theme, each of the concepts again were deemed to be of a higher evaluative score; with integration (3.1) and interaction (2.7) judged as guidance and influence (2.0) and the digital environment (2.4) each judged to standardise as can be seen in table 6.1 that provides an overview of all comparisons.

6.3.1.2 Comparison of using data as a resource

Table 6. 2 Using data as a resource evaluation of planning policy & questionnaire responses

Comparison of planning policy evaluation and questionnaire responses			
Factor	Evaluation	Questionnaire	Result
Using data as a resource			
Privacy	0	1.5	Neutral > Standardisation
Accountability	0.43	2.0	Neutral > Standardisation
Efficiency	1.16	2.4	Facilitate > Standardisation
Innovation	1.62	3.1	Standardisation > Guidance
Average	0.8	2.25	Facilitate > Standardisation

When compared to the average evaluation of planning policy for using data as a resource (0.8 – facilitate), the questionnaire responses scored 2.25 (standardise) thereby again representing an increase in the deemed role for planning that outweighs the evaluation of planning policy. Table 6.2 above documents the relationship within this theme, whereby each of the concepts again increased with a higher evaluative score; as privacy (1.5), accountability (2.0) and efficiency (2.4) all were judged for a standardised role of planning while innovation (3.1) returned a judgement of guidance.

6.3.1.3 Comparison of project phases

Table 6. 3 Project phases evaluation of planning policy & questionnaire responses

Comparison of planning policy evaluation and questionnaire responses			
Factor	Evaluation	Questionnaire	Result
Project phases			
Design	0.83	3.3	Facilitate > Guidance
Implementation	0.04	2.6	Neutral > Guidance
Monitoring	0	1.8	Neutral > Standardisation
Adaptation	0.17	2.7	Neutral > Guidance
Average	0.07	2.6	Neutral > Guidance

When compared to the average evaluation of planning policy for project phases (0.07 – neutral), the questionnaire responses returned the highest scoring (2.6 – guidance) for the theme as well as the concepts, thereby reinforcing the growing pattern whereby the deemed role for planning outweighs the evaluation of planning policy. Within this theme, each of the concepts increased and returned judgements for a planning role of guidance in design (3.3), implementation (2.6) and adaptation (2.7) with monitoring judged slightly lower to standardise with (1.8). The fact that this theme was deemed of higher relevance (see overview in table 6.3) could be down to the observation that planning as a profession often operates in these phases for ‘traditional’ development and those respondents from the built environment sectors could apply their knowledge within these fields for smart cities.

6.3.1.4 Comparison of data-cycle

Table 6. 4 Data-cycle evaluation of planning policy & questionnaire responses

Comparison of planning policy evaluation and questionnaire responses			
Factor	Evaluation	Questionnaire	Result
Data-cycle			
Production	0	2.3	Neutral > Standardisation
Capture	0	2.1	Neutral > Standardisation
Communication	0	2.1	Neutral > Standardisation
Processing	0	2.0	Neutral > Standardisation
Average	0	2.1	Neutral > Standardisation

When compared to the average evaluation of planning policy for the data-cycle (0), the questionnaire responses returned a score of 2.1 (standardise) and this was replicated throughout the concepts for the theme as production (2.3), capture (2.1), communication (2.1) and processing (2.0) were all judged as a role for standardising planning in its role to smart city development. As is represented in the above table 6.4, a consistent evaluation within standardise was measured in the questionnaire responses thereby providing some level of agreement across the respondents.

6.3.1.5 Overview

Overall the comparison of the evaluation of planning policy to the questionnaire responses revealed a gap between where planning policy presently is with regard to smart city development and where planning professionals believe it to be required.

6.3.3 Summary

A system of engagement is required for the planning sector in creating smarter cities. In the public sector, this system will be integral to the cities competitive offering and certainty for developers. The cities strategy should be aimed at increasing the amount of data produced while also ensuring interoperability and accessibility, as well as ensuring the validity, reliability and accuracy of data produced. It must provide the environment in which smart city developers can work while also ensuring citizens receive a return on investment for their loss in privacy of data.

While there are a number of attempts to shape planning policy with the requirements of the smart city, none do so with a view to the role of data as a resource and how the value of said data can be extracted for increasing transparency, improving efficiency and providing an evidence base for future decision-making. Online data platforms provide access to a range of information, however, there is no strategy for the cross-boundary capture and communication of data. The digital age has changed the way people expect to be able to interact with their city governance and how local authorities should manage their interests.

Citizens want assurance that their data will be secure, open and accessible and view a new role for themselves in the development of their city. The technology that is available goes some way to meet this demand, however, a planning policy framework for smart cities will provide city governance with a roadmap by which they can begin to develop their own planning policy for the digital age and go some way to delivering policy that underpins the design, implementation, monitoring and adaptation of smart city projects within the built environment.

With the rise of personal technological devices there is an opportunity to improve the interaction of users and produce data the city requires for its future development and growth. The planning policy framework for smart cities is a solution that recognises this opportunity and provides a response to the analogue planning policy of our time. The policy provides a road map by which cities can instruct and inform the future development of their local plans and pushes for a strategic view to cross-boundary planning – specifically through interoperability and a standardised approach to the

capture of data in order to ensure convenience of accessibility for cities in a duty to cooperate that extends beyond the current plan-making process.

In a world that is introducing technological change and advances that are dramatically altering the way in which the city ecosystem operates, it is more important than ever that there is a strong, flexible and well-designed planning policy to reflect such a digital age. The planning policy framework will appeal to local authorities, planning professionals and developers alike while also ensuring citizens receive a return in terms of value of service and quality of life when factoring in their contribution to the development of the smart city.

7 Conclusion

Development of the framework for planning in smart cities brought together the research from all phases of the investigation and also worked toward objective (e) to produce recommendations for the future direction of the role of planning in smart city development and as such the following chapter brings together the findings from all sections of the research and aims to discuss their implications for the development of an evaluative framework for the role of planning in smart cities.

This chapter will present the main findings of research, their contribution to knowledge, limitations and recommendations for future work. It is important at this point to reflect upon the research investigation so as to provide concluding thoughts that can be used in any future work that builds upon this initial study. The concluding part of the thesis is therefore an important process in preparing the foundations for future insights and research investigations that could be shaped around the unique insight of this study.

7.1 Recommendations for planning

A national framework guiding local authorities to implement smart strategies would be beneficial to provide the oversight in direction for city governance. The implementation of such a strategy to work alongside existing forms of delivery are key to ensuring an appropriate response to the future of cities challenge in a mitigation and adaptation role. A key example of an area where this could be achieved is in climate change, whereby the coordination of a network of consultees for planning projects with smart city dynamics could ensure the future of cities and work towards a cohesion in the transformation of smart cities.

7.1.1 How are cities changing?

It is not so much that cities themselves are changing, but our ability to observe the city is achieving new levels of insight that, while always existing as a form of variables has not necessarily been analysed and therefore understood to the

degrees by which they can now be. One area in which we can see an evolution, however, is with the advancement of technology and thereby its application as a tool throughout the built environment. These technologies fundamentally alter the way people experience the city and create new forms of services and applications that people – both citizens and visitors – utilise through demand. Due to the characteristics of ICT (hardware and software) data forms a central pillar to the operating and business models of smart city projects and initiatives. This data is viewed as a resource, which built environment professionals can utilise to inform the design of their development projects or planning officers can draw from to inform their decision-making.

The types of challenges facing cities is new as an increase in population, migration and climate change are combining to form new issues for planning. While sustainable development has been coordinated as the primary principle through which these future challenges can be solved, the opportunity for technology to provide unique data forming insight to solve many challenges, including through the provision of prediction, is now at the forefront of many applications, services and designs to ensure a safe and stable future for society. In light of this observation then, the thesis highlights planning as the principal sector within the built environment that can coordinate between all professions to provide holistic solutions for citizens.

7.1.2 What are the consequences for planning?

Planning as a 'traditional' profession exists as a democratic function of society for development of places and shaping of spaces and I do not view this as changing with the introduction of technologies transforming cities to smart ones. On the contrary, planning should build upon this opportunity to ensure it is at the heart of the consultative process with citizens, expanding upon the thought through wide-thinking that smart cities should be for citizens and designed with people in mind. Technology actually poses an opportunity as a primary tool in enabling greater consultation with citizens for schemes, providing new means of communication and visualisation for residents and it will therefore be interesting to see how this function progresses with

neighbourhood plans and more localised planning of development through the Localism Act.

In expanding upon this, the utilisation of data as a resource provides citizens with greater sources of input to proposed developments, while also allowing decision-makers to justify their decisions with more transparency and accountability. The thesis observes that these demands will ultimately grow as a movement throughout wider society involving open data and Government accountability increases. There are also increased expectations of local governance to provide efficient operational services as data provides greater insight or new frequencies, with planning over longer periods of time enabled through new analysis methods of prediction and thereby future-proofing of design - these demands will also be replicated by planners as development design begins to integrate technology into buildings, providing new forms of revenue in the viability of schemes and improved energy efficiency.

7.1.3 What are the risks to, and vulnerability of, planning and the wider built environment community?

A key observation of the study lies in the timeframe from which an emerging plan becomes adopted and thereby informs decision-making on a local level. While these constraints are true for the 'traditional' forms of development, the effect is impacted when compared to the advancement of technological change, and more specifically, the updating of software to hardware that can span seconds and minutes – having the potential to ultimately change the fabric of a development in terms of its digital layer that includes the collection of data and provision of services. Planning should therefore establish a dynamic, adaptable and flexible framework for consultation with alternative bodies, on a similar model to the existing relationship with sectors such as highways, environment health, utilities and heritage.

Alternative sectors rising to prominence as the area of authority and influence in smart cities is also a threat that could potentially undermine the role of planning in smart city development. As the authority within the built environment that operates on an all-encompassing, holistic, and consultative approach; planning should seek to build on these strengths to ensure leadership in the transformation of cities, tying in

the expertise of all sectors across the range of professions that can benefit from technology and form the smart city ecosystem to ensure a coordinated approach to new development incorporating smart city characteristics.

7.2 Main findings

In providing a representation of literature highlighting the relationship between smart cities and planning the thesis laid the foundations for identifying key components of the smart city (objective A) by providing knowledge that was utilised to design questions for interviews in the first phase of research. The initial categories and concepts of codes arising from the data analysis of phase one found that there were general themes as to what constitutes smart city projects and therefore combine to form the smart city. These themes were smart city characteristics, using data as a resource, the data-cycle of the smart city and project phases and in applying these categories to the analysis of planning policy in phase two, the investigation studied the relevance of planning policy in the digital age of the smart city and thereby met objective B of the study which was to critically assess planning policy in relation to the smart city. The results from this evaluative procedure found that a neutral to facilitation oversight is present whereby the opportunities of forming a relationship of planning and smart city development does not exist (this was a key aim of objective C to probe the relationship between smart city development and planning policy) and the study therefore focused upon investigating objective D, which was to compare the evaluation of planning policy with the opinion of built environment professionals.

Finally, the evaluative framework produced recommendations for the future direction of the role of planning in smart city development (objective E), providing the primary means by which the study produced value and a contribution to the understanding of how planning can co-exist with smart cities. The following statements describe the quadrants that are essential to understanding this relationship:

- The capture of data through the integration of technology in project design and implementation

- The communication of data through interaction with place in project implementation and monitoring
- The analysis of data through intellect of the organisation with project monitoring and adaptation
- The production of data through influence of citizens and their actions arising from project adaptation and design

All of which combine to act as pillars defining the framework and its evaluative assessment qualities. The data that is analysed creates insight, informing decision-makers to evolve the 'reality' of the city, thereby providing an environment within which new data is produced and development should recognise this in the design of planning projects.

In testing whether this situation should be improved, the study tested the present level of oversight in planning policy and asked questions of built environment professionals predominantly from the planning sector to provide responses of their professional judgement as to what role planning should have in the development of the smart city. Throughout the hypothesis testing of phase three, in each instance the tested hypothesis was rejected and null hypothesis was therefore accepted to conclude that there was no significant relationship between the strength of planning policy and smart city development based on the evaluation of planning policy in phase three and smart city planning application index. The results of the survey involving secondary data collection was therefore conclusive in confirming the initial view of the thesis that there is presently no role in development of the smart city for planning.

7.3 Framework proposition

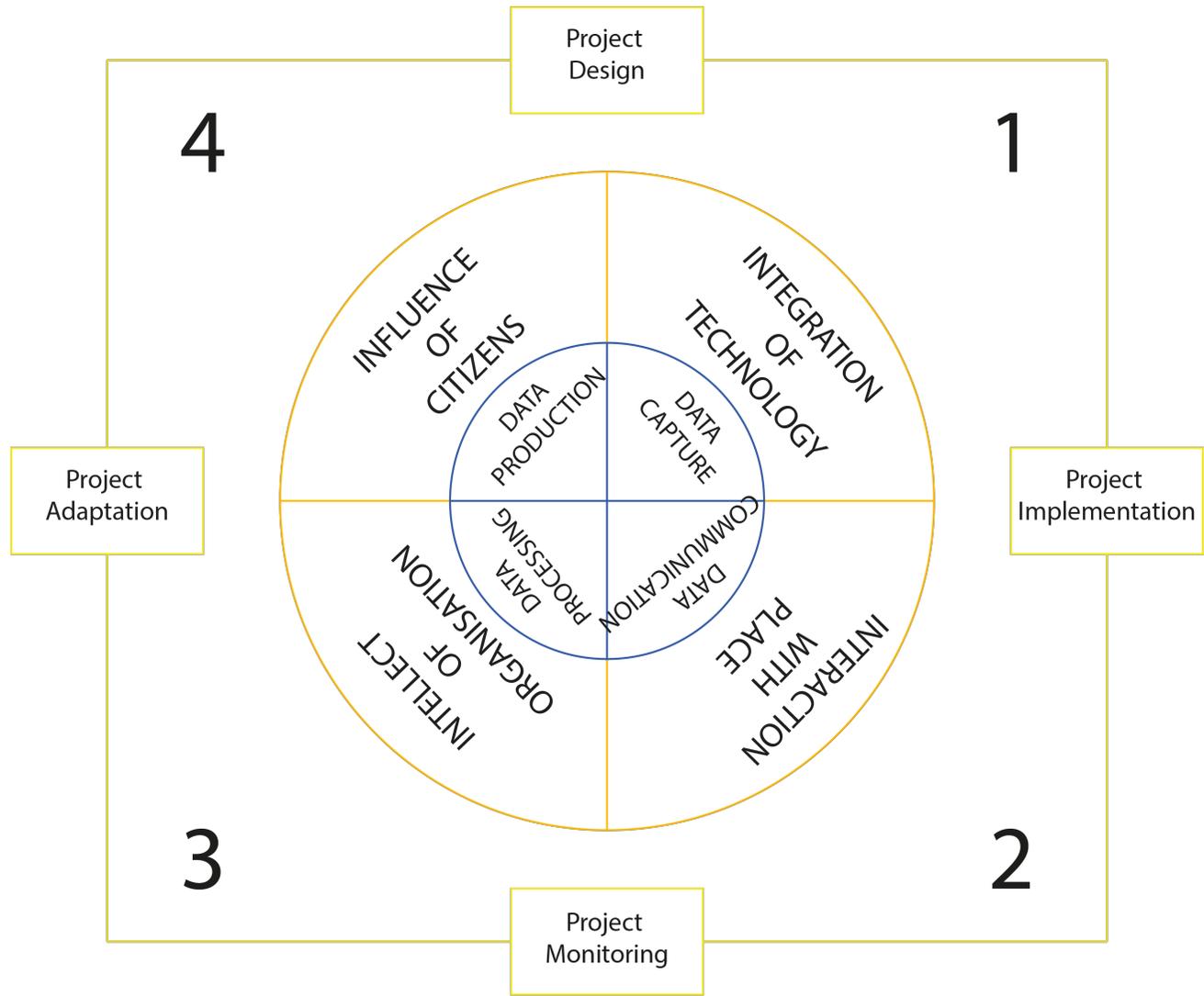


Figure 7. 1 An evaluative framework for assessing the role of planning in smart cities

7.3.1 Explanation of the components of the evaluative framework for assessing the role of planning in smart cities

The following section will explain each segment of the evaluative framework (see figure 7.1) for assessing the role of planning in smart cities beginning with the centrally positioned concept of using data as a resource, before moving outwards toward the central concept of the data-cycle, then again to smart city characteristics and finally the project phases that link the smart city to the wider planning ecosystem. Smart city characteristics and the data-cycle very much bridge the gap between the two ends of the spectrum that altogether form a dynamic assessment tool for city governance in producing relative planning and smart city policies to the private practitioner designing their development with digital technologies in mind. The above diagram and description that follows is a representation of the abductive research approach and process that has provided the outcome of the study.

Using data as a resource

The values of accountable, operational and innovative data are universally linked via the requirement to ensure data is secure and therefore valued as a resource by ensuring the data that should be private is. Such a value is of the utmost importance to citizens and therefore increases the likelihood that their use of data to inform decisions in urban planning will be politically acceptable. The role of data as a resource underpins the framework. Each value of data has a timing dimension to it, as accountable data should be open and provided to ensure transparency of decisions in the democratic system of planning in the UK. Operational data meanwhile holds value in real-time by enabling greater efficiency of services to citizens. Innovative data meanwhile provides the ability to predictively model how cities work, the consequences of decisions in planning and therefore allow for the future-proofing of cities. The following data-cycle will explain how using data in these values leads to new 'realities' of the city, while also explaining how data can be obtained for these purposes.

The data-cycle

The central concept to the framework aims to provide an overview of the process by which data is created to how it is eventually used to inform decisions. This process, or cycle, as the thesis labels it due to its continuous nature, begins with the observation of data being produced – termed capture – whereby technological advancements provide a means by which data is collected. Rather than being stored, and thereby becoming a stagnant commodity, cloud technologies allow for the synchronous storage and communication of data – available online to those having access. Those who can access this data, either via privately agreed commercial contracts or through openness of data, are able to analyse this data to create insight and thereby inform decisions that alter the ‘reality’ of the city producing a wholly new set of data that is again observed through data capture thereby demonstrating the continuous cycle of data in the smart city.

Smart city characteristics

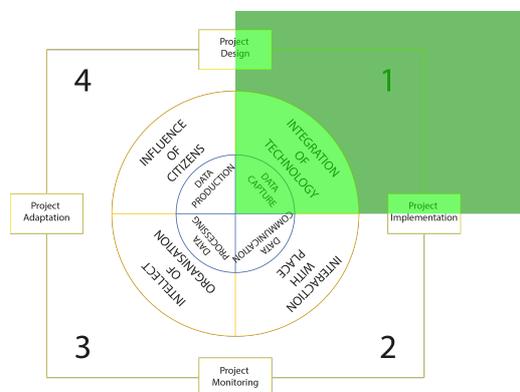
Smart city characteristics encompass the relationship between the three components of technology, people, and place introduced in figure 2.1. The interrelationship between these components provides an understanding of the first attempt by the thesis to demonstrate the relationship between smart cities and planning. The integration of technology explains the relationship between technology and place (cities), as technology is designed into developments of the built environment. Interaction of people with place therefore occurs, as citizens are ever-more connected via smart phones and wearable technologies. Such technology provides the opportunity for greater interaction with organisations -specifically governance and thereby alters the influence citizens have in the development of their city. The combination of these elements thereby completes the smart city segment of the framework and goes some way to linking the inner-digital elements to the physical environment and thereby influences the planning system.

Project phases

Project phases link the smart city framework to the planning system, providing an overview as to the various planning procedures throughout the planning process that enable a role for planning in smart city development. Within this stage, it was determined through the questionnaire that project design would best take place pre-application, while the application process, through implementation, provided the greatest opportunity for influencing the outcome of development to incorporate smart city characteristics. The planning procedures in place for monitoring of projects was through planning conditions, while adaptation of projects would best take place through enforcement. It is important to note at this stage, however, that the project would have benefitted from a larger data source so as to provide results that with more certainty could expand upon the findings, as the thesis will go on to explain in the conclusion. Just as important, however, is to note that the segments for breaking up the smart city framework exist on their own, irrespective of planning, and it is therefore the use of the framework within a planning setting that creates the true value of the framework as an evaluative tool for assessing the role of planning in smart cities and their development.

7.3.2 Explanation of the quadrants of the evaluative framework for assessing the role of planning in smart cities

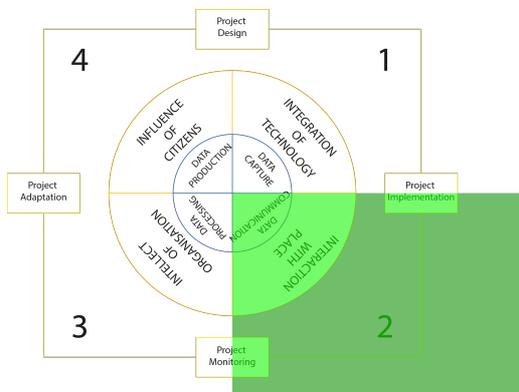
Quadrant 1: Data capture, Integration of technology, Project design / implementation



Data is collected through the integration of technology to the built environment and planning policy should therefore recognise this to provide guidance as to the design of development.

Figure 7.2 Quadrant 1

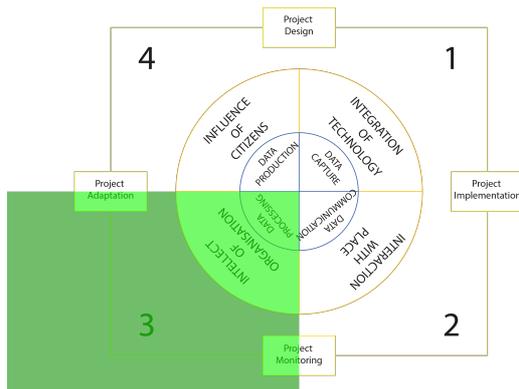
Quadrant 2: Data communication, Interaction with place, Project implementation / monitoring



Data is communicated as people interact with their city and the planning system should ensure means by which development can be designed so as to achieve these ends.

Figure 7.3 Quadrant 2

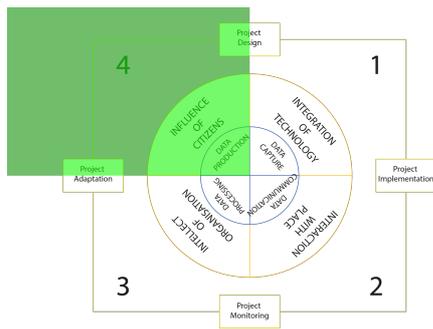
Quadrant 3: Data processing, Intellect of organisation, Project Monitoring / adaptation



Data is analysed to provide insight and a greater knowledge of the city through information and organisations should recognise this to implement appropriate processes reflecting this new

Figure 7.4 quadrant 3

Quadrant 4: Data production, Influence of citizens, Project adaptation / design



The data that is analysed creates insight, informing decision-makers to evolve the 'reality' of the city, thereby providing an environment within which new data is produced and development should recognise this in the design of planning projects.

Figure 7.5 Quadrant 4

7.3.3 Summary of the evaluative framework for assessing the role of planning in smart cities

The framework, as explained in the above descriptions expanding upon the diagram, is of value to public sector local authorities throughout the UK, specifically their planning departments in the development of appropriate planning policies to reflect the new environment of the smart city, but also innovation, data and executive departments of those same organisations that can use the framework as a guide for producing smart plans that work alongside planning and recognise the role of the sector in the built environment, ensuring opportunities are not missed to influence the outcome of development so as to incorporate digital technologies thereby providing a new resource for the city. In reflection of the existing relationship between the public and private sectors with regard to planning policy; the framework can also be utilised by private practice in their design of planning projects of physical development in smart cities that aim to incorporate the digital technologies of the new environment of the smart city.

7.4 Value of research

The observation of concepts and codes forming themes from interview data that was specifically designed to understand the unique characteristics of smart city projects in relation to urban planning has gone some way to better informing professionals of the relevance of the subject area. In establishing whether in principle there is a relationship between planning policy and smart city development the study has

contributed to better understanding of the premise for future research into the relationship between the two sectors. Bringing all of these points together, the creation of a decision-making framework for planning smart cities has gone some way towards the formulation of a strategy for the accumulation of data in the smart city with a framework that can contribute to the future relationship of planning and smart city development.

The decision-making framework for planning smart cities would be a tool for planners in the design and assessment of smart city planning projects, with insight from questionnaires informing the most appropriate stages of the planning process in order to create an understanding for areas of opportunities, strengths, weaknesses and threats to any potential future relationship between the sectors.

7.5 Research limitations

There are certain limitations that are a reality to all forms of research and it is therefore important to acknowledge these short comings when reflecting on the research process so as to inform the opportunities of future work.

7.5.1 Interview data collection

A more structured process for the data collection of interviews could have been beneficial to the progression of questions and probing of research avenues. As an example, including more planning professionals within the sample, in which technological and smart city participants dominated, could have provided more manoeuvrability for the researcher in terms of investigating the role of planning in smart city development. As it happens, there was some good insight generated through this process as the unstructured interview procedure allowed for flexibility and adaptability within the interview. However, as it happens the following phase did ensure an input from the built environment sector to satisfy the aims of the thesis which were to produce a decision-making framework for planning smart cities through the investigation of the relationship between the sectors and concepts.

7.6 Recommendations for future work

Expanding upon the questionnaire data collection to provide a specific roadmap for study cities in their progression toward development of the smart city would result in a more detailed insight into specific cities, their strengths, weaknesses, opportunities and threats; while also providing an additional angle to insight. The progression of the research investigation could therefore be built upon through focus groups with participants from numerous sectors operating throughout the geographic area of the study cities. The insight generated from such a practice would enable the research to understand the local requirements and characteristics of the city, aligning these to the evaluation of planning policy and questionnaire data collected from the geographic location. This could essentially be done through administering the questionnaire to potential respondents within the area and following up on this questionnaire process with focus groups investigating the requirements of a road map for the future role of planning in smart city development within the individual city.

7.6.1 Questionnaire data collection

There are a number of limitations to using questionnaires as a survey for the collection of data and the thesis experienced these issues first hand with the response rate to questionnaires in a time-consuming process that did not always return the results hoped for. As such a decision was made to bring to a close the data collection and analyse the data in hand as opposed to spending additional time and resource chasing responses. Expanding the questionnaire data collection from Liverpool toward a wider geographic area that encompasses the study cities would provide a new level of insight into the comparison of planning policy and professional judgement of built environment professionals. This would create a richer set of data from which to draw insight. For example, rather than producing a decision-making framework for planning smart cities, the research could provide a road-map for each individual study city based on their present planning policy and judgement of professionals.

7.6.2 Comparing evaluation of planning policy to the secondary data survey collection for individual cities

As opposed to a UK-wide investigation of the relationship between evaluation of planning policy and smart city planning applications, the study would have created a more detailed insight had the data been analysed on an individual-city-basis.

7.7 Summary

Overall, this research has identified smart city themes that can be related to the built environment profession of planning, thereby bridging the gap between two sectors that have a large number of possibilities and opportunities in meeting the challenges of the future of cities. By assessing the appropriateness of existing planning policy, the study has produced insight of value to planning professionals and the wider smart city ecosystem that is evolving at a pace quicker than planning policy can adapt. The high-level theory in concept of the decision-making framework for planning smart cities can therefore be adapted to suit the requirements of individual cities' needs. The true value of this research, however, is found in laying the foundation for future work in expanding the research community's understanding of the relationship between smart cities and the planning of cities to becoming smart.

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X Appendix

X.i Phase one

X.i.i Participatory field observation

Silva et al. (2015) proclaim taking field notes and making observations to be 'among the most fundamental data collection techniques used in qualitative research' (p. 147). The data collected through these processes are combined with other qualitative data collection techniques, such as semi-structured interviews. Silva et al. (2015) state that field observation alone can be substantial enough to stand alone as the only qualitative method of data collection, however, for reasons later stated it was deemed that field observation alone would not be enough to stand alone and therefore, it formed a supportive yet still influential role in the research investigation. The primary form of data gathered through field observation are field notes that 'constitute a written record of field observation' (Silva et al., 2015) representing chronological records of facts and events observed through the experience. It is important to divulge at this stage that the field notes produced during the first three quarters of the research were created after a significant period of time after the said observations. The field notes displayed in the appendix therefore relied heavily upon the replication of notes procured during the observation. The delay in timing was a consequence of the researcher's 'blindness' with regards to the practical element of attendance at said meetings qualifying as a valid method of data collection, the effect of which is reflected in the admission earlier that the field notes arising from the field observation play a supportive role in the qualitative data collection method, as opposed to what potentially could have been a primary role. Nonetheless the field notes still provided a rich form of valuable data even though the timing between abridged notes, collected during the observation, and full field notes, developed after the observation (Silva et al., 2015), was longer than what could be perceived as normal practice. Below can be found more details about the various experiences that formed the observation of the field.

Alongside conducting the MPhil research study, note-taking through fulfilment of a planning officer role in a local authority has highlighted gaps in knowledge on a practical level that have contributed toward the theory generation on a philosophical level. These gaps in knowledge highlight the juxtaposition between the practice of planning and development of smart cities. This observation formed part of the research problem the MPhil set out to resolve. While abridged notes did not exist for

the time spent working at the council, full field notes were developed that sought to provide an overview of the experience of planning practice and the gaps that motivated the decision to pursue research in the subject area.

Attendance at Urban Mobility Action Network meetings also formed part of the field observation. Through an introduction via a research advisor, participation in the action meetings provided unique insight into the operations of a network partnership set up specifically to enhance funding provision for key stakeholders of transport's role in the development of smart cities throughout the Liverpool City Region. While attendance at said meetings formed part of the informal interviews highlighted earlier, the production of abridged notes and field notes formed a substantial part of the qualitative data for analysis.

X.i.ii Calender

Participatory field observation

Overview					
18/06/2015	02/07/2015	19/10/2015	03/02/2016	14/04/2016	18/10/2016
Smart Cities Working Group			Sustainable Urban Mobility Action Network		
Attendees		Attendees			
Merseytravel	Merseytravel	Merseytravel	Merseytravel	Merseytravel	Merseytravel
Liverpool City Council	Liverpool City Council	Liverpool City Council	Liverpool City Council	Liverpool City Council	Liverpool City Council
Liverpool LEP	Liverpool LEP	Liverpool LEP	Liverpool LEP	Liverpool LEP	Liverpool LEP
AECOM	AECOM	AECOM	AECOM	AECOM	AECOM
Red Ninja	Red Ninja	Red Ninja	Red Ninja	Red Ninja	Red Ninja
	LCR EU representative	LCR EU representative	LCR EU representative	LCR EU representative	LCR EU representative
Appendix		Liverpool Chamber	Liverpool Chamber	Liverpool Chamber	Liverpool Chamber
10.1.2.1	10.1.2.2	The Bluecoat	The Bluecoat	The Bluecoat	The Bluecoat
		Knowsley Council	Knowsley Council	Knowsley Council	Knowsley Council
		Sefton Council	Sefton Council	Sefton Council	Sefton Council
		Wirral Council	Wirral Council	Wirral Council	Wirral Council
		Halton Council	Halton Council	Halton Council	Halton Council
		Amey	St Helens Council	St Helens Council	St Helens Council
		Appendix			
		10.1.2.3	10.1.2.4	10.1.2.5	10.1.2.6

Figure 10. 1 Participatory field observation attendance calendar

X.i.iii Notes (18/06/15)

Attendees: Merseytravel, Liverpool City Council, Liverpool LEP, AECOM, Red Ninja

Notes:

- Introductions around the table including first names & industry backgrounds
- Discussed interests and current projects
- Identified streams of funding and opportunities – primarily revolving around EU funding through the Horizon 2020 initiative
- Discussed aims and objectives of individuals throughout the group – to be finalised for the next meeting
- LJMU priorities were as follows:
 - Sensor technology – R&D with active involvement in sensor city
 - Technology & maritime operations – Port & logistics, freight corridors, sensors
 - Built environment – Includes everything to do with buildings, energy efficiency, surveying, construction, development etc.
 - UAV's – Unmanned aerial vehicles, drones, R&D
 - Actively researching smart cities – Implications for industry, benefits, opportunities

10.1.1.3 Notes (02/07/15)

Attendees: Merseytravel, Liverpool City Council, Liverpool LEP, AECOM, Red Ninja, LCR EU representative

Notes:

- Aims & objectives of group finalised to make more focused discussion surrounding collaborative opportunities with projects specifically to target funding that predominantly requires partnership approaches
- Outcome of discussion was to formalise a separate group that brings together more people
- North West Europe INTERREG funding priorities as follows:
 - Innovation and R&D – Building innovation capacity in regions; social innovation; and bridging the gap transnationally to bring products, processes and services
 - Low carbon economy – Delivery of city or region low carbon strategies including energy poverty; implementing low carbon technologies e.g. renewables; mitigation relevant adaptation strategies; low carbon transport
 - Resource efficiency – Reducing use of non-energy sources; fostering eco innovation; environmental efficiency
- Interreg smart cities specific objectives as follows:
 - SO1 – Enhanced innovation capacity through international cooperation in North-West Europe: Building innovation capacity of regions and territories; improving the competitiveness of enterprises; delivering societal benefits through innovation

- SO2 – Implementation of low carbon, energy, or climate protection strategies
- SO3 – The uptake of low carbon technologies, products, processes and services
- SO4 – Transnational low carbon solutions in transport systems

10.1.1.4 19.10.15 Notes

Attendees: Merseytravel, Liverpool City Council, Liverpool LEP, AECOM, Red Ninja, LCR EU representative, Liverpool Chamber, The Bluecoat, Knowsley Council, Sefton Council, Wirral Council, Halton Council, Amey

Notes:

- Combined authority agreed plan for better LCR engagement with EU transnational funding opportunities
- Plan revolves around five priority themes to focus activity including one for sustainable urban mobility (this includes the theme of smart cities) while also endorsing ‘action networks’ model of working (this entails setting up, for each of the five priority themes, a network of interested local partners to progress activity
- Each network would be supported by an identified local lead and the Brussels Office

10.1.1.5 Notes (03/02/16)

Attendees: Merseytravel, Liverpool City Council, Liverpool LEP, AECOM, Red Ninja, LCR EU representative, Liverpool Chamber, The Bluecoat,

Knowsley Council, Sefton Council, Wirral Council, Halton Council,
St Helens Council

Notes:

- Discussion of potential project ideas as a result of funding options included travel solutions type intervention linked to health and cultural sectors, air quality issues linked to active travel, e-city technological solutions that could be applied across a range of issues, greater involvement with SMEs and start-ups on EU projects
- Existing and past LCR environmental projects
- Brussels networks
- H2020 transport work programme
- Presentation from Red Ninja on Smart City projects
- TfGM bidding reference group to establish for more specialised coordination in project and funding strategy

10.2.1.6 Notes (14/04/16)

Attendees: Merseytravel, Liverpool City Council, Liverpool LEP, AECOM, Red Ninja, LCR EU representative, Liverpool Chamber, The Bluecoat, Knowsley Council, Sefton Council, Wirral Council, Halton Council, St Helens Council

Notes:

- Discussion revolving around how to influence future Horizon 2020 work programmes, including discussion of transport priorities resulting in the following 11 challenges:
 - Urban nexus - Integration of transport modes looking at movement of people between transport hubs; look at potential technology based solutions to provide clear and relevant information e.g. push notifications / interactive journey planning
 - Climate, air pollution and noise mitigation - Transport adaptation to climate change; alternative fuels strategy – looking at taking forward some of the key recommendations to encourage HGV's and Bus operators to switch to cleaner fuels with the expansion of the port – interest to look at mitigating some of the air quality impacts due to the increase in freight movements, greener fuels – how to encourage greater uptake of alternative fuels / e-vehicles – behaviour change programmes etc, looking at how carbon and greenhouse-gas information can be better modelled – could carbon and greenhouse-gas metrics be incorporated into the transport model?
 - Demographic trends - Active travel and health perceptions, travel trainers linked with cultural sectors; transport and the elderly – dementia aspects – what information / platforms are needed to provide the appropriate information; technology-based information solutions – way finding / journey planning, particular issues for us are ageing population with respiratory problems, lower driver numbers, deprivation; our lead practice is on dementia and autism.
 - New transport and ICT technology – Sensor City use of different technologies to optimise transport planning, traffic management and data collection; E-cities / Smarter Cities – use of different technologies to optimise transport planning, traffic flow and data collection. Optimising network using sensors – looking to develop these to allow air-quality data to be collected; need to address disconnect of

information at public transport hubs – technology solutions sought; need to engage with SME's and start-up businesses – look at local businesses' key skills and areas of expertise – how can these be tapped into to alleviate LCR known issues e.g. technology company to support Smart Cities development. How can we sell EU project involvement to SME's – what do we need from them? What is required of them to be part of the work programme?; more intelligent transport planning around large-scale events – scaling up existing transport planning systems to cope with these sudden major pressures; growing tourism economy requires ITS tailored for those unfamiliar with the city – such as in-vehicle announcements

- Uncertainty and risk - Transport risk, safety and security, particularly container cargo theft
- Resilience of transport system - Resilience of container supply chains; data needs to be shared / open / available to allow a resilient transport system to be designed and managed
- Safety and health - Transport and health – dementia aspects; linked with the aging population transport network needs to meet the needs of the LCR demographic.
- Dependence on fossil fuels - Greener fuels; air-quality impact of port expansion as above; zero emission last mile delivery; alternative fuels strategy; E-mobility strategy
- Resource utilisation - Open data; SMEs' access to data; to share information around use of existing assets etc., power into tunnels, upgrading stations, rolling stock; impact of port expansion – study suggested to assess air-quality impact of port expansion – possibly through joint working with the university. Also, interaction between different ports – what is impact on Liverpool port and wider transport system if a Channel port suddenly closes due to, say, migrant crisis?;

working with Peel ports to encourage measures to reduce harmful emissions for idling ships (switch from diesel to electric when idling)

- Advances in infrastructural maintenance - Pipeline projects – EU funding could support; transport for the North – how to ensure such major new inter-regional infrastructure developments incorporate the state of the art and have robust governance, etc.
- Competitiveness - Port competitiveness given the Liverpool 2 project; centre for entrepreneurship

10.2.1.7 Notes (18/10/16)

Attendees: Merseytravel, Liverpool City Council, Liverpool LEP, AECOM, Red Ninja, LCR EU representative, Liverpool Chamber, The Bluecoat, Knowsley Council, Sefton Council, Wirral Council, Halton Council, St Helens Council

Notes:

- Brexit update – what should LCR response be? What are implications for funding and partnership programmes?
- Urban agenda and funding update – Urban innovative actions call with focus on sustainable urban mobility; EU Urban Agenda and new sustainable urban mobility partnership; Smart Cities latest
- TEN-T/Connecting Europe facility update – Upcoming connecting Europe facility calls; Atlantis project latest on current projects looking forward to Atlantis 2
- Updates on other funding opportunities including private e.g. Artes

- Round table update on transport bids that are currently in progress

X.i.ii Interview transcripts and coding

Interview (A) Initial and Focused coding

1.

Initial Coding

internal organisation
external environment

Merseytravel (public) Interview Transcript

01/07/2016

Researcher – (R)

Participant – (A)

R-Thanks for agreeing to speak with me today. I know we spoke on the phone briefly, but just to give a bit of a background as to why we're meeting today: I'm currently studying towards my PhD titled, *Data-driven value modelling for smart cities* and as part of that we are conducting two phases of research. Phase one involves qualitative data collection in the form of interviews with organisations operating in the smart cities sector throughout the city of Liverpool. We're trying to gain an insight into the effect data is effecting organisations such as Merseytravel. So I've sent over the interview protocol and hope you've had a chance to look through that so you can bring your thoughts and insights to the project.

So to start off can you give me a bit of a background to how long you've been in your present position and what it entails?

- Quite new to role
- A newly established role

A – In my current position I'm called the performance coordinator and I entered that role in October '14 - the role was actually established in October '13 but I was away on Maternity leave.

R – So the role is quite recent, really.

- Explaining a new organisation
- Review of my new environment
- New focus of department
- Performance report means competitive environment for diverse business
- Internal judgement team
- Streamlining of process to central area
- Initial evaluation, now we start to improve

A – Yes it is. The organisation went through a restructure and the performance team was developed as part of that restructure. So I'm initially from a research background and now I'm in the performance team. So originally we aimed to coordinate performance and as I'm sure you appreciate the nature of Merseytravel as it's a very diverse business – so with performance stats it was the idea of bringing them into one new board basically so that's why the team was established. Now that the performance framework is up and running we are now looking more at the data side of things.

R – So it would be fair to say you have streamlined the process? In terms of how you restructured to handle data?

- In process of organising
- Centralised process, now rolling out to individual departments
- Data emerging as resource value within company
- Company prioritising its response to this

A – Yes, so the idea is to have one data performance point of contact within the organisation and now that's widening-out if you like to separate areas of the organisation. In terms of the data role that's happened really in the last year and the organisation have realised its quite important.

- Evaluation of all aspects of company
- Data valuable + used as resource in organisation
- Needed to accommodate data in work
- Made link between performance + data
- Performance becomes responsible for data
- Evaluation of whole org re data
- Presented data review + highlighted outcomes of efficiency, business, risk
- money saving, cost cutting, profit enhancing

- Link between performance team + responsibility of data resource
- To extract value of that data

- Performance responsible for data + evaluation
- Consistent throughout year, monthly
- Accounting out to all departments
- All services included
- Systems have to be in place
- Explains capture of data - where from?
- Trust issue of data, reliability of resource - important to org.
- What do they do with data?
- There is a cycle of data, input, process, output
- Data is a resource, but need a system to make sense + create value.
- Evaluation of all departments
- Problems with existing procedure, need to adapt to data environment
- Old system for capture of data
- Risk issue to data
- new systems in place for capture of data
- New technology in place
- New communication with customers
- Access to new types of data, new data capture
- Testing - out phase for data, then evaluation process
- Where does the data go once captured?
- Data needs to be trusted, linked to org. name + therefore public profile
- Continuous evaluation of practice
- Some strategy in place to meet outcomes + priorities of org.
- Linked to wider ambitions of company

Over a year ago there was a board set up reviewing our support services, so that was our legal team, HR and IT as well as some others and as part of that review they concluded that data was an integral theme that cuts across all of the departments and operations of Merseytravel and it needed to be looked at. So a work package came in for data and because the performance team and our background it made sense that we looked at the data side of things. So we've done a very thorough root and branch review of data within the organisation and we're working towards the principles of efficiency, business insight and managing risk.

R - So the factor that the performance team took over that role would suggest Merseytravel view data and performance as a mutually beneficial relationship?

A - Yes, I think that would be right to make that observation.

R - Ok, so would you like to describe to me your own personal role in a bit more detail?

A - Yes, of course. My role at the minute is to make sure the performance framework takes over, and that happens on a quarterly basis via a report. So we make sure that this is carried out but now my data role is about going out and speaking to the individual service areas. We have established where there is real areas of risk in terms of data and how we gather it, but we've also looked at how we present data. So we are looking at the whole process if you like from gathering, to analysing, to presenting. So I suppose my role is again coordinating the understanding of data and how it's being used in the organisation.

When we went out and spoke to people we came up with quite a few issues. A whole variety from duplication, systems such as the systems people were using to gather data that were very dated and if they were to break down there is no system in place to fix them, if you like. So that was a big issue. We've addressed the gathering of data and we use new software now to go out and gather information for example with customers on the street or recording punctuality - that type of thing. So that has already happened and we're in the process of piloting our first surveys of how we gather data. So we are addressing the data gathering, we are looking at the analysis using process maps and data flows - this is making the data more accountable for the organisation. We have a set of KPI's (key performance indicators) and we make sure that we now have a proper data flow with process maps behind that for each of all of the KPI's that we have established.

3.

- What do we do with data we have?
- How do we communicate it?
- Specific habits in team, proficient with handling data
- Presentation related communication of data
- Strategy in place for evaluation
- Linked to outcomes of value to org
- Trade outcomes/value linked to business model.

- Technology needed to support
- Data as resource - not used efficiently
- Evaluation system in place
- Lack of communication resulted in duplicated data
- Technology like a software
- New way of handling resource of data
- Need to adapt
- New technology, new way to capture data
- Better systems, better process in order to meet KPI's for value & linked to business model.

KPI's, value of data resource
linked to business model & operations

- On-going work to implement strategy
- Use data as resource
- Can improve on current situation
- There is an ecosystem/interplay of data
- Linked to a process, input, output
- Strategy linked to KPI's, value of data, business model
- On-going work still in process
- How do we capture data? What is data
- Analysis of data once it is gathered
- Create value from the data
- How resource used in org
- How do they communicate data? for what purpose?
- Didn't understand how change approach org - performance of org
- People are more informed because of work done to date
- Where is the data gathered from?
- How instrumented/sustainable is it? We need to use this as resource
- Resource of data linked to operations of org & business model

And then it is about present that data and making it available to people. So we are very lucky to have a member of the team who is really skilled in excel and developing and he has actually developed our own dashboards to present the information. And I oversee these elements, making sure that we are addressing those principles I mentioned before.

R – When you mentioned about some of the issues and systems – was one of the issues that certain departments for instance may have been using different systems to one another?

A – Yes, there were issues to do with systems and using internal data. People doing slightly different things or duplicating data in different formats. But then the actual hardware was an issue. We were using very dated hardware and also we were sending staff out with three different pieces of kit and a charge to cover their duty. So we are removing that and people are using tablets now to gather that information.

R – Just to pick up again on something you said before, what were the three principles?

A – Yes those were managing risk, efficiency, and business insight.

R – So moving onto the organisational overview, I know we've spoken already but I just wondered if there was anything you'd like to add to that maybe in terms of any strategy development?

A – We're actually in the process now of establishing a strategy on how we handle data and how we link that to our evidence and intelligence base. We are trying to draw it all together really, so I wouldn't have a strategy to show you at the minute but I suppose what we have in our head is based around those three principles. So we are doing lots of different work packages to address those and making sure that we are gathering the data properly, straightening how the process works – the analysis stage. What were doing more as an organisation and also how we present that data. But I think now in terms of the organisation there is definitely more of an appreciation for information and what we do and don't have. I think decisions were made in the past of changing things and not understanding the consequences of turning systems off or changing things. I think now because of the data we are handling people will now say, stop hold on we need that information. Where is it coming from? I think we've created more of an appetite for data and understanding how it informs business.

- In process of developing data strategy
- Evaluation of strategy before implementation
- Collaborative approach to development
- Need to link to wider data infrastructure
- What do we do with data? How is it communicated?
- Use of resources linked to performance of org. → therefore business model
- Use of resources linked to future company activities
- Making most important early B use
- Inspiration of Strategy team

- Using data for future decisions, different time capabilities for value of data
- Thinking about future, next step in cycle
- How do we capture the data?

- Use of data as internal resource
- Diverse business owners, sectors - data plays role in future
- Diverse uses of data in activities
- Inherent impact for priorities of org.
- Communicating data with external
- Improving that communication, sharing is giving & receiving
- How do we work alongside other areas?
- Do we share data with other districts?
- Combined authority means different way of doing things
- What are other areas doing?
- Make sure data is efficient, do not want to duplicate

R – So I know you don't have a strategy right now, but you do have those three principles to build upon and you're in the process of developing a strategy?

A – Yes that's right, we've put one paper together, well we've put many papers together but there's one paper that is progressing at the minute to our information management group and that has been agreed but we have to revise that again to include the whole loop – the changes that re made, the data that is presented – how that links to the overall performance but also how it shapes future services. So we are just making that a bit clearer and hopefully you will see that strategy document come out some time in the near future.

R – So you mentioned the value of data in terms of making future decisions, and that would associate a timing aspect to data's handling. Therefore, as well as being able to use data now with relation to performance you can use it for the future direction of Merseytravel and the decisions being made there?

A – Yes, I think that's the idea. If people are thinking about their next steps, then it will grow from what we are able to gather now.

R – This actually relates to a lot of the theory arising from the project no, which is that we can use data to better inform on future decisions as well as decisions that are to be made right now with real-time data. So what kind of networks do you see developing with regard to data? Is it all internal or are you beginning to build external links?

A – At the minute we are very much focused internal. Because at Merseytravel we have the Mersey ferries and Mersey tunnels as well as overseeing the bus and rail network and tourist attractions its quite a diverse business – and this data work is cutting across all of those so at the minute it is about getting our house-keeping right. But there is potential for sharing data through the urban transport group, we do that currently anyway, but maybe strengthening those ties in the near future. Also looking at what is going on through the districts. With the combined authority coming in and the changes that that may bring, we are going to need to be aware of what the districts are doing as well to make sure there is no duplication there on the city region aspect.

R – Yes, because the combined authority could potentially have quite a large impact on the region itself and how organisations within that region operate in terms of communication and collaboration. As I'm sure you know as well, creating external links and making that data open it also gives the benefit of yourselves

5.

- Sharing of data provides benefits to all
- Important to get internal from first, set standards before external sharing
- Communication of data
- Data resource used for value in itself
- Need to improve confidence in data
- Organisation of data has their own name to it
- Communicating data sharing across
- Sharing of data is increasing use of data

- Lack of data that means losing out on competition
- Easy access to communication tools

- Highlighted lack of dashboard
- No communication portal/outlet
- Need to improve on communication
- Work planned down on management
- Need to improve systems
- Not easy, it is a long process and consistent
- Structural issues where need to be
- Team structure change to adapt
- May be a reason for all this change

- There are challenges to data frequency of data - how often it arrives
- Trying to improve timing of data
- Need it to be consistent
- Need to improve accuracy of data
- Improve trust in the data, its validity
- There is great value in data
- Can also go wrong - have negative effect
- Think about the data cycle, who uses the data?
- Improve their confidence in the data

having access to separate sources of data that may not have existed in the past. The open data movement is actually really gathering a lot of momentum in wider society as well as the industry itself.

A – Yes and I think that's why we have to be very confident that we have got it right here before we start to think about open data and sharing data. Don't get me wrong, we have data now that is available in terms of KPI's but we need to be at a higher level of confidence when we are presenting data and making that available for other people to use and interpret.

R – I suppose it's a step-by-step process and actually looking not just at the organisations in the region, but the Liverpool city region itself, compared to the likes of London for example it is lagging behind in terms of the development of a shared data portal for the city. The London Datastore acts as a portal for the likes of TfL, who are Merseytravel's counterparts, and they have access to that portal for sharing data. As you know Liverpool doesn't.

A – And that means we are lagging behind.

R – Exactly, so is that something you as an organisation have highlighted previously?

A – We certainly have within the team. The research we do it's quite obvious and there is probably an appreciation at a higher level that we need to do more and that's why this work has been sponsored and progressed. I think it's not something that we would publicly state but it is something that we have to improve. It's not something that can be fixed overnight, it's very much about understanding the existing processes and implementing change where change is needed rather than for change sake.

R – This is all great insight so far. I know we've spoken about what you are currently doing as a department and organisation as a whole but are there any major challenges or obstacles you've experienced. I know we have mentioned the open data platforms of other cities but do you see any specific challenges facing the organisation due to the increasingly data-driven environment?

A – I suppose the challenges relate to very basic things like the frequency of data. We are trying to make data more timely because in the past there has been great lags in getting the information through so we are looking at that. Also the accuracy and making sure it is clearly labelled in terms of confidence and what people are actually referring to, because a little bit of information can be powerful but can also be dangerous if it is used in the wrong way so we are now trying to give the end-user that confidence if you like so

- They have confidence in the data, more likely to use
- Major challenge is gathering the data
- And if it is the data they need, the right data
- Establish what do they want it for?
- Need to adapt to survive
- Where does the data go?
- Make sure it is valid, high quality

- Strategy will result in better process, improved results

- Real-time data improve frequency
- Good resource to have
- Need to know what data can be used for
- Current frequency only twice per year, this is not good enough
- Need real-time, but need to understand how it is gathered - to improve trust
- Real-time is also about how it is gathered? For what purpose as well

- Introduction of technology will result in more data
- Needs to be more addressed
- Wealth of data as resource to be gathered, more info captured
- Need to know how to use that data
- Need to extract value from it

they can say right, we understand the process, the information has been verified, we understand the limitations. But I suppose the major challenge is making sure that we are gathering the right data. So we need to establish what the objectives are, other than 'oh we have always done it this way', but what is the reason? What is it feeding into? So we do challenge the objectives of the data quite a lot and make sure that it is fit for purpose.

R - Would it be fair to say that the process will strengthen as you develop and start to implement your strategy to a greater degree?

A - That is what we are hoping yes.

R - I'd just like to pick up on something you mentioned with regards to the timing issue and frequency of data. Previously, you have mentioned the challenge in terms of the lag and getting that data through, how do you view the development of gathering real-time data?

A - Real-time will be very beneficial but again it is understanding the limitations of the data and what it can be used for. Currently our patronage is based on a six monthly methodology so we are only getting data at a six-monthly interval for a city overview. So I would have to understand, in terms of RTI (real time interval) how that has been built and modelled to make it a meaningful set of information. So it is as much about the method when looking at RTI data.

R - To give you some insight into smart cities and what we are looking at, one of the theories behind the concept is that as you introduce technology into the built environment, it enables you to gather a more diverse range of data and at different frequencies. As an example TfL are at the forefront of that with regards to their smart card system - just by introducing that type of technology into their transport network it gives them RTI data and I know that is something Merseytravel are looking at. It is a process really, but I just thought I'd bring that up to give you some context as to why it is I am looking at data and the smart city.

A - Yes because we have got our smart card launched but I suppose there will be realms and realms of data that arise from that. It is not at a stage yet though for us to deal with but my understanding is that there is a wealth of data that the smart card brings but again you have to understand how to best use that data and make it meaningful.

R - So again it comes back to the strategy and the point that there is no use just introducing this technology for the sake of it.

7.

- Need to have a strategy to use data, to extract its value
- Why are we gathering this data?
- Another department looking into this, prominent throughout organisation
- Different times of day, how capture of data
- Trying to capture more data, we technology to gather more
- There is a reason behind why they want to have it though
- Want to use data to better understand & improve on their service
- Technology doesn't necessarily mean more data, need to have justification & place to create value
- There is data available, not use it
- There is data available, not captured, we need to design a way to capture it

- Minimal training
- Aimed to look at best practice
- Strategy aimed to increase new training
- Trying to get more confidence in data
- Gathering up data and what they plan do with that data
- Train staff on standards expected
- What do they do with data?
- Improving confidence in data
- Are there checks in place?
- Is there a system in place?
- Trying to improve situation

- Data is creating new environment
- Current situation not reflecting this new environment
- There are some areas we are good at
- Still need to improve upon them
- Increase the value of our data
- Need to be a first for this use of data
- Make things more accountable

A – Exactly, and it comes back to the objectives that we are using it, we are gathering it. There is some work being done by the policy arm of our section looking at journey reversing. That is were if you tap on in the morning, then tap on in the afternoon in your way back that they would match that journey and try to understand the flow of journeys on and journeys off because on the bus there is no incentive to tap off. Because from our point of view we may know were you get on but we do not know were you get off and that is something the urban transport group are looking at. So here we have a wealth of information but just looking at one tap doesn't give you a full picture. This means that we have to take a step back to take an overview of where the two taps occur – we cannot chip everyone so we won't always now how people use the network exactly. In this sense then it is looking at the data that is available to you and making best use of that data.

R – I know you have mentioned about the restructuring that occurred, but have you as an organisation introduced any new training methods involving staff and data?

A – I would not say there has been a lot of training or teaching as such but there has been referencing best practice. It is something that is part of the strategy, because I think as we get this a little bit further on, and we are more confident in the data that we are gathering and presenting we can then do a little bit of education to staff to get them to think about the processes that they are going through inputting data. Even very simple steps really such as verification of information so if they are inputting something there are checks in place – is somebody doing the proofing? Is somebody signing it off? Very basic principles but we are trying to get them out there.

R - So to reiterate what you are saying, although it is not happening now maybe in the future you see data affecting the day-to-day activities of more people in the organisation?

A – Yes. 9 times out of 10 it is happening. One of the observations we have made is that we are relying on the good will of officers in handling the data. Even whether it is day to day patronage on the ferries there are good processes out there but what we need to do is make them a little but more formed to make that data more valuable. So it is not that we are trying to change for change's sake but it is juts making things more accountable.

R – Yes because accountability, as we have found through our research, is a big opportunity with data, both accountability and transparency.

- Using data to become more accountable
- Using data to become more transparent
- Organisation trying to do this

- Data is affecting day-to-day activities of org.
- Use data to evaluate
- Data gives feedback on projects, their progression, whether they are a success,
- Improve base of evidence

- Data important to improve evidence base
- Linked to projects tells us if it's a success
- This is the link to funding
- Competition of funding, better data = better chance due to evidence base
- This means it is important to business model + competition
- Data used to inform decisions

- Competition for the same money
- Big drive due to competition
- Need to provide business case to gain access
- Better evidence base means better chance of funding
- Better data = better evidence base
- Data is a factor for funding
- Data will continue to grow in volume
- Data becoming more important

- opportunities of data in efficiency, business insight + managing risk
- Transparency of data
- Data used as a resource to improve performance

A – Yes, that is what we are trying to achieve through this process.

R – Now I know we've spoken about how data is influencing the organisation, but could you just speak a bit more about how you feel data is affecting the day-to-day activities of the organisation?

A – Absolutely, yes it is affecting our day-to-day activities. The way to think about it is that we need to use data in terms of our evaluation of work, so if you think about the STEP projects that are going on data is what is showing whether it is working and what is going on. We have to have a signed evidence based to justify our existence.

R – Sure and that has been one of the negatives of smart cities – the idea that it is hard to provide or demonstrate a return on investment, not just in money terms but time and energy. So how do you view the role of data in achieving this return on investment?

A – Definitely, this is a very important issue to be honest because not only does it provide us with the power to show what we are doing and change as we see fit, but it is also to do with funding. If we do not have a strong data set when we are applying for funding and Manchester does, who is going to get it? If they have a strong evidence base to build upon straight away and a good base line, they are the ones who are going to get the funding. We need it for so many reasons, not just to show what we have done but also to say we need help here – it is that string baseline really.

R – If I could just pick up on that because we had not thought about it previously. The competitiveness of funding between regional rivals and the role data has to play in that.

A – Absolutely, Amy (a colleague) would be a good person to give you more information on the funding aspect of things but the Department for Transport have a big pot of money that they need to get out and you only get it if you can show a good business case, and that business case would be strengthened by a good evidence base. So again, yes it is definitely a factor when it comes to funding and will only continue to grow in influence as more organisations use data to inform their evidence base.

R – So now we have spoken about the challenges, I'd like to talk about the development opportunities you see emerging in the organisation that focus on extracting the value of data, or how you capture that data?

A – Yes, I think it is going back to those three principles we spoke about earlier, which are managing risk, efficiency, and business insight, and the transparency of the data. But in terms of the

9.

- Opportunities in communication of data
- Increase exposure through data platform
- Want to be example of best practice
- Opportunity of data in investment
- Increased exposure, more development partnerships
- Larger supplier together provides business to other companies
- More collaborative environment

- Work we do to benefit end-user who is the customer, citizen
- Confidence in data
- How it is presented
- End-user customer or stakeholder

- Benefit of data to internal reaches the external citizen
- Improve services to citizen
- Better communication to citizen through better technology
- Data feedback allows us to improve service we offer

- No current evaluation strategy
- People currently work how they always
- Could improve on current situation
- People need to become more aware of data environment
- There is room to improve
- Need to look at evaluation of data process to meet KPIs where
- Take more of info + improve

opportunities it is that data platform to say here we are and this is what we do. If we are doing it well then people may come to us for other things as well. Other than the investment side of things which we have spoken about, there are opportunities if we are doing well that other stakeholders may want to tap into that and expand our network. Merseytravel can lead the way in terms of development and then we could bring the operators on with us in a more collaborative environment so economies of scale.

R – So the benefits of your development filtering down to operators and then end-users?

A – Yes, I know from our work that it is all about the end-user. This work is driven by the end-user, making sure they have the confidence to understand what they are presenting. Whether the end-user be a stakeholder or a customer.

R – So as well as data benefitting the end-user within an organisation that is making decisions, again it will benefit the customer (citizen) eventually who is using the transport services.

A – Absolutely. And Merseytravel are very good at that in terms of looking at patterns and the information feedback from customers to see if there are any issues. Traditionally we have done a lot of customer relation feedback and we have been looking at the intelligence that derives from this through such things as our complaints database, passenger transport focus groups and surveys. If there are issues cropping up in our area, we will go out and deal with them.

R – Some really insightful information so far, thank you. Just to move on to the final part of the interview dealing with evaluation, so to what extent are data related activities evaluated in your department at within the organisation?

A – Using the word 'evaluated' I think you would have some areas where the data and the evidence has a process that achieves a good standard of work with data, however, a lot of people will be doing it and not even realising they are evaluating data or the information to hand, so in terms of roles and responsibilities there is nobody who goes in to actually look at every point of the information to do an audit if you like. Now that could happen, I know when it came to the traditional KPI's our audit team would have gone and looked at that process – in fact that is something I need to look at as well especially when it comes to information that feeds into the monitoring side of things as there should be strong processes on that. In terms of my role, what I do is I look at the information and make sure it is fit for

- What is the purpose of the data?

purpose. This is evaluation if you like but it is not my role per say but it is part of my role.

R – So perhaps the development of the data strategy will reinforce that evaluation.

- Data strategy implementations will impact situation

- Introduced new system to meet KPI's
- New role within teams for specific data governor
- Responsibilities linked to their use of data
- Streamline the process
- Need to understand the data cycle, how it relates to each part

A – Yes definitely and I suppose one thing I have not mentioned which is important is that we have been trying to establish, originally using the term data owner, and we realised that this wasn't strong enough with relation to the KPI's, so we are now using the term data governor with the idea that each will be a head of service and they will be taking the process map or the data flow to understand what feeds it and they will understand where it goes – that is the key really, to understand where that information goes. They will pinpoint the relevant officers to liaise with for that information strand. In terms of the data governor role I think that is really important. They do not have to know the ins and outs but they understand that there is a process there and this is where it ends.

R – So it is a process of increasing awareness?

- Need to improve process
- Make it the process simple, logical order
- Need to provide a demand of use for data
- People need to take responsibility of handling data

A – Yes, and you have to have an order for the data to make it tangible. Because if somebody does not say that is mine, then everyone is interested in it but nobody wants to actually use it so we are trying to put that responsibility on people through the development work that we are doing.

R – So taking ownership of that data is an important factor.

- Taking ownership of data important
- Evaluation of data
- Objectives for new role of data governor
- Why are we using this data?

A – Yes, so I suppose in terms of evaluation that is a main one at the minute. The objectives for the governors and making sure that we have got a governor strand of this for their information.

R – Fantastic, so to conclude the interview I'd just like to gain an insight into your opinion on how you see the development of the organisation with relation to data.

- There has been a change in attitude to data
- Need to adapt to the new data environment
- Need a review of current systems to form plan
- Will start to make more use of data
- Data affecting business needed
- There is a data ecosystem
- Implementation of objectives vital to realising potential of data

A – Yes I think to be honest that the will is there now. We realise that we cannot just do things the way we have always done them and I imagine that is the same in most organisation now. That you cannot just keep ticking over and over, you have to stop and review at times. So I think now that we have the will to drive forward with data we are going to see more of the efficiency, implementation of those principles. In improving the efficiency, we are managing risk and ultimately providing business insight so it does not matter which way you start it on those three principles. They are all inter-linked and to start with business insight you have to look at managing risk so those three principles have been fantastic for us in progressing the organisation to adapt to the data world. Efficiency is not

11.

- Efficiency is good for business
- Improves performance of company
- Want to spend more time analysing data
- need to improve gathering information to free up time on analysing
- Better data process results in better decisions

something we should be scared of because it will free you up to do other things and you have to spend more time making use of the information. Currently, people may spend up to 80% of the time inputting the information and not spending a lot of time actually analysing that information. So if we do things a bit better in terms of gathering information and making it more streamlined and efficient, then we have the opportunity to say stop lets look at this information and become more informed as officers.

R – Building upon the three principles you mentioned of business insight, efficiency, and managing risk. To give you a background to the project as part of developing the model we have formed a framework that is composed of data's value in accountability, efficiency and innovation/pro-activity – this strand involves using data for future decisions and everything you have mentioned about Merseytravel as an organisation links with this and I can now use this data to frame that model within the scope of Merseytravel and the insight you have brought today. So to end with the topic of efficiency and you as an organisation, how would you view the use of an efficiency model for the life cycle of data and do you believe it would be useful to organisations such as yourself who operate in the smart cities sector? In terms of the capture, communication, and processing of data to inform decisions? How we gather information, how we distribute that amongst stakeholders such as Merseytravel, Liverpool City Council, SME's etc. and how we then process that information or use it.

- Models for data process welcomed
- Will aid in development of city
- Would like to look at it in future
- See how it links to our work

A – Absolutely, we really would welcome any insights or models that can aid in the development of the city region and smart cities. Definitely, we would be more than happy to also look at it and see how it could be adapted and linked to the work we are doing.

1.

Focused Coding

Merseytravel (public) Interview Transcript

01/07/2016

Researcher – (R)

Participant – (A)

R -Thanks for agreeing to speak with me today. I know we spoke on the phone briefly, but just to give a bit of a background as to why we're meeting today: I'm currently studying towards my PhD titled, *Data-driven value modelling for smart cities* and as part of that we are conducting two phases of research. Phase one involves qualitative data collection in the form of interviews with organisations operating in the smart cities sector throughout the city of Liverpool. We're trying to gain an insight into the effect data is effecting organisations such as Merseytravel. So I've sent over the interview protocol and hope you've had a chance to look through that so you can bring your thoughts and insights to the project.

So to start off can you give me a bit of a background to how long you've been in your present position and what it entails?

New data specific role

A – *In my current position I'm called the performance coordinator and I entered that role in October '14 - the role was actually established in October '13 but I was away on Maternity leave.*

R – So the role is quite recent, really.

new data department

A – *Yes it is. The organisation went through a restructure and the performance team was developed as part of that restructure. So I'm initially from a research background and now I'm in the performance team. So originally we aimed to coordinate performance and as I'm sure you appreciate the nature of Merseytravel as it's a very diverse business – so with performance stats it was the idea of bringing them into one new board basically so that's why the team was established. Now that the performance framework is up and running we are now looking more at the data side of things.*

R – So it would be fair to say you have streamlined the process? In terms of how you restructured to handle data?

data specific role

A – *Yes, so the idea is to have one data performance point of contact within the organisation and now that's widening-out if you like to separate areas of the organisation. In terms of the data role that's happened really in the last year and the organisation have realised its quite important.*

data role in business

role of data in KPI's

evaluation of data practice

data capture
data communication
data analysis
value of data

issues of data
duplication
capturing data

implement new technology
testing implementation
data analysis

value of data

Over a year ago there was a board set up reviewing our support services, so that was our legal team, HR and IT as well as some others and as part of that review they concluded that data was an integral theme that cuts across all of the departments and operations of Merseytravel and it needed to be looked at. So a work package came in for data and because the performance team and our background it made sense that we looked at the data side of things. So we've done a very thorough root and branch review of data within the organisation and we're working towards the principles of efficiency, business insight and managing risk.

R – So the factor that the performance team took over that role would suggest Merseytravel view data and performance as a mutually beneficial relationship?

A – Yes, I think that would be right to make that observation.

R – Ok, so would you like to describe to me your own personal role in a bit more detail?

A – Yes, of course. My role at the minute is to make sure the performance framework takes over, and that happens on a quarterly basis via a report. So we make sure that this is carried out but now my data role is about going out and speaking to the individual service areas. We have established where there is real areas of risk in terms of data and how we gather it, but we've also looked at how we present data. So we are looking at the whole process if you like from gathering, to analysing, to presenting. So I suppose my role is again coordinating the understanding of data and how it's being used in the organisation.

When we went out and spoke to people we came up with quite a few issues. A whole variety from duplication, systems such as the systems people were using to gather data that were very dated and if they were to break down there is no system in place to fix them, if you like. So that was a big issue. We've addressed the gathering of data and we use new software now to go out and gather information for example with customers on the street or recording punctuality – that type of thing. So that has already happened and we're in the process of piloting our first surveys of how we gather data. So we are addressing the data gathering, we are looking at the analysis using process maps and data flows – this is making the data more accountable for the organisation. We have a set of KPI's (key performance indicators) and we make sure that we now have a proper data flow with process maps behind that for each of all of the KPI's that we have established.

3.

Communicating data

Skilled team members
in data

value of data

And then it is about present that data and making it available to people. So we are very lucky to have a member of the team who is really skilled in excel and developing and he has actually developed our own dashboards to present the information. And I oversee these elements, making sure that we are addressing those principles I mentioned before.

R – When you mentioned about some of the issues and systems – was one of the issues that certain departments for instance may have been using different systems to one another?

Lack of process for data

A – Yes, there were issues to do with systems and using internal data. People doing slightly different things or duplicating data in different formats. But then the actual hardware was an issue. We were using very dated hardware and also we were sending staff out with three different pieces of kit and a charge to cover their duty. So we are removing that and people are using tablets now to gather that information.

introduction of new technology
data capture

R – Just to pick up again on something you said before, what were the three principles?

value of data for
KPI'S

A – Yes those were managing risk, efficiency, and business insight.

introducing process
for data

R – So moving onto the organisational overview, I know we've spoken already but I just wondered if there was anything you'd like to add to that maybe in terms of any strategy development?

value of data for KPI'S

A – We're actually in the process now of establishing a strategy on how we handle data and how we link that to our evidence and intelligence base. We are trying to draw it all together really, so I wouldn't have a strategy to show you at the minute but I suppose what we have in our head is based around those three principles. So we are doing lots of different work packages to address those and making sure that we are gathering the data properly, straightening how the process works – the analysis stage. What were doing more as an organisation and also how we present that data. But I think now in terms of the organisation there is defiantly more of an appreciation for information and what we do and don't have. I think decisions were made in the past of changing things and not understanding the consequences of turning systems off or changing things. I think now because of the data we are handling people will now say, stop hold on we need that information. Where is it coming from? I think we've created more of an appetite for data and understanding how it informs business.

capturing data
analysing data

using data for business

trust of data

how systems for data

communicating data

value of data
collecting data

process in place for
data

sharing data
partnership development

validity of data

R – So I know you don't have a strategy right now, but you do have those three principles to build upon and you're in the process of developing a strategy?

A – Yes that's right, we've put one paper together, well we've put many papers together but there's one paper that is progressing at the minute to our information management group and that has been agreed but we have to revise that again to include the whole loop – the changes that re made, the data that is presented – how that links to the overall performance but also how it shapes future services. So we are just making that a bit clearer and hopefully you will see that strategy document come out some time in the near future.

R – So you mentioned the value of data in terms of making future decisions, and that would associate a timing aspect to data's handling. Therefore, as well as being able to use data now with relation to performance you can use it for the future direction of Merseytravel and the decisions being made there?

A – Yes, I think that's the idea. If people are thinking about their next steps, then it will grow from what we are able to gather now.

R – This actually relates to a lot of the theory arising from the project no, which is that we can use data to better inform on future decisions as well as decisions that are to be made right now with real-time data. So what kind of networks do you see developing with regard to data? Is it all internal or are you beginning to build external links?

A – At the minute we are very much focused internal. Because at Merseytravel we have the Mersey ferries and Mersey tunnels as well as overseeing the bus and rail network and tourist attractions its quite a diverse business – and this data work is cutting across all of those so at the minute it is about getting our house-keeping right. But there is potential for sharing data through the urban transport group, we do that currently anyway, but maybe strengthening those ties in the near future. Also looking at what is going on through the districts. With the combined authority coming in and the changes that that may bring, we are going to need to be aware of what the districts are doing as well to make sure there is no duplication there on the city region aspect.

R – Yes, because the combined authority could potentially have quite a large impact on the region itself and how organisations within that region operate in terms of communication and collaboration. As I'm sure you know as well, creating external links and making that data open it also gives the benefit of yourselves

5.

validity of data
sharing data
value of data

competitive nature

new system to handle data

adapting to data environment

quality of data
frequency
constant data flow

confidence in data

having access to separate sources of data that may not have existed in the past. The open data movement is actually really gathering a lot of momentum in wider society as well as the industry itself.

A – Yes and I think that's why we have to be very confident that we have got it right here before we start to think about open data and sharing data. Don't get me wrong, we have data now that is available in terms of KPI's but we need to be at a higher level of confidence when we are presenting data and making that available for other people to use and interpret.

R – I suppose it's a step-by-step process and actually looking not just at the organisations in the region, but the Liverpool city region itself, compared to the likes of London for example it is lagging behind in terms of the development of a shared data portal for the city. The London Datastore acts as a portal for the likes of TfL, who are Merseytravel's counterparts, and they have access to that portal for sharing data. As you know Liverpool doesn't.

A – And that means we are lagging behind.

R – Exactly, so is that something you as an organisation have highlighted previously?

A – We certainly have within the team. The research we do it's quite obvious and there is probably an appreciation at a higher level that we need to do more and that's why this work has been sponsored and progressed. I think it's not something that we would publicly state but it is something that we have to improve. It's not something that can be fixed overnight, it's very much about understanding the existing processes and implementing change where change is needed rather than for change sake.

R – This is all great insight so far. I know we've spoken about what you are currently doing as a department and organisation as a whole but are there any major challenges or obstacles you've experienced. I know we have mentioned the open data platforms of other cities but do you see any specific challenges facing the organisation due to the increasingly data-driven environment?

A – I suppose the challenges relate to very basic things like the frequency of data. We are trying to make data more timely because in the past there has been great lags in getting the information through so we are looking at that. Also the accuracy and making sure it is clearly labelled in terms of confidence and what people are actually referring to, because a little bit of information can be powerful but can also be dangerous if it is used in the wrong way so we are now trying to give the end-user that confidence if you like so

understanding data

capture of data

purpose of data use

data strategy development

understanding data

frequency of data flow

handling data

introduction of new technology

analysing data to understand it

they can say right, we understand the process, the information has been verified, we understand the limitations. But I suppose the major challenge is making sure that we are gathering the right data. So we need to establish what the objectives are, other than 'oh we have always done it this way', but what is the reason? What is it feeding into? So we do challenge the objectives of the data quite a lot and make sure that it is fit for purpose.

R – Would it be fair to say that the process will strengthen as you develop and start to implement your strategy to a greater degree?

A – That is what we are hoping yes.

R – I'd just like to pick up on something you mentioned with regards to the timing issue and frequency of data. Previously, you have mentioned the challenge in terms of the lag and getting that data through, how do you view the development of gathering real-time data?

A – Real-time will be very beneficial but again it is understanding the limitations of the data and what it can be used for. Currently our patronage is based on a six monthly methodology so we are only getting data at a six-monthly interval for a city overview. So I would have to understand, in terms of RTI (real time interval) how that has been built and modelled to make it a meaningful set of information. So it is as much about the method when looking at RTI data.

R – To give you some insight into smart cities and what we are looking at, one of the theories behind the concept is that as you introduce technology into the built environment, it enables you to gather a more diverse range of data and at different frequencies. As an example TfL are at the forefront of that with regards to their smart card system – just by introducing that type of technology into their transport network it gives them RTI data and I know that is something Merseytravel are looking at. It is a process really, but I just thought I'd bring that up to give you some context as to why it is I am looking at data and the smart city.

A – Yes because we have got our smart card launched but I suppose there will be realms and realms of data that arise from that. It is not at a stage yet though for us to deal with but my understanding is that there is a wealth of data that the smart card brings but again you have to understand how to best use that data and make it meaningful.

R – So again it comes back to the strategy and the point that there is no use just introducing this technology for the sake of it.

7.

understanding data
capturing data

Building a more
informed
picture

analysing data

"Guinea Pig"

capturing data
communicating data

validity of data
quality

Using data daily

quality of data

new processes in place

A – Exactly, and it comes back to the objectives that we are using it, we are gathering it. There is some work being done by the policy arm of our section looking at journey reversing. That is were if you tap on in the morning, then tap on in the afternoon in your way back that they would match that journey and try to understand the flow of journeys on and journeys off because on the bus there is no incentive to tap off. Because from our point of view we may know were you get on but we do not know were you get off and that is something the urban transport group are looking at. So here we have a wealth of information but just looking at one tap doesn't give you a full picture. This means that we have to take a step back to take an overview of where the two taps occur – we cannot chip everyone so we won't always now how people use the network exactly. In this sense then it is looking at the data that is available to you and making best use of that data.

R – I know you have mentioned about the restructuring that occurred, but have you as an organisation introduced any new training methods involving staff and data?

A – I would not say there has been a lot of training or teaching as such but there has been referencing best practice. It is something that is part of the strategy, because I think as we get this a little bit further on, and we are more confident in the data that we are gathering and presenting we can then do a little bit of education to staff to get them to think about the processes that they are going through inputting data. Even very simple steps really such as verification of information so if they are inputting something there are checks in place – is somebody doing the proofing? Is somebody signing it off? Very basic principles but we are trying to get them out there.

R - So to reiterate what you are saying, although it is not happening now maybe in the future you see data affecting the day-to-day activities of more people in the organisation?

A – Yes. 9 times out of 10 it is happening. One of the observations we have made is that we are relying on the good will of officers in handling the data. Even whether it is day to day patronage on the ferries there are good processes out there but what we need to do is make them a little but more formed to make that data more valuable. So it is not that we are trying to change for change's sake but it is juts making things more accountable.

R – Yes because accountability, as we have found through our research, is a big opportunity with data, both accountability and transparency.

improving data quality

A – Yes, that is what we are trying to achieve through this process.

using data

R – Now I know we've spoken about how data is influencing the organisation, but could you just speak a bit more about how you feel data is affecting the day-to-day activities of the organisation?

more informed decisions

A – Absolutely, yes it is affecting our day-to-day activities. The way to think about it is that we need to use data in terms of our evaluation of work, so if you think about the STEP projects that are going on data is what is showing whether it is working and what is going on. We have to have a signed evidence based to justify our existence.

role of data in funding

R – Sure and that has been one of the negatives of smart cities – the idea that it is hard to provide or demonstrate a return on investment, not just in money terms but time and energy. So how do you view the role of data in achieving this return on investment?

competitive nature of cities

A – Definitely, this is a very important issue to be honest because not only does it provide us with the power to show what we are doing and change as we see fit, but it is also to do with funding. If we do not have a strong data set when we are applying for funding and Manchester does, who is going to get it? If they have a strong evidence base to build upon straight away and a good base line, they are the ones who are going to get the funding. We need it for so many reasons, not just to show what we have done but also to say we need help here – it is that string baseline really.

data improving evidence-base

R – If I could just pick up on that because we had not thought about it previously. The competitiveness of funding between regional rivals and the role data has to play in that.

data used for funding bids

A – Absolutely, Amy (a colleague) would be a good person to give you more information on the funding aspect of things but the Department for Transport have a big pot of money that they need to get out and you only get it if you can show a good business case, and that business case would be strengthened by a good evidence base. So again, yes it is definitely a factor when it comes to funding and will only continue to grow in influence as more organisations use data to inform their evidence base.

data to provide evidence base

R – So now we have spoken about the challenges, I'd like to talk about the development opportunities you see emerging in the organisation that focus on extracting the value of data, or how you capture that data?

data role in KPI's

A – Yes, I think it is going back to those three principles we spoke about earlier, which are managing risk, efficiency, and business insight, and the transparency of the data. But in terms of the

9.

communicating data

opportunities it is that data platform to say here we are and this is what we do. If we are doing it well then people may come to us for other things as well. Other than the investment side of things which we have spoken about, there are opportunities if we are doing well that other stakeholders may want to tap into that and expand our network. Merseytravel can lead the way in terms of development and then we could bring the operators on with us in a more collaborative environment so economies of scale.

developing partnerships

R – So the benefits of your development filtering down to operators and then end-users?

data usability
outcome orientated

A – Yes, I know from our work that it is all about the end-user. This work is driven by the end-user, making sure they have the confidence to understand what they are presenting. Whether the end-user be a stakeholder or a customer.

R – So as well as data benefitting the end-user within an organisation that is making decisions, again it will benefit the customer (citizen) eventually who is using the transport services.

outcome orientated

A – Absolutely. And Merseytravel are very good at that in terms of looking at patterns and the information feedback from customers to see if there are any issues. Traditionally we have done a lot of customer relation feedback and we have been looking at the intelligence that derives from this through such things as our complaints database, passenger transport focus groups and surveys. If there are issues cropping up in our area, we will go out and deal with them.

customer satisfaction

R – Some really insightful information so far, thank you. Just to move on to the final part of the interview dealing with evaluation, so to what extent are data related activities evaluated in your department at within the organisation?

evaluation of data

A – Using the word ‘evaluated’ I think you would have some areas where the data and the evidence has a process that achieves a good standard of work with data, however, a lot of people will be doing it and not even realising they are evaluating data or the information to hand, so in terms of roles and responsibilities there is nobody who goes in to actually look at every point of the information to do an audit if you like. Now that could happen, I know when it came to the traditional KPI’s our audit team would have gone and looked at that process – in fact that is something I need to look at as well especially when it comes to information that feeds into the monitoring side of things as there should be strong processes on that. In terms of my role, what I do is I look at the information and make sure it is fit for

value of data

purpose. This is evaluation if you like but it is not my role per say but it is part of my role.

R – So perhaps the development of the data strategy will reinforce that evaluation.

new data process

new data responsibilities

new data processes

A – Yes definitely and I suppose one thing I have not mentioned which is important is that we have been trying to establish, originally using the term data owner, and we realised that this wasn't strong enough with relation to the KPI's, so we are now using the term data governor with the idea that each will be a head of service and they will be taking the process map or the data flow to understand what feeds it and they will understand where it goes – that is the key really, to understand where that information goes. They will pinpoint the relevant officers to liaise with for that information strand. In terms of the data governor role I think that is really important. They do not have to know the ins and outs but they understand that there is a process there and this is where it ends.

R – So it is a process of increasing awareness?

viability of data

A – Yes, and you have to have an order for the data to make it tangible. Because if somebody does not say that is mine, then everyone is interested in it but nobody wants to actually use it so we are trying to put that responsibility on people through the development work that we are doing.

R – So taking ownership of that data is an important factor.

restructuring of organisation

A – Yes, so I suppose in terms of evaluation that is a main one at the minute. The objectives for the governors and making sure that we have got a governor strand of this for their information.

R – Fantastic, so to conclude the interview I'd just like to gain an insight into your opinion on how you see the development of the organisation with relation to data.

organisation is adopting

value of data

adopting to data world

A – Yes I think to be honest that the will is there now. We realise that we cannot just do things the way we have always done them and I imagine that is the same in most organisation now. That you cannot just keep ticking over and over, you have to stop and review at times. So I think now that we have the will to drive forward with data we are going to see more of the efficiency, implementation of those principles. In improving the efficiency, we are managing risk and ultimately providing business insight so it does not matter which way you start it on those three principles. They are all inter-linked and to start with business insight you have to look at managing risk so those three principles have been fantastic for us in progressing the organisation to adapt to the data world. Efficiency is not

11.

value of using data

improving officer skills

something we should be scared of because it will free you up to do other things and you have to spend more time making use of the information. Currently, people may spend up to 80% of the time inputting the information and not spending a lot of time actually analysing that information. So if we do things a bit better in terms of gathering information and making it more streamlined and efficient, then we have the opportunity to say stop lets look at this information and become more informed as officers.

R – Building upon the three principles you mentioned of business insight, efficiency, and managing risk. To give you a background to the project as part of developing the model we have formed a framework that is composed of data's value in accountability, efficiency and innovation/pro-activity – this strand involves using data for future decisions and everything you have mentioned about Merseytravel as an organisation links with this and I can now use this data to frame that model within the scope of Merseytravel and the insight you have brought today. So to end with the topic of efficiency and you as an organisation, how would you view the use of an efficiency model for the life cycle of data and do you believe it would be useful to organisations such as yourself who operate in the smart cities sector? In terms of the capture, communication, and processing of data to inform decisions? How we gather information, how we distribute that amongst stakeholders such as Merseytravel, Liverpool City Council, SME's etc. and how we then process that information or use it.

new systems for data use

A – *Absolutely, we really would welcome any insights or models that can aid in the development of the city region and smart cities. Definitely, we would be more than happy to also look at it and see how it could be adapted and linked to the work we are doing.*

10.ii.ii Interview (B) Initial and Focused coding

1.

Initial Coding

internal organisation

external environment

02/08/2016

Researcher – (R)

Participant – (B)

R - Maybe if we could begin with an introduction into the projects that are helping Liverpool develop into a smart city.

- Ability to bring in SC funding bids
- Virtual representation of SC initiative
- Big data environment
- We now have opportunity to make use of big data
- Use of city would allow for testing of SC projects, resources more limited
- What is relationship between datasets?
- Coordination with neighbouring authorities
- Council effort, local health
- Liverpool has strategic advantage due to location in Darsbury

B - One thing we were and still are interested in doing through the IoT bid is to create a virtual representation of the city. In an era when we have the opportunity to use big data - and big data has always existed - it is just that it has not been accessible or we haven't had the ability to query it in quite the same way as we do. So the idea was to have a virtual representation of the city which you can then test out different scenarios on and see what the relationships are between very diverse data sets. And that would make use of the facilities in the Hartree Centre over in Darsbury if that was the case as they have got the computing power (through the super computer) that we don't have anywhere else.

R - The quantitative stage of this research is to two separate data sets and see what we can take from them in terms of services to the city.

- Use of datasets to improve value of each

B - What are the particular data sets?
R - So we are going to use data sets from London simply because as a city they provide the most easily accessible data store. We have one health data set and one transport data set. Now the reason we took those two data sets is because they are grouped and formatted into standardised codes or locations throughout the city that then enables better interoperability.

- Have used interoperability of datasets previously
- Using data to improve situation within ward
- Targeted a solution based on data gathered
- Used two data sets to improve understanding of situation
- Use of one dataset increased value of other, which therefore increased value of each

B - About four maybe five years ago, perhaps even six in the ward that I represent we took a number of different data sets from transport, police, council, housing and overlay-ed them to see whether there are some issues in the ward that we could approach. So as an example we found a location where there was a high instance of elderly people with limited long terms illnesses, in the same location we also found there was a high instance of environmental crime, high instance of normal crime, high instance of needs and from that we began to question well what is the issue

- Built up strong picture of local contextual area

- Used data to improve understanding
- Data coordinated with local area revealed more insight
- Targeted on new solution based on data reviewed/collected

- Gathered the data and applied it to local area for local solution

- Data provided us with more insight

- Local contextual issue required a local solution

- Data was used to provide insight + design solution

- Use of data allowed for more cost effective solution

- Public policy doesn't create localised solutions

- Creation of new company to reflect new environment

- Use of big data to inform future policy

- Policy as it stands is not responsive to new changing environment

- Forecasting for future of DC's

- Interconnectivity of people & technology results in more data

- Data can allow for new & improved services

around here? Now there was some specific issues but one issue that we all identified and all found had an impact was the existence of a number of dis-used garages so the plan was to knock down those garages and open up the area more. We got rid of that space where people could hide behind and also made it better for the people living there so they didn't feel they were living in a bad place. Of course overtime the housing association have upgraded the flats that were there as well and both these actions began to tackle the problem. Now on an estate next door to that which had been labelled bad for anti-social behaviour because we used the data and overlay-ed those maps and began to assess that data we began to realise that there wasn't an issue with anti-social behaviour across the estate, there was simply an issue at two separate points. And we knew the families that lived there, so we targeted the intervention and action both with and against those families and this helped improve the area for the residents. Now this only came about sorry because we were able to take the data and began to apply it on another level.

R - So the data created a lot more insight into the situation would you say?

B - Yes, well it certainly helped in that sense. If we work with the instances on the housing estates we knew there was issues on social behaviour but what it helped us do is to target our response much better. So rather than us just turning around and saying "oh, the whole estate is terrible for anti-social behaviour so therefore we need to formulate an area-wide response" using the data we were able to actually say that if we deal with these two families we will see a huge improvement in anti-social behaviour in that location. This means that it is more cost effective, but also it deals with the problem. And quite a lot of public policy that tries to intervene is not doing it quite in the right way. Myself and a colleague, we set up a company called incubator of change that tries to tackle these types of issues. This is because we believe in three things around this whole agenda (and it is not necessarily a smart city issue, but is in-keeping with the ethos of smart cities and how you use data) of future policy making and how big data impacts on that. One was that when we are making policy we very rarely look into the future and take into account future trends (and this is a challenge for how we approach smart cities in general) so the elderly person of 2030/2040 is currently walking around now with a smart phone in their hand and are more than happy to be using apps and engaging in that way and yet our approach to provision for social services and meeting the needs of them people is very much focused on the

3.

- As it stands we do not look to the what enough?
- We do not make full use of data as it stands
- We have potential for advanced warning of danger, but do not use it
- Data can help reveal the problem
- Policy is ever-changing
- System needs to be in place to accommodate future change + policy
- Over-time things change
- Can we use data to better understand this change?
- How can we understand why the change happened? By data
- We haven't had the opportunity for that insight in the past
- We now have the opportunity for that insight
- We now need to put systems in place to account for the new environment
- There are examples of best practice
- We need to learn from that but remember we have locally contextual issues
- Need to develop a targeted strategy a targeted response

people of today and how we have historically seen its development - so we very rarely take into account future trends. Second point is that we very rarely will make use of big data to monitor and manage what we do, so what do we mean by that? Well for instance we talk about canaries in the coal mine and that is what happens, or what changes have occurred that we should have known about that may have precipitated the problem? Because we make policy as if it is going to last for ever and it doesn't. So we don't set up our systems well enough. Here is an example, if we look at Anfield - the bit opposite and around the football ground - twenty years ago it was a very vibrant community, all be it still very deprived, but it was still a vibrant community but then something happened and over time something began to change that. Now it wasn't just policy intervention but we are saying could it have been the changing of a bus route? Could it have been a shop closing down? Could it have been a family moved in or family moved out? All of those different variables. Could it have been one major crime incident that precipitated some of this? We probably haven't had the facility to monitor that in the past but we do now - so being a bit more granular in how we measure those factors and provide response. The third point is building on that when we look at implementing policy in different areas or for instance we see something great going on in Manchester and say "oh we would love to do that here" we don't spend enough time looking at the variables which go into that and actually could it have just been really successful because there was a particular person involved and you are not going to replicate that person.

R - That is one of the issues I have found is that people try to put a broad aspect on the smart city and it is actually a locally contextualised approach.

- People focus a lot on the technology
- The technology is one aspect
- People are the SC product
- We need to focus outcomes + solutions of people

B - Well I think a better way from my point of view to describe it is that many people focus on the technology side of things and technological element, and don't focus enough on people - the organic element.

R - The citizens themselves. Now to move this on a little bit, would you like to briefly describe your role as the mayoral lead for energy and smart cities?

- There is a specific position within local gov. for development of the SC
- Aim is to develop + drive agenda forward

B - Yes, so I am the mayoral lead for energy and smart cities so it is my responsibility to drive that agenda forward. So it is probably worth explaining what a mayoral lead is and the mayor would like to lead on a number of different issues but recognises that there are

- There are limited resources for city
- There are pressures for important areas, SC's is one of these
- Smart Cities is its own domain/area
- SC is related to many other areas
- Trying to create a strategic vision for the city
- Improving the exposure of the city, trying to draw investment
- Enabling the development of SC projects + initiatives
- Bringing together many diff. aspects of the city
- Promoting Liverpool as a city to increase investment for smart cities
- By making Liverpool better it will increase more SC projects/initiatives
- Requirement to change the way the city runs to better reflect the SC + data environment
- making the system a lot better understood
- Technology is requiring things to be run differently
- The citizens are also a driving force
- They are driving the force for change

- Citizens are a challenge
- The council is responsible + funded by the citizens
- Trying to adapt the organisation to the new environment
- Trying to increase exposure + get funding
- There are no dedicated offices in place to help facilitate this
- This new role is heavily focused on doing this work
- Not working well having to coordinate across departments
- Internal set-up not appropriate
- SC not a priority for all at the moment
- Always need to be aware of change
- Need to adapt

only 24 hours in a day and he gets side-tracked among a number of things. So what he does is to appoint a number of councillors to lead on a number of issues and one which is energy and smart city. Perhaps because in the mayors head at one point he saw them as similar things but actually they are quite different, although they are related in some ways but are still quite different. So what do I do? Well part of it is helping better strategic vision for how the city will do that as a political role. However, some of it is just using influence to open doors and enable things to happen as well as instigate for certain things that should occur in the city. So for instance when Red Ninja (an SME in the smart cities sector) were trying to develop their approach to ambulance response they needed access to the urban traffic control systems in the city so I was able to open that door to enable the access to that data. Whether that is by simply saying yes you can do it or through liaising better between the different stakeholders, and I also have a role I suppose for going out of the city and promoting what is going on for Liverpool. This is so that Liverpool can sell itself better and this will attract others who are willing to invest in a smarter Liverpool. There is also the issue of advocating internally the need for specific changes that may be occurring and communicating this to the mayor and city and explaining it to them that that these changes are taking place in the city and that is the way technology is pushing us. Secondly, we are being pulled that way by the general public anyway in a way that previously the general public may have been reluctant to change, certainly so rapidly.

R - Do you think that is a challenge?

B - Definitely yes. Especially because a lot of people see it as that is what their job relies on. So one of my roles is to prepare for the change that we may see internally as an organisation and externally as I said is to promote the city and get engaged with different projects so we can see what is going on in terms of best practice. I don't have support officers as such so there is nobody dedicated to doing it so part of the role is to work across different boundaries to use my own personal influence on stuff effectively to represent the city. We came to the conclusion recently that it isn't particularly working well doing it in this way, we have a number of different issues that we are still falling behind with in the city. Some of that is because of the way the city is set up, while some of that is because it is not a priority for others like it should be. I personally always think that change is something that you should be constantly aware of within public services, I have worked for ten years as a sustainability manager in a local authority and we are constantly trying to push

5.

- Trying to get the organisation to change
- Trying to get people to adapt
- Accountable to the public
- Public money holds back development
- Less chance to fail
- Conscious of resources e.g. money
- People cannot take chances
- People need to adapt
- Creation of external organisation to facilitate change required
- Collaboration between many industries
- Trying to implement the change that is required
- Viability + promotion of SC approach
- Attempt to increase investment
- There is still a long way to go to get to right place

through different ways of doing things and in local authority terms it is agonising trying to get people to change. As I say in part it is understandable to a degree. A bigger issue is that people think this is public money and I can't take chances - this is a big hold back on local authority and government in general as people do not want to be seen to be wasting money. That means that people are very risk averse. But some of it is just personality in terms of changes. So one of the things I am looking to develop is effectively another organisation that sits outside of the council, is not a joint venture as it works separately from the council but it gets that buy in by having the link between the two through my role. So you would have business, academia and local authority as well as community. It's role then would be around helping affect that change and taking on some of the burden of what I have been doing. Now a lot of people think Liverpool has got a smart city approach mainly because I have been going out there and telling them so we do have a good name with the some of the stuff that we do, this is partly because I have just gone out there and sold Liverpool. The reality, however, is different and we have still got issues that we need to address.

R - Just to pick up on something that you mentioned there on the local authority - how do you think devolution will effect the development of Liverpool as a smart city?

- The devolution will affect the region + SC development
- SC approaches have larger pops
- City region will help to increase pop
- Larger scale makes it more attractive to develop
- More attractive investment environment
- Liverpool city can make things happen
- Diverse city with many sectors
- Economic force for area is part of its local context
- These are advantages
- Also has six authorities who do not know how new system will work?
- This creates confusion among SC approach
- Good at pre-development phase of SC development

B - There is positives and benefits. Most of the smart city approaches from around the world are dealing with cities that are much bigger than the 470,000 that Liverpool has so you will be looking at a city region of 1.7 million (I do not know the exact figures) which is much more of a scale. Now in one respect that makes it a lot more attractive for people coming in and trying to do things because it is at a scale where they can see the benefits that they can make from it whether that is through social change of monetary benefits and the like. The problem with that though is that Liverpool is big enough to matter and small enough to make things happen and it is at a scale, just Liverpool itself, where it is small enough to affect big change if you have people behind you but it is big enough in terms of it has everything a city needs - it has a lot of people, it has lots of different industries, it is an economic driver of an area, it has a port unlike many other cities. All of those different things it has that but then it has also got six different authorities across the city region who don't know quite how the metropolitan area governance is going to work. Some elements of the city region are more sceptical of a smart city approach or it is not even on their radar, it is not even something they would think about. One of the problems is that we are very good at bringing forward projects and saying (it could also be said

- Poor implementation due to systems
- Governance is issue in development
- Need to have a strategic vision
- No better means hard for sectors to work towards one goal
- All sectors need to be engaged in vision + one aim
- Links exist only on project level

this is a British view) haven't we done really well on that but we poor when it comes to a whole systems approach to it. This is not a smart city thing, although the smart city in theory should help it, this is just a governance issue. We very rarely will have a big vision for an area that turns around and says this is the type of place it will be and this is why everything moves in that direction. So because we don't have that over-arching vision we don't have that health sector which is really engaged with the transport sector which in turn is really engaged with the business sector, which in turn is really engaged with the social services sector. So there is those links that exist on a project level more than they exist on any higher one.

R - If I could just pick up on that point as what you are talking about here with regards to data interoperability is something that emerged from the Merseytravel interview when we were discussing data platforms of the city. In my experience with this project I think it would have been great to perform the quantitative data collection on Liverpool, due to the fact many of the interviews are taking place in the region, but gaining access to that data was an issue.

- Data platforms are a wider discussion
- Debate surrounding data platforms
- Have discussed data platform previously
- No understanding of what data LCC holds
- No capacity to analyse the situation
- Do not know what to do with data
- Issues with privacy + security of data
- Need a system in place
- Need to understand how to improve situation
- System will allow better use of data
- Who will benefit from the data?
- Private sector will lead growth, outcomes need to be for citizens
- Requirement to monetise data
- Adaptation of business models
- Challenges before we can discover usefulness of data.

B - I was having a twitter conversation yesterday about data platforms. There are people I know who have been involved in open data movements who are adamant we do not need a data platform and I understand that. There have been discussions around having that before. One of the big problems I think is that we do not know what data we hold, and we do not have the capacity to analyse that situation or we don't have the goods to just pay somebody to do it for us. We also have an awful lot of data that we do not know what we are supposed to be doing with it, so it is people's personal data and there are lots of safeguards around that but we are overly cautious when it comes to things like that. If only we took a bit of advice on what can we do? How can we anonymise this and on what level? And then we can make use of it but we are not very good at that on a city region level. We probably need an open data officer who works across a number of different organisations. And that it comes to whose benefit are doing this for? And this comes back to something I was saying about who does it benefit? And it should always be for the individual but initially it is always going to be for the private sector who are going to benefit. Right now it is about how they can monetise it. But it doesn't mean we shouldn't do it, do not be scared of the fact people make money. So there are still some challenges.

7.

- Use of data to inform policy
- Use of data to make future decisions
- New organisation development

R - I thought it was interesting you mentioned earlier about data's role in future trends and policy making, with the principles of the incubator for change.

B - Yes, that is more of a policy making approach that we are trying to make separate rather than my own particular role with Liverpool City Council.

R - So you were saying you think the city region could benefit from the creation of dedicated role as an open data officer? Even myself looking for participants, in terms of Liverpool City Council, there was nowhere to go.

- NO dedicated role in LCC for data
- Digital team most relevant to SC's
- No specific SC organisation
- Internal set-up not open to environment
- Devolution taking precedence

B - Yes well you wouldn't. You may speak to our digital team within the council but they are not necessarily the people who will be involved with smart cities. This is because the local authority is not set up to do it like that. And at this moment in time it is not even on the radar because they are so obsessed with devolution.

R - Because if we look at Manchester in terms of smart cities they are ahead.

- Competitive nature of SC's
- Funding enables Manchester to be ahead in competition
- Dedicated SC's roles in MGC
- Trial of SC initiatives
- Funding plays crucial role in SC development
- Regional, national, union, international funding
- Ranking/measurements of cities not representative
- Doesn't take into account local contextual situations
- Local problems require local solutions
- Smart means diff. things to diff. places e.g. India -> clean water
- India leading SC implementation initiatives
- How can we measure performance of cities in relation to one another?
- How can we measure progress?
- What areas matter to that city?

B - Yes they are ahead and I know Steve (Turner - the ex-head of smart cities). In part that is because they have had a huge amount of funding and have been able to trial stuff as well as now they have the IoT bid. It is worth pointing out that all the cities that turn around and say we are doing some great smart city projects have had some funding at some point whether it be through Europe or Innovate UK. They are no real further on, however, than what we would be. I completely find the rankings of top ten smart cities as not relevant nor representative to the actual situation in those cities and in comparison with others. Because if I was to turn around to someone in a deprived area of Manchester and say look how smart this city is they would still turn to me and say look at the poverty I still live in. How is that smart? You will see from my blog that a lot of that is driven by a conversation I had with a guy in a conference who is from India and he said a smart city to him was one which he could provide sanitation and clean water to the people - that is a smart city as far as they are concerned. Although in India they have the 100 smart city initiative that they are looking at which will be a lot more than water and sanitation but the point is these things matter. When you turn around and say that city is much more smart than that one, to what end? What is actually getting any better there? Are they streets ahead because of economics? Are they ahead in terms of social services? Are they streets ahead in terms of health? I would

- Return on investment for SC solutions/projects
- Adoption of business model
- People should be the outcome, not technology
- What is the purpose?

- Cities require a vision/purpose
- London SC initiative
- Collaborative SC initiatives
- How can we apply best practice to local contextual area
- Analysis of local areas provides local solutions

- Overview of local contextual situation
- Highlight priorities
- Create a plan to meet priorities
- This affects other areas that stem from initial problem
- Create holistic approach/solution
- Competitive nature of cities means diff. investment
- Diff. approaches to same problem
- Return on investment issue for SC initiatives
- Role of data + policy in mitigating their issues
- What is the purpose?
- Data was used to forecast problems
- Did not make use of data
- Overview of market required
- Supply / Demand
- Citizens create demand
- Experience in meeting citizens
- Change in the way people meet

argue not really. And so a cost benefit analysis of some of this would be quite interesting. And that is because you can be driven by the technology and not driven by the people. Why are we doing this?

R - Yes. And cities do sometimes lack direction or that vision that everybody can work towards.

B - Yes. So London's digital future was a piece that was done by various groups in London before the last mayoral elections. Centre for London, Mayoral Tech Manifesto was the report but I'm looking at how you can do that in terms of what Liverpool needs. Some of it is lifting what they are doing. We have done the analysis now I think and we know where Liverpool is failing when it comes to the smart city agenda.

R - Would you be able to perhaps give us a brief of what they may be? As from our research we have been looking for a smart plan or policy for Liverpool and have yet to find one. Something to show it is happening.

B - Yes. So it starts with what our governance is, who is doing what, and who should be doing it, as well as who isn't. The most pressing thing at the moment is the infrastructure. That is not to say we don't do anything until we are able to improve the infrastructure, but Liverpool's infrastructure is not at the standard it needs to be. So you could go into the central business district and you have terrible internet connection. It really is behind. This is partly because the government has failed. Their whole approach to improving broadband focused on this super fast broadband and it is neither super nor fast and the cost to put this in is the same as to put something really good in. We are just not there right now. It will cost a massive amount and the return will not be what we are happy with in terms of the investment. This goes back to what I mentioned before, when you are developing that policy where is your future trends analysis? With that there is no excuse with regards to broadband speeds. The UK should have been able to know what the trends were - a brief understanding of Moores Law would have been enough. Technological change for instance is a great example. So we should have been able to see that. So there is a need for us to look at the push and pull factor between technology and users. And people want to see things change so they demand things differently. I use the example of when I became a councillor in 2008 we provided the advice surgeries for people - a couple of different advice surgeries a month in each ward that people can come along to, drop in to get advice and support. Less and less people now drop in, certainly in

- Provision of new services
- Smart city agenda targeting 7 areas
- Diverse solutions to local problems
- Still need to adapt to new environment
- Need to create environment supporting innovation
- Understand local contextual area
- Need to implement better planning
- Create a strategy
- How do we work together? LAs + business + citizens
- New strategy must reflect new environment
- Planning plays a larger role now in this new environment

- Gap exists between planning now + where it needs to be
- Plan process is complicated
- Current UDP policy out of date
- Not appropriate for new environment
- New environment not reflected in plan
- New technology changes needs
- Less buildings needed for services
- Planning cities needs to change
- Again changing environment needs to be reflected in policy
- Change of use for areas in new environment
- Using data to inform future decisions
- Use data to create policy
- Changing environment results in new economy
- Connectivity an issue in new world
- Changes are happening + we need to respond to these changes

itself and within our services, or the infrastructure of the city. So they are the kind of seven different areas that we would look at around the smart city agenda, it is just not specifically written down and there are still gaps. So looking at London's digital future and Liverpool's there are still gaps around that in understanding how we support innovation, understanding how digitally inclusive we are, understanding security issues, understanding that planning is not consistent everywhere and that is planning for the infrastructure as well as planning for use and that is another issue that at a city region level becomes a big question and there is going to be a responsibility by the mayor for that strategic planning. And strategic planning before this has really failed to take into account the digital world. It is more than just about where do I put this building?

R - Even from my time at the council in the planning department compared to the work I am doing now I feel there is a massive gap between where it is now and where they need to be.

B - Yes. I have been through a local plan process and it is really difficult getting policies through. The Unitary Development Plan is still quite analogue in what it is talking about. The delivery of a service these days used to be reliant on a building so you would have to have a building for dealing with your housing issues whereas you do not need that as much now or you certainly take up a smaller footprint. The same goes for planning our cities and where do you put the retail? Well now retail has changed and more and more people are buying online. More and more people buy online and see the shops as somewhere you go to view a product before buying it online. That throws up questions for ourselves and the use of areas change especially for planning. That is what the future trends deals with and there is also the element in terms of smart city about the way people will live. So we have people who are much more inclined, certainly with younger generations, towards the sharing economy so jobs are something you do as a freelancer much more, there is huge growth in free lancing. So that means you need just as good broadband at home as you would need at a workplace. It also means you see your job very different and are not tied to a location. It also means do we necessarily need to provide the road space or parking that we have done in the past as increasingly people are car sharing more or would rather live somewhere closer to work, rather than having to drive there.

R - So in terms of everything that we have spoken about today and linking that back to the smart city how do you view the role of data in achieving those things?

9.

- Adoption of process
- New technology results in new trends
- People reacted to new environment
- New approach to life
- People interact in diff. ways
- Services respond to changes
- New technologies require new services
- Council can offer better service
- People interact differently
- expect council to act differently also
- New technology means adopt services
- New environment created
- Need to adapt to new environment
- Citizens should be included in process
- Smart city agenda focuses on outcomes for citizens
- Open data changes environment
- Not currently extracting value from data
- There is a large amount of data available
- Not utilizing this resource efficiently
- Use of new technological software systems
- Huge investment in systems
- Not making most use out of systems
- Need to diversify use to all departments for better results
- Need more communication of data
- Will result in better value + outcomes
- Using technology to provide services
- How do we support technology?
- Allow for testing of city for SC projects
- Create environment that encourages development
- Increased revenue partnerships
- more collaborations
- Local solutions not forward in international city

ours although it is not the same across the city, but it is because they can always get in touch with us. So people deal with us in a very different way. We have also scaled a lot back with regards to the one-stop-shop because people now contact us in very different ways using not just the telephone. There is email, there is online, there is being able to sort stuff out yourself whereas previously you would have to rely on other people to do that for you. Even something so basic as can you change your details with the council, you used to have to drop in somewhere and tell them whereas now you can just go online and change. We used to have an awful lot of resident groups. Why? Because people don't come together in quite the same way now. A resident group was good because you could turn up and you could have people speaking with you in person so you could find out what was going on, however, you don't need to turn up to a location to find out now you can do it online - and you can use your phone. So the situation really has changed. The local library has more people using computers than it does taking books out. This is important because the whole approach to services and what constitutes providing that service is changing so we need to be more smarter with our services. Then there is also engagement so we need to have people engaged in this whole agenda. It is not worth telling them they are involved in a smart city agenda but they need to be engaged in all of this change that is going on because we are doping it for them. The open data is a big issue, mainly because we don't get the most out of the data that we do have and that is to say there are many instances when you have got access to huge data stores were one or two people in the authority is using it for a small area of work and they don't use it all - they use only an element. Geographical Information Systems (G.I.S) are a good example. You will get huge investment in massive G.I.S systems in some authorities and the people using it in general are planning but there are more that can be used for it. Releasing that data and allowing people more access to it will help them. Some of that is through direct access and some of that is through making better use of API's. Even just helping with the data cleansing of it all. Are we using the best data here? Could we be getting it from somewhere else? And then there is the energy which is how do we provide energy for it all? An awful lot of this technology is energy intensive and how do we support that? Because a more digital city is a city that is more reliant on power, so what are we doing for that? The final thing is the city as a laboratory - we need to open up the city so that people and organisations can make better use of the city. One of the current things I am trying to push through is a memorandum of understanding between Liverpool City Council and the universities around sensor city so that sensors that are developed within sensor city are able to be used within the city

11.

- Data plays a prominent role in achieving IC vision
- There are also many important factors
- Data can only do so much
- Human(s) processes are just as important
- New ideas for IC initiatives
- Data plays supportive role, people are the architect
- The action of production tells us just as much as the data itself
- There are different levels of data
- There are political aspects to the running of the city that affects data use
- The data may contradict the political philosophy
- Challenges towards the use of data
- Data can help improve outcomes for people's lives
- More than just the data required

- What is the purpose of why you are doing it?
- Why do you want to use the data?
- Needs to be grounded in context of local area
- Need to draw into wider strategic aim
- Data also brings up new avenues to enquire
- You need the purpose for it

- Why are you collecting this data?
- Data can be very useful
- Big data is the most valuable
- Big data can reveal a lot + it therefore valuable
- Increases understanding, allows better outcomes
- There has to be a process in place to extract value

B - You can be forgiven for thinking that it drives everything. But that is to place too much emphasis on what data can do for you. Data does not create the ideas that go on, data does not decide how you will live your life. If it is all just about what the data tells you about something what a boring world we live in. There has got to be a role for serendipity. Knowledge is more important than space and that is why cities thrive. It is not necessarily the data itself but it is people coming together to create that data that really helps. So data is important as it helps tells us stuff but it is not the be all and end all. You have got the different levels of data, information, knowledge and the data can never be wrong but the other elements are much more about how and where people live and work than necessarily within the data. And there is always going to be political philosophies of how people want to run the city. It may even be that the way they want to run people's lives is way at odds with the data. The data only tells you one part of the story and you need to have room to think. Other things that begin to shape the way that we live because ultimately that is what it is about - living better lives. But the data can be really important to help support that. But there is more to it than that.

R - So I suppose then the emphasis is on the process and how you then analyse that data. At the end of the day it is people.

B - And at the end of the day, what are you doing it for? Because that is what you are going to find the data for. If you are just led by the data some things will make sense, that wouldn't in real life. For example, if your aim is to get people jobs, people from Liverpool should move to Cambridge because there are more jobs there. But really? It is never going to happen. There is so much the data cannot explain at the same time as it can explain everything. You just have to have the focus as to where or what you are aiming for or looking for.

R - The question is why you are doing it. The return on investment for whom? Is it people and their way of life or profits.

B - Yes. Data is really useful. It is really useful and helpful. I am more excited about big data than just data. At its most basic level it is the opportunity to find patterns that we didn't even know existed and relationships that we didn't know existed and then consider what we can do with them. So there is definitely something really useful in that but should you always be governed by that?

R - I think it's interesting to see the distinction between data and big data - in a good way. Obviously the bigger the data set the more accurate a picture we build.

- Big data is useful for policy
- It simplifies the picture
- Data provides the evidence base
- The council can influence your life
- But you are the one in control
- Governance provides the conditions
- Citizens decide how to use those conditions
- Big data allows councils to understand better
- More understanding results in better provision of services
- Big data for governance
- Big data provides insights
- Challenges ahead
- Systems need to be in place to extract value of data

B - From a city and policy making level it is much more interesting for me because cities are messy. They are not clean and uniform and very easy to run. And much of what happens in a city has nothing to do with the people who are governing it. Certainly not directly. If you decide to go to a restaurant tonight the council had no say in which one you should go to, but it does have a say in where that restaurant can be and what time it is open. We can't make the food nice for you, but we can make it safe. So that is entirely your experience, we can create conditions. That means at some levels individual data sets are useful but I think increasingly we are realising now that we are running things at a city level and because of all these different influences understanding big data and the issue if someone gets on bus in Bootle does it affect asthma levels in Garston. The question is who knows? I could throw up things like that because it is a question we have the opportunity these days query and I think there is a lot more excitement behind that use of big data. But there are a lot of challenges with regards to getting to that point and begin to provide that analysis.

R - I feel as though everything is there for Liverpool but it is just making that final push.

- Liverpool has potential but needs to implement
- There needs to be a vision
- Failure in part has set back the city
- Need to allow for testing of ideas before implementation
- There needs to be a purpose
- Creation of SC part is new
- Highlights importance of SC agenda
- Increased exposure due to role
- Health sector is pushing SC agenda
- Local solutions to local problems
- Need to communicate better with citizens
- Need to communicate in right way
- Need to recognise role within larger cross-system
- Collaboration of stakeholders

B - Yes and that is why some of us have come together to say we need this better focus. But we have resisted it in part because we did have an aborted smart city approach which concluded that we were going to build a big energy centre up in the North of the city. This was a poor smart city approach and that knocked Liverpool back in terms of what it is to be a smart city, and what one is. Yet you can't have a smart city unless you have smart ideas, and not every idea is a smart one. Because of that we fell behind and we did not have that focus. The mayor, however, created this post because it created some more focus on the issue. And I think increasingly now people have got that focus. Some great stuff is going on, especially in the health sector which is world class (as it had to be because we have some world class health problems) and if you want to be the best in the field go to where the big problems are and solve them. We know this and there are some great things going on but we don't necessarily communicate that well to the people in the city. Nor is it communicated in the right way. Some people who are working in the sector, however, want to run the whole process without recognising that it is much bigger than just them and we have an obligation to

13.

- Outcome should be citizen orientated
- Resources of Local Council
- Need to look at collaboration with stakeholders
- Private sector + academia
- Implementation needs to improve
- SMEs play important role in innovation
- Larger companies facilitate that innovation
- Beginning to overcome challenges
- Many SC initiatives ongoing

the citizens as well with their data. It is very difficult because there is a capacity issues and a knowledge issue within the public sector with driving this forward. We have to look outside of the local authority to the private sector, as well as academia, to deliver some of this. Larger corporations are much better at delivering a scaled response because running a city is not a small enterprise but smaller companies are better at innovation. A lot of the time the larger corporations will buy the innovation whereas SMEs are very good at innovation but not so much at scale and we need to get a balance between the two. So we have some real challenges about that but I think we are beginning to understand how this should best work. I am very hopeful and positive about the future of the city and there are lots of great things going on.

R - I agree there is certainly enough people in Liverpool to really push on with Red Ninja, the universities, sensor city.

- Technology doesn't necessarily mean smart
- Smart can be more non technology
- Local solutions to local problems
- Need to make better use of solutions in place
- Capture more data to improve understanding + provide better services

B - There are also many things that may not be deemed smart but are. For example, city bike is the smartest thing we have done. It has helped people to use the city differently and it has helped people to experience the sharing economy. It has provided connectivity that previously wasn't there and it has engaged people who would not normally be engaged. There is a challenge there for how we can make better use out of it, for example, putting trackers on it so we can figure out where to travel.

R - And all of this creates data, which creates more insight to how they are used.

- Create more data for more insight
- Allows new services
- Analysis using data
- Collection of data is important
- Planning plays role in this

B - Yes at present we do not know where they go which would allow for more services to be applied. I am really interested in that level of analysis. That is when work on individual data sets and how you collect that data is really helpful. Certainly in planning terms.

1.

Focused Coding

Liverpool City Council (political) Interview Transcript

02/08/2016

Researcher – (R)

Participant – (B)

R - Maybe if we could begin with an introduction into the projects that are helping Liverpool develop into a smart city.

Pursuit of SC projects
Funding for projects
Testing out SC projects
Partnerships for projects

B - One thing we were and still are interested in doing through the IoT bid is to create a virtual representation of the city. In an era when we have the opportunity to use big data - and big data has always existed - it is just that it has not been accessible or we haven't had the ability to query it in quite the same way as we do. So the idea was to have a virtual representation of the city which you can then test out different scenarios on and see what the relationships are between very diverse data sets. And that would make use of the facilities in the Hartree Centre over in Darsbury if that was the case as they have got the computing power (through the super computer) that we don't have anywhere else.

R - The quantitative stage of this research is to two separate data sets and see what we can take from them in terms of services to the city.

B - What are the particular data sets?

R - So we are going to use data sets from London simply because as a city they provide the most easily accessible data store. We have one health data set and one transport data set. Now the reason we took those two data sets is because they are grouped and formatted into standardised codes or locations throughout the city that then enables better interoperability.

Collaborative approach to data-sets

Local contextual analysis pre-design

B - About four maybe five years ago, perhaps even six in the ward that I represent we took a number of different data sets from transport, police, council, housing and overlay-ed them to see whether there are some issues in the ward that we could approach. So as an example we found a location where there was a high instance of elderly people with limited long terms illnesses, in the same location we also found there was a high instance of environmental crime, high instance of normal crime, high instance of needs and from that we began to question well what is the issue

local outcomes of solutions

Using data for solutions

value of data informing decisions

data provided better response

current policy ineffective

Using data for future decisions

accessibility to new technologies

around here? Now there was some specific issues but one issue that we all identified and all found had an impact was the existence of a number of dis-used garages so the plan was to knock down those garages and open up the area more. We got rid of that space where people could hide behind and also made it better for the people living there so they didn't feel they were living in a bad place. Of course overtime the housing association have upgraded the flats that were there as well and both these actions began to tackle the problem. Now on an estate next door to that which had been labelled bad for anti-social behaviour because we used the data and overlay-ed those maps and began to assess that data we began to realise that there wasn't an issue with anti-social behaviour across the estate, there was simply an issue at two separate points. And we knew the families that lived there, so we targeted the intervention and action both with and against those families and this helped improve the area for the residents. Now this only came about sorry because we were able to take the data and began to apply it on another level.

R - So the data created a lot more insight into the situation would you say?

B - Yes, well it certainly helped in that sense. If we work with the instances on the housing estates we knew there was issues on social behaviour but what it helped us do is to target our response much better. So rather than us just turning around and saying "oh, the whole estate is terrible for anti-social behaviour so therefore we need to formulate an area-wide response" using the data we were able to actually say that if we deal with these two families we will see a huge improvement in anti-social behaviour in that location. This means that it is more cost effective, but also it deals with the problem. And quite a lot of public policy that tries to intervene is not doing it quite in the right way. Myself and a colleague, we set up a company called incubator of change that tries to tackle these types of issues. This is because we believe in three things around this whole agenda (and it is not necessarily a smart city issue, but is in-keeping with the ethos of smart cities and how you use data) of future policy making and how big data impacts on that. One was that when we are making policy we very rarely look into the future and take into account future trends (and this is a challenge for how we approach smart cities in general) so the elderly person of 2030/2040 is currently walking around now with a smart phone in their hand and are more than happy to be using apps and engaging in that way and yet our approach to provision for social services and meeting the needs of them people is very much focused on the

3.

Extracting value from data

Current systems not appropriate

Using data for better understanding

Using data for better responses

"guinea pig" of cities

Technology is only part of solution

Dedicated political role for SC's

people of today and how we have historically seen its development - so we very rarely take into account future trends. Second point is that we very rarely will make use of big data to monitor and manage what we do, so what do we mean by that? Well for instance we talk about canaries in the coal mine and that is what happens, or what changes have occurred that we should have known about that may have precipitated the problem? Because we make policy as if it is going to last for ever and it doesn't. So we don't set up our systems well enough. Here is an example, if we look at Anfield - the bit opposite and around the football ground - twenty years ago it was a very vibrant community, all be it still very deprived, but it was still a vibrant community but then something happened and over time something began to change that. Now it wasn't just policy intervention but we are saying could it have been the changing of a bus route? Could it have been a shop closing down? Could it have been a family moved in or family moved out? All of those different variables. Could it have been one major crime incident that precipitated some of this? We probably haven't had the facility to monitor that in the past but we do now - so being a bit more granular in how we measure those factors and provide response. The third point is building on that when we look at implementing policy in different areas or for instance we see something great going on in Manchester and say "oh we would love to do that here" we don't spend enough time looking at the variables which go into that and actually could it have just been really successful because there was a particular person involved and you are not going to replicate that person.

R - That is one of the issues I have found is that people try to put a broad aspect on the smart city and it is actually a locally contextualised approach.

B - Well I think a better way from my point of view to describe it is that many people focus on the technology side of things and technological element, and don't focus enough on people - the organic element.

R - The citizens themselves. Now to move this on a little bit, would you like to briefly describe your role as the mayoral lead for energy and smart cities?

B - Yes, so I am the mayoral lead for energy and smart cities so it is my responsibility to drive that agenda forward. So it is probably worth explaining what a mayoral lead is and the mayor would like to lead on a number of different issues but recognises that there are

Developing a vision for the city

Enabling implementation of SC initiatives

Attracting investment for SC's

Organisation adaptation to data environment

Data environment provides challenge

Organisation not set up to facilitate development

Internal systems not set up for data enviro

only 24 hours in a day and he gets side-tracked among a number of things. So what he does is to appoint a number of councillors to lead on a number of issues and one which is energy and smart city. Perhaps because in the mayors head at one point he saw them as similar things but actually they are quite different, although they are related in some ways but are still quite different. So what do I do? Well part of it is helping better strategic vision for how the city will do that as a political role. However, some of it is just using influence to open doors and enable things to happen as well as instigate for certain things that should occur in the city. So for instance when Red Ninja (an SME in the smart cities sector) were trying to develop their approach to ambulance response they needed access to the urban traffic control systems in the city so I was able to open that door to enable the access to that data. Whether that is by simply saying yes you can do it or through liaising better between the different stakeholders, and I also have a role I suppose for going out of the city and promoting what is going on for Liverpool. This is so that Liverpool can sell itself better and this will attract others who are willing to invest in a smarter Liverpool. There is also the issue of advocating internally the need for specific changes that may be occurring and communicating this to the mayor and city and explaining it to them that that these changes are taking place in the city and that is the way technology is pushing us. Secondly, we are being pulled that way by the general public anyway in a way that previously the general public may have been reluctant to change, certainly so rapidly.

R - Do you think that is a challenge?

B - Definitely yes. Especially because a lot of people see it as that is what their job relies on. So one of my roles is to prepare for the change that we may see internally as an organisation and externally as I said is to promote the city and get engaged with different projects so we can see what is going on in terms of best practice. I don't have support officers as such so there is nobody dedicated to doing it so part of the role is to work across different boundaries to use my own personal influence on stuff effectively to represent the city. We came to the conclusion recently that it isn't particularly working well doing it in this way, we have a number of different issues that we are still falling behind with in the city. Some of that is because of the way the city is set up, while some of that is because it is not a priority for others like it should be. I personally always think that change is something that you should be constantly aware of within public services, I have worked for ten years as a sustainability manager in a local authority and we are constantly trying to push

5.

Public money holds back progress

Restructure of organisation

Collaborative approach to development

Increasing profile of the city

Devolution potential to improve SC approach

Playing to strengths of city

Lack of coordination between local areas

through different ways of doing things and in local authority terms it is agonising trying to get people to change. As I say in part it is understandable to a degree. A bigger issue is that people think this is public money and I can't take chances - this is a big hold back on local authority and government in general as people do not want to be seen to be wasting money. That means that people are very risk averse. But some of it is just personality in terms of changes. So one of the things I am looking to develop is effectively another organisation that sits outside of the council, is not a joint venture as it works separately from the council but it gets that buy in by having the link between the two through my role. So you would have business, academia and local authority as well as community. It's role then would be around helping affect that change and taking on some of the burden of what I have been doing. Now a lot of people think Liverpool has got a smart city approach mainly because I have been going out there and telling them so we do have a good name with the some of the stuff that we do, this is partly because I have just gone out there and sold Liverpool. The reality, however, is different and we have still got issues that we need to address.

R - Just to pick up on something that you mentioned there on the local authority - how do you think devolution will effect the development of Liverpool as a smart city?

B - There is positives and benefits. Most of the smart city approaches from around the world are dealing with cities that are much bigger than the 470,000 that Liverpool has so you will be looking at a city region of 1.7 million (I do not know the exact figures) which is much more of a scale. Now in one respect that makes it a lot more attractive for people coming in and trying to do things because it is at a scale where they can see the benefits that they can make from it whether that is through social change of monetary benefits and the like. The problem with that though is that Liverpool is big enough to matter and small enough to make things happen and it is at a scale, just Liverpool itself, where it is small enough to affect big change if you have people behind you but it is big enough in terms of it has everything a city needs - it has a lot of people, it has lots of different industries, it is an economic driver of an area, it has a port unlike many other cities. All of those different things it has that but then it has also got six different authorities across the city region who don't know quite how the metropolitan area governance is going to work. Some elements of the city region are more sceptical of a smart city approach or it is not even on their radar, it is not even something they would think about. One of the problems is that we are very good at bringing forward projects and saying (it could also be said

Implementing projects a challenge

Lack of overall vision for city

Lack of coordination between sectors

this is a British view) haven't we done really well on that but we poor when it comes to a whole systems approach to it. This is not a smart city thing, although the smart city in theory should help it, this is just a governance issue. We very rarely will have a big vision for an area that turns around and says this is the type of place it will be and this is why everything moves in that direction. So because we don't have that over-arching vision we don't have that health sector which is really engaged with the transport sector which in turn is really engaged with the business sector, which in turn is really engaged with the social services sector. So there is those links that exist on a project level more than they exist on any higher one.

R - If I could just pick up on that point as what you are talking about here with regards to data interoperability is something that emerged from the Merseytravel interview when we were discussing data platforms of the city. In my experience with this project I think it would have been great to perform the quantitative data collection on Liverpool, due to the fact many of the interviews are taking place in the region, but gaining access to that data was an issue.

Communicating data through platform

Lacking in system for data handling

Learning from other cities

Restructuring of organisation required

Private sector leading development

B - I was having a twitter conversation yesterday about data platforms. There are people I know who have been involved in open data movements who are adamant we do not need a data platform and I understand that. There have been discussions around having that before. One of the big problems I think is that we do not know what data we hold, and we do not have the capacity to analyse that situation or we don't have the goods to just pay somebody to do it for us. We also have an awful lot of data that we do not know what we are supposed to be doing with it, so it is people's personal data and there are lots of safeguards around that but we are overly cautious when it comes to things like that. If only we took a bit of advice on what can we do? How can we anonymise this and on what level? And then we can make use of it but we are not very good at that on a city region level. We probably need an open data officer who works across a number of different organisations. And that it comes to whose benefit are doing this for? And this comes back to something I was saying about who does it benefit? And it should always be for the individual but initially it is always going to be for the private sector who are going to benefit. Right now it is about how they can monetise it. But it doesn't mean we shouldn't do it, do not be scared of the fact people make money. So there are still some challenges.

7.

Implementing new strategy for data use

R - I thought it was interesting you mentioned earlier about data's role in future trends and policy making, with the principles of the incubator for change.

B - Yes, that is more of a policy making approach that we are trying to make separate rather than my own particular role with Liverpool City Council.

R - So you were saying you think the city region could benefit from the creation of dedicated role as an open data officer? Even myself looking for participants, in terms of Liverpool City Council, there was nowhere to go.

Organisation not adapted to environ

B - Yes well you wouldn't. You may speak to our digital team within the council but they are not necessarily the people who will be involved with smart cities. This is because the local authority is not set up to do it like that. And at this moment in time it is not even on the radar because they are so obsessed with devolution.

R - Because if we look at Manchester in terms of smart cities they are ahead.

(Competing alongside other cities)

Funding for SC projects

B - Yes they are ahead and I know Steve (Turner - the ex-head of smart cities). In part that is because they have had a huge amount of funding and have been able to trial stuff as well as now they have the IoT bid. It is worth pointing out that all the cities that turn around and say we are doing some great smart city projects have had some funding at some point whether it be through Europe or Innovate UK. They are no real further on, however, than what we would be. I completely find the rankings of top ten smart cities as not relevant nor representative to the actual situation in those cities and in comparison with others. Because if I was to turn around to someone in a deprived area of Manchester and say look how smart this city is they would still turn to me and say look at the poverty I still live in. How is that smart? You will see from my blog that a lot of that is driven by a conversation I had with a guy in a conference who is from India and he said a smart city to him was one which he could provide sanitation and clean water to the people - that is a smart city as far as they are concerned. Although in India they have the 100 smart city initiative that they are looking at which will be a lot more than water and sanitation but the point is these things matter. When you turn around and say that city is much more smart than that one, to what end? What is actually getting any better there? Are they streets ahead because of economics? Are they ahead in terms of social services? Are they streets ahead in terms of health? I would

What is the purpose of the SC approach

Linked to local contextual area

Nepal to be targeting
outcomes to
citizens

argue not really. And so a cost benefit analysis of some of this would be quite interesting. And that is because you can be driven by the technology and not driven by the people. Why are we doing this?

R - Yes. And cities do sometimes lack direction or that vision that everybody can work towards.

"Guinea Pig"
of cities

B - Yes. So London's digital future was a piece that was done by various groups in London before the last mayoral elections. Centre for London, Mayoral Tech Manifesto was the report but I'm looking at how you can do that in terms of what Liverpool needs. Some of it is lifting what they are doing. We have done the analysis now I think and we know where Liverpool is failing when it comes to the smart city agenda.

Competing with other
cities

R - Would you be able to perhaps give us a brief of what they may be? As from our research we have been looking for a smart plan or policy for Liverpool and have yet to find one. Something to show it is happening.

Assessing current state
of city

B - Yes. So it starts with what our governance is, who is doing what, and who should be doing it, as well as who isn't. The most pressing thing at the moment is the infrastructure. That is not to say we don't do anything until we are able to improve the infrastructure, but Liverpool's infrastructure is not at the standard it needs to be. So you could go into the central business district and you have terrible internet connection. It really is behind. This is partly because the government has failed. Their whole approach to improving broadband focused on this super fast broadband and it is neither super nor fast and the cost to put this in is the same as to put something really good in. We are just not there right now. It will cost a massive amount and the return will not be what we are happy with in terms of the investment. This goes back to what I mentioned before, when you are developing that policy where is your future trends analysis? With that there is no excuse with regards to broadband speeds. The UK should have been able to know what the trends were - a brief understanding of Moore's Law would have been enough. Technological change for instance is a great example. So we should have been able to see that. So there is a need for us to look at the push and pull factor between technology and users. And people want to see things change so they demand things differently. I use the example of when I became a councillor in 2008 we provided the advice surgeries for people - a couple of different advice surgeries a month in each ward that people can come along to, drop in to get advice and support. Less and less people now drop in, certainly in

Challenges of local
context of city

Using data for policy
development

Smart cities market
economy

9.

New technologies changing
current system

Organisation services
adapting to new
enviro.

Engaging with
communities

Sharing data for
more benefits

Introducing new
technologies

Handling of
data

Using city as
a test-bed

Collaborative approach

ours although it is not the same across the city, but it is because they can always get in touch with us. So people deal with us in a very different way. We have also scaled a lot back with regards to the one-stop-shop because people now contact us in very different ways using not just the telephone. There is email, there is online, there is being able to sort stuff out yourself whereas previously you would have to rely on other people to do that for you. Even something so basic as can you change your details with the council, you used to have to drop in somewhere and tell them whereas now you can just go online and change. We used to have an awful lot of resident groups. Why? Because people don't come together in quite the same way now. A resident group was good because you could turn up and you could have people speaking with you in person so you could find out what was going on, however, you don't need to turn up to a location to find out now you can do it online - and you can use your phone. So the situation really has changed. The local library has more people using computers than it does taking books out. This is important because the whole approach to services and what constitutes providing that service is changing so we need to be more smarter with our services. Then there is also engagement so we need to have people engaged in this whole agenda. It is not worth telling them they are involved in a smart city agenda but they need to be engaged in all of this change that is going on because we are doing it for them. The open data is a big issue, mainly because we don't get the most out of the data that we do have and that is to say there are many instances when you have got access to huge data stores where one or two people in the authority is using it for a small area of work and they don't use it all - they use only an element. Geographical Information Systems (G.I.S) are a good example. You will get huge investment in massive G.I.S systems in some authorities and the people using it in general are planning but there are more that can be used for it. Releasing that data and allowing people more access to it will help them. Some of that is through direct access and some of that is through making better use of API's. Even just helping with the data cleansing of it all. Are we using the best data here? Could we be getting it from somewhere else? And then there is the energy which is how do we provide energy for it all? An awful lot of this technology is energy intensive and how do we support that? Because a more digital city is a city that is more reliant on power, so what are we doing for that? The final thing is the city as a laboratory - we need to open up the city so that people and organisations can make better use of the city. One of the current things I am trying to push through is a memorandum of understanding between Liverpool City Council and the universities around sensor city so that sensors that are developed within sensor city are able to be used within the city

Developing a SC Strategy

"Guinea Pig"

Planning's role in digital age

itself and within our services, or the infrastructure of the city. So they are the kind of seven different areas that we would look at around the smart city agenda, it is just not specifically written down and there are still gaps. So looking at London's digital future and Liverpool's there are still gaps around that in understanding how we support innovation, understanding how digitally inclusive we are, understanding security issues, understanding that planning is not consistent everywhere and that is planning for the infrastructure as well as planning for use and that is another issue that at a city region level becomes a big question and there is going to be a responsibility by the mayor for that strategic planning. And strategic planning before this has really failed to take into account the digital world. It is more than just about where do I put this building?

R - Even from my time at the council in the planning department compared to the work I am doing now I feel there is a massive gap between where it is now and where they need to be.

Existing situation is a challenge

Planning's role in new digital age

B - Yes. I have been through a local plan process and it is really difficult getting policies through. The Unitary Development Plan is still quite analogue in what it is talking about. The delivery of a service these days used to be reliant on a building so you would have to have a building for dealing with your housing issues whereas you do not need that as much now or you certainly take up a smaller footprint. The same goes for planning our cities and where do you put the retail? Well now retail has changed and more and more people are buying online. More and more people buy online and see the shops as somewhere you go to view a product before buying it online. That throws up questions for ourselves and the use of areas change especially for planning. That is what the future trends deals with and there is also the element in terms of smart city about the way people will live. So we have people who are much more inclined, certainly with younger generations, towards the sharing economy so jobs are something you do as a freelancer much more, there is huge growth in free lancing. So that means you need just as good broadband at home as you would need at a workplace. It also means you see your job very different and are not tied to a location. It also means do we necessarily need to provide the road space or parking that we have done in the past as increasingly people are car sharing more or would rather live somewhere closer to work, rather than having to drive there.

Adopting services to new environment

Shaping peoples behaviours

R - So in terms of everything that we have spoken about today and linking that back to the smart city how do you view the role of data in achieving those things?

11.

Larger process behind
extracting value of
data

Producing the data
through behaviour

"House of Cards"

Using data to improve
lives

Creating a purpose for
actions

Focusing your job/ideas
on outcomes

Using data for decisions

B - You can be forgiven for thinking that it drives everything. But that is to place too much emphasis on what data can do for you. Data does not create the ideas that go on, data does not decide how you will live your life. If it is all just about what the data tells you about something what a boring world we live in. There has got to be a role for serendipity. Knowledge is more important than space and that is why cities thrive. It is not necessarily the data itself but it is people coming together to create that data that really helps. So data is important as it helps tells us stuff but it is not the be all and end all. You have got the different levels of data, information, knowledge and the data can never be wrong but the other elements are much more about how and where people live and work than necessarily within the data. And there is always going to be political philosophies of how people want to run the city. It may even be that the way they want to run people's lives is way at odds with the data. The data only tells you one part of the story and you need to have room to think. Other things that begin to shape the way that we live because ultimately that is what it is about - living better lives. But the data can be really important to help support that. But there is more to it than that.

R - So I suppose then the emphasis is on the process and how you then analyse that data. At the end of the day it is people.

B - And at the end of the day, what are you doing it for? Because that is what you are going to find the data for. If you are just led by the data some things will make sense, that wouldn't in real life. For example, if your aim is to get people jobs, people from Liverpool should move to Cambridge because there are more jobs there. But really? It is never going to happen. There is so much the data cannot explain at the same time as it can explain everything. You just have to have the focus as to where or what you are aiming for or looking for.

R - The question is why you are doing it. The return on investment for whom? Is it people and their way of life or profits.

B - Yes. Data is really useful. It is really useful and helpful. I am more excited about big data than just data. At its most basic level it is the opportunity to find patterns that we didn't even know existed and relationships that we didn't know existed and then consider what we can do with them. So there is definitely something really useful in that but should you always be governed by that?

Potential of big data

Citizens produce data through actions

Using data for more understanding

Systems required to extract data value

City requiring more focus to aims

Lacking in focus hinders development

Communicating with citizens

R - I think it's interesting to see the distinction between data and big data - in a good way. Obviously the bigger the data set the more accurate a picture we build.

B - From a city and policy making level it is much more interesting for me because cities are messy. They are not clean and uniform and very easy to run. And much of what happens in a city has nothing to do with the people who are governing it. Certainly not directly. If you decide to go to a restaurant tonight the council had no say in which one you should go to, but it does have a say in where that restaurant can be and what time it is open. We can't make the food nice for you, but we can make it safe. So that is entirely your experience, we can create conditions. That means at some levels individual data sets are useful but I think increasingly we are realising now that we are running things at a city level and because of all these different influences understanding big data and the issue if someone gets on bus in Bootle does it affect asthma levels in Garston. The question is who knows? I could throw up things like that because it is a question we have the opportunity to these days query and I think there is a lot more excitement behind that use of big data. But there are a lot of challenges with regards to getting to that point and begin to provide that analysis.

R - I feel as though everything is there for Liverpool but it is just making that final push.

B - Yes and that is why some of us have come together to say we need this better focus. But we have resisted it in part because we did have an aborted smart city approach which concluded that we were going to build a big energy centre up in the North of the city. This was a poor smart city approach and that knocked Liverpool back in terms of what it is to be a smart city, and what one is. Yet you can't have a smart city unless you have smart ideas, and not every idea is a smart one. Because of that we fell behind and we did not have that focus. The mayor, however, created this post because it created some more focus on the issue. And I think increasingly now people have got that focus. Some great stuff is going on, especially in the health sector which is world class (as it had to be because we have some world class health problems) and if you want to be the best in the field go to where the big problems are and solve them. We know this and there are some great things going on but we don't necessarily communicate that well to the people in the city. Nor is it communicated in the right way. Some people who are working in the sector, however, want to run the whole process without recognising that it is much bigger than just them and we have an obligation to

13.

Responsibility of PS in handling data

Building partnerships for collaborative approach

Private sector SC market

Building on current SC initiatives

Introducing new technology

Introducing new services
Analysing data

the citizens as well with their data. It is very difficult because there is a capacity issues and a knowledge issue within the public sector with driving this forward. We have to look outside of the local authority to the private sector, as well as academia, to deliver some of this. Larger corporations are much better at delivering a scaled response because running a city is not a small enterprise but smaller companies are better at innovation. A lot of the time the larger corporations will buy the innovation whereas SMEs are very good at innovation but not so much at scale and we need to get a balance between the two. So we have some real challenges about that but I think we are beginning to understand how this should best work. I am very hopeful and positive about the future of the city and there are lots of great things going on.

R - I agree there is certainly enough people in Liverpool to really push on with Red Ninja, the universities, sensor city.

B - There are also many things that may not be deemed smart but are. For example, city bike is the smartest thing we have done. It has helped people to use the city differently and it has helped people to experience the sharing economy. It has provided connectivity that previously wasn't there and it has engaged people who would not normally be engaged. There is a challenge there for how we can make better use out of it, for example, putting trackers on it so we can figure out where to travel.

R - And all of this creates data, which creates more insight to how they are used.

B - Yes at present we do not know where they go which would allow for more services to be applied. I am really interested in that level of analysis. That is when work on individual data sets and how you collect that data is really helpful. Certainly in planning terms.

X.ii.iii Interview (C) Initial and Focused coding

1.

Initial Coding

Data Consultancy Performance (private) Interview Transcript

04/08/2016

Researcher – (R)

Participant – (C)

R - So if we could begin with a background as to what it is you do here at Data Consultancy Performance and how you work with data and the development of the smart city.

- Private solution to public sector through SC
- Local authority collaborate with sectors
- Public sector needs more collaboration
- Issue of interoperability
- SC agenda come later in process
- Working with larger corporations
- IBM facilitator to SME's
- Strategic vision for development
- Data used to incorporate in solutions
- Development of SC model
- Data integral to design of model.

C - So I've been working in the field now for six years looking at how the public sector works, the public sector procurement strategy and development in the technology space. Now a lot of this work is around developing a system of how the local authorities and the NHS work together. This is because the way the public sector is is that it works in isolation a lot of the time. So there is no interoperability model. Now the concept of smart cities didn't start to come into this area until 2011/2012 and I had been speaking with the likes of IBM around what I was trying to do and that is when they introduced the smart city space. What this did was to form a road map as to what I was trying to achieve. Essentially this was to create a more coordinated and data driven outcome framework. So I carried on this work developing a design specification for a smart city model and a smart city platform where data would go into the model and be analysed.

R - So was it the data that led you into the smart cities sector?

- Application of engineering applied in SC's - Collaborative environment
- Issue with use of data in public sector
- Organisation not adapted to environment
- Frequency of turn around for data an issue
- Could not locate required data, lack of system in place
- No process in place
- Resulted in bad service

C - Well I'm actually an electrical engineer by trade but if we go back a couple of years I had my own company and worked with the public sector a lot and this brought about a number of issues with regards to the way data was used in the public sector. I found the organisation inept as an instance. As an example, there was an accident on a site and both myself and the hospital received a letter from lawyers representing the claimant. Now from the day of that letter to the matter being resolved there was a period of 14 months and that was because the data was everywhere. Not from us as a company but the issue was that we could not prove there wasn't an accident, but more importantly when the hospital was looking for their data it was located in another department or another department. When the investigators were coming out and taking statements they were asking for other types of information and data. What this did was lead me to think surely there is a process in

- Needed a strategy to process data
- Where is governance model?
- No model in place for data in public sector
- Cost to public sector as a result of lack of system
- Not an isolated problem to health sector
- Lack of data integration across all public sector departments
- This resulted in a cost to the public sector
- Not isolated to one geographic area
- New process for data in public sector
- Propose new approach to public sector
 - Provision of services delivery
 - Lack of departmental communication
 - Outsourcing of work to private sector
 - More costs to public sector
 - New communication platform for data in public sector

the public sector for when these things happen. So what is the next action plan? What is the governance around it? And what we found was that there was nothing. And eventually the person got paid out as the hospital did not have enough evidence to support that there wasn't an accident. Now we as a company had all of our records and we could prove that the likelihood of it happening may have been there but because there was no logging system with regards to the hospital and it's lifts nothing could be proved. And when I looked into this I found that this was going on right across the country - people were making small claims and the public sector was paying out so much. So everything I've been doing in terms of smart cities is around the development of policy which is underpinned by process and the process is underpinned by data. So you create the agent, site, asset, the person, i.d. - if you can get that right and then develop a framework that can be replicated everywhere else what you are doing is making a standardised approach to delivery. The way the public sector works right now is that it just does not happen because each individual authority whether it be police, ambulance, environment all have their own systems and own way of doing things which means there is no system of way to communicate across boundaries. That is unless you start to pay more consultancy fees for people to start making that integration. So what I set out to do is build a platform that can handle that information layer to develop that and pull the information in for the public sectors presentation.

R - It is interesting you mention the public sector and as one of the reasons I am doing this research is because I used to work in the planning department of the public sector and as you say the ability of the council to adapt to the increasingly data driven environment is simply not there.

- Gap between public sector and new data-driven environment
- Interoperability an issue for LCC
- Results in wasted time + money for public sector
- Quality of data is poor
- Need to provide local solution to local problem
- Take into account contextual conditions
- Linking cities in data
- New services
 - new outcomes
- Adaptation to environment

C - Yes I agree and it is massively behind. Right now we are working with Liverpool City Council and there is no interoperability across planning, health and care etc. they work off excel spreadsheets. When working on reports people waste many hours looking for data and once they get that data it is often poor in quality. So from my perspective we are now in a position where we needed a city to come online because you cannot build this platform with your own perception. You have to understand what the intricacies are within each individual department. So I am working with Blackburn and Darwin to create a case study for this model and effectively we have a demographic of 190,000 all together and are looking at how we can link each of the cities in terms of data, services and outcomes. Because again the model we have developed is based around social

3.

- Outcomes for citizens
- SC agenda too much technology
- Large corporations leading sector
- Cities are not adopted
- Have to adopt cities
- Increased regulation of air quality environment
- What is the purpose of why you do it?
- This has effect on other area e.g. health
- Create a localized plan to provide solution to challenge
- Solution linked to alternative sector/area
- Collection of data to inform decision
- Options to respond from many areas
- Risk of technology to respond to challenge
- Is the technology already in place?
- Is it at a level capable enough to provide detailed insight?
- Extra cost to public sector
- Need social outcomes for people
- There needs to be a purpose

- Have to have a purpose
- How can impact be measured?
- What is the purpose?
- What is the return on investment of the SC initiative?
- Are there alternative business models?

- Issue of who owns the data
- Current model is commercial ownership
- Who gets to provide the service?
- Who then owns it + the data?

value and social outcomes. Smart cities of today is all about technology and it is driven by the large technology companies who want to get a foothold in the market. Smart cities is a buzzword but when you turn it around cities are not smart. Technology is smart but cities are not so we have to turn that around. We have to make cities smart before we buy smart technology. I will give you another example, companies will go around and say you need to measure the air quality across a city. Why? Because Liverpool and Manchester have been designated the two worst polluted areas in the UK. Well how and why would I do that? Well it has been proven that air quality has a number of effects on things like health. So by measuring it you can get a baseline or outcome as to where you are today compared to where you want to be tomorrow and you can then develop a policy that outlines how you plan to reduce air pollution throughout the city. And that could be by transport measures, it could be from renewable technology, or it could be from any range of impacts such as biking schemes. Now a technology company may come and say we will put 1000 sensors around the city at a cost of X and the politicians will go that is great. But what they do not realise is that the sensors are already available in the city because you can measure air quality through CCTV. Now they don't necessarily know that, they don't know about that type of research. So public money is then spent on something that is not required or needed. The model we have developed is around social outcomes, firstly how do we save money for the public sector and secondly how can we prevent what I call visions of vanity where a project is implemented without a real need for it.

R - Almost asking the question before investment is made about is there really a need for this and what impact will it have.

C - Exactly. And the model we are developing looks at how we can measure impact and if a city-wide WiFi mesh is proposed who is going to do it? Why are they going to do it? What commercial gain will the city get from it, for example, is there simply a capital cost and no benefit? Or actually can we use the existing assets to commercialise that and lease out its use.

R - I suppose there is also the issue of who owns that data almost as well.

C - Yes so we propose that the city owns the data. Nobody else. because if you look at the current model for the UK it is British Telecoms (BT) that want to own the city infrastructure as a service, including owning the WiFi systems among other things, and then

- Many layers to service provision
- Collection, analyse data
- Ownership of data
- Distribution of data
- Platform acts to distribute data
- Use of data to inform decisions
- Communication of data facilitates this
- Need to be prepared for outcome of initiative, creates more data and new problems
- Need to think of future when developing solution
- Costs and effect
- Cost of decision to future services via public sector
- What is return on investment?

own data sensors as well as the platform as a service where all the analytics is carried out and finally the software as a service. That would mean they own all the data and what that means is they will own the city. They will hold the data and distribute as they please. So by owning the platform as a service we deliver the information straight to the client which is neither good or bad information - just data. A neutral layer that allows the city to make more informed decisions based on data. This is because if you put a scheme in across a city and you don't develop the road infrastructure it may provide a clear outcome but you may not necessarily be ready for that outcome. For example, more bikes on the road and not a good enough standard to facilitate that means that your creating the danger of possibly more accidents. By causing more accidents there are more costs to the NHS, as well as the costs of the bikes themselves, maintenance, theft etc. all of these things that very rarely get factored in at the sales stage. And then you look at the whole life cost of that and the benefit compared to the actual initial cost.

R - It is interesting you mention that because one of the issues we have picked up on during this research is the issue of showing a return on investment for many of the smart city initiatives out there, or which are at least proposed, and the effect this may be having on the development of smart cities.

- Try to provide return on investment
- Outcome for social reasons
- Need to understand outcomes in local context
- Aim outcomes + produce KPIs
- Data collection then fits KPIs
- Improves the process via strategy
- Need better communication in public sector
- Duplication of data
- More efficient process required

C - The approach we have taken to that is to develop a piece of software that provides a social return on investment. We have worked with Liverpool City Council to develop their social value policy and framework. By understanding what the outcomes are i.e. we want to create more jobs here in Liverpool, or reduce air pollution levels here in Liverpool. Once you have those KPIs you can then source the data. And you can do it in a much more efficient way. However, if it was given to planning as is currently the case they will purchase a piece of software that another department in the council may already have. So they are paying for it twice when they could get the data elsewhere. We are aggregating the data in order to present more efficient information.

R - If I could just pick up on the social value aspect you mentioned there.

- Outcome is socially orientated
- Outcomes linked to city
- Local solutions to local problems

C - Everything that we do is with the aim of a special purpose vehicle. The special purpose vehicle will procure the smart element to the city. It will look at what the outcomes are required in terms of the vision of the city. The special purpose vehicle will go away and set

5.

- Roadmap to provide solutions
 - Social outcome to investment
 - Reduce costs for public sector
 - Allows investment elsewhere
 - Social outcome offsets initial cost to implement
 - Outcomes targeted based on local contextual conditions
-
- How can interoperability of sectors be achieved?
 - How can data be shared?
 - Return on investment off-set to other areas in economy
 - Local solutions for local problems
 - Technology allows for increased personalisation of solution
 - Data required to provide personalised solutions
 - Role of technology in capturing data
 - Using technology to provide data for smart solutions
-
- Not just technology
 - Also processes behind that
 - Technology increasing access to services in city
 - Improving services to reduce demand in other areas e.g. health

out how to procure that. Always in mind is that there is a social return on investment from it. You need to return a process at a local authority level for them to save money. This then allows for the investment to go away and build the infrastructure levels required for that city. Efficiency will allow the city to pay that back. If you do not create efficient social return you will not be able to pay that city back creating a negative equity. The platform enables a detailed review of how those outcomes can be met. The Blackburn situation at the moment, one of their outcomes is to try and get people more healthy. Now one of the ideas is to tackle obesity through a demonstrator model of how local authority care and primary care at a hospital level interact. The question is how do we create the interoperability between the two in terms of efficiency of data. That is fine in one element but we also have to understand what the cost is to the NHS for people with obesity and what are the further outcomes from it, and why you would invest in this to create a resolution. One pathway is that you have a policy that says we want to reduce obesity across the region and these are processes and pathways. One pathway we are looking into is the creation of a single specific dietary plan for an individual that is enabled by a personalised application. The application however uses scientific data that goes a step beyond the current dietary regulations. Sensor technology for example will have a role to play and this can act as a checking process to make sure they are doing simplistic things. These are an example of how you use smart technology to then be smart at a city wide level creating social return on investment.

R - There is more than just the technology then is what you are saying.

C - There is lots more. For example if a city introduces a leisure plan, and each individual gets a leisure card with free access to gyms and bikes they can then start to use the city. It is trying to incentivise people to start looking after themselves. The impact of that is the burden on the NHS is reduced, the burden on adult care and services is reduced and that frees up budget to use in other areas.

R - If I could just pick up on something you spoke out which is the interoperability of data. To give some insight to what we are doing in the quantitative phase of the research we are taking two data sets - health and transport - to work off a framework for providing services back to the city from the network effects that are created through taking these two data sets and working with them to provide a solution.

- Data analysis is important for SC realisation
- How do we use the data?
- How do we make sense + extract value from data?
- Data analysis to create insight
- Privacy/Security issue of data
- Communication in open source data
- Need to become as well informed on situation as possible to provide response
- Local contextual conditions play a role in outcomes
- Try to create personalised solutions
- Be aware of cause-effect relationship of solutions

C - Yes so data science is going to be one of the biggest industries over the next ten years. How we use data such as ONS data, using transport data etc. There are ways now in which we can plug them in through APIs. Being able to plug those data sets in and use Hypercat protocols to catalogue that data and then reference that data into an analytics engine is what we do. Creating a security layer around that is also important, as well as making open source data. Now I think the reality and worry may be that we have to look at as many inputs as we possibly can to get a clear idea as to what the issue is. Working with your example, if you are looking at loneliness, you cannot just look at transport. You also have to look at alcoholism, divorce rates. What are the reasons for somebody to feel lonely? And that comes back to the people consortia. We are a very diverse variable and we are not the same. To create assumptions around a percentage would be very dangerous. If you make an assumption for people feeling lonely because of XYZ then the people feeling lonely for something else will feel isolated. So then you create a secondary problem.

R - So the key is to be as well informed as possible with as many variables as possible.

- Increase evidence base to be well informed
- Gather as much data as possible
- Data analysis in role for providing services/outcomes
- Role of technology in increasing interaction
- Technology facilitating supply of a service
- Need to understand local contextual condition to provide response

C - Yes and going back to the work we are doing we are trying to plug in as much data as we possibly can to the model in order to look at the inputs. There is also a need then to talk to people and see why it is we are seeing what we are. Data science then becomes even more important because you can start to build algorithms around that and developing for example artificial intelligence. You can start to build apps whereby people who are identified as being depressed or lonely could actually be given an application as a service. That is giving feedback and by giving feedback you are working towards resolving some of the variables that are issues. You need to understand the variables that are relevant and that are not relevant in order for the analytics to be successful.

R - So your model takes all these data sets and with the benefit at the end of returning some sort of benefit for citizens.

- Social value return as outcome
- Citizens at heart of outcomes
- Based on social return
- Not technology for sake of it
- Improving peoples lives

C - Absolutely yes. Because again if you look at the definition of smart cities, citizen centric is what it is. It is about people and not about selling technology, it is about making life better for people. and making your city smart so that the lives of the people within that city is much better and improved.

7.

- Use of data to inform future policy
- Policy is outcome orientated
- Data used to influence outcomes
- Processes fill the gap to get to outcome
- Cities can learn from processes of other cities
- City collaboration + network
- Local outcomes, share processes

- Match up local contextual conditions
- Timing issue of data
- Forecasting future environmental impact
- Allows for more prepared response
- Using data for future planning

- How does the city fit into the wider ecosystem?
- Too much technology push
- Not directed funding
- Political aspect of SC's
- Cause-effect of SC implementation
- Need to future-proof development
- Lack of local contextual insight

R - Could you speak a little bit more about the role data has to play in the development of future policy? From the research we are undertaking we have developed a framework that consists of three principles being accountability, efficiency, and innovation.

C - We work with a process classification framework. This means you develop a policy and then you develop the processes underneath those policies that include people and potential outcomes that feed into the main outcome. As I say you do not look for example at obesity on one level but you look at all of the different pathways but each time there is data and governance coming into it. There is a cost to all of this. Each one of those processes are referenced and underpinned by the main policy. Once that framework has been made you can replicate that to any city in the world. It provides a standard from which other cities can learn about each individual process. It may be that there is a better way of doing something and another city is doing it that way. It is working towards connecting cities up by being smart and with better outcomes.

R - So it is not just internal communication within the city but external as cities can learn from one another.

C - Exactly. If you think about global warming by connecting for example Liverpool and Bilbao, or any other port area, by looking at a demographic and one average temperature is ten degrees more the other. A global warming takes place the culture to live and work in hot conditions is different to the other. But in ten years time if that situation is reversed what you can do is look at the lessons of the one to teach the other. The processes that are in cities that have encountered this can start to impact upon where you are today.

R - That is a good point you make with regards to learning from other cities.

C - You have to think about what the bigger game is. What is the holistic perception of all this? You cannot make just one city smart. All smart cities now do it for themselves and they are not learning as such. Funding and an increase in technology has resulted in kudos. A lot of that is because of politicians. Sometimes the introduction of a smart city programme can create another social problem. An example is the introduction of the WiFi mesh in New York. Although it was a great idea that improved connectivity for a lot of people what was happening is that homeless people began to sit all day at the beacons - congregating around the kiosks. The problem was not with them being there but using the network to download large

- What is the effect of implementation of SC project?

television shows which reduced the speed across the whole network because it did not have the capacity. So you have got to think about a lot more than just the project you are pursuing. Each input has separate outcomes.

R - Yes the cause and effect relationships of smart city initiatives.

- Can we learn from other cities?

C - Yes so if we were to do that in Liverpool, I would ask the question would I do it in that way? The answer is that I most probably wouldn't.

R - There is also the case I suppose of fitting in with the planning regulations. Do you have any experience of how receptive the council are to the introduction of technology into built environment projects?

- The role of planning sector in facilitating SC development

- Competitive nature of SC's funding

- Using SC's as case studies to learn for future development

- Implementation of technology to capture data

- Lack of local contextual insight

- Future maintenance of SC initiative

- Holistic approach to SC development

- Collaborative ethos of cities

- Funding for local issues to provide local responses

- Political aspect of sharing data

- Clash between political philosophy + data sharing

C - You have just touched on a very good point. The smart city catapults that you see around the country at the moment - Bristol which is quite a way ahead of everybody else because it has been funded - are coming up with the case studies. However, if Liverpool was to introduce a similar scheme it would go out to procurement so it means the companies with the expertise and experience do not necessarily get the opportunity. The bid would have to go out for tender because of EU procurement law. Future cities did a study in Hyde park for air pollution, a lot of money was spent and the result was that 10% of sensors were destroyed by squirrels and 10% destroyed by vandals. Now if you were to put that across a city-wide area you would lose 20% of your access as well as 20% of public money gone into the project. Again this is why you have to think about what you do before actually doing them. It is about taking a holistic approach and that is where cities can learn from one another. For example they can say, do not do that we have tried that and it didn't work. or these are the lessons we have learnt and introduce these safe guards. Because what this does then is allow for different cities to pursue different specific areas that increases the knowledge for all. Is there really a need for two cities to both obtain funding for the same project? Why not come up with two different projects. It is also worth remembering with regards to data that some people may not want to release data because it goes against what they are saying or have worked towards for many years. They may have systems in place that are not efficient enough but they do not want to get rid of them. So these are things that the social science element will have to work with.

9.

- Best showing if data is bad
- Politics can hold up IC development
- Need to create more value in data produced
- Need to categorise data for specific use
- How is the data communicated?
- Need to adapt to new environment

R - To bring the interview to a conclusion if I could just pick up on something you mentioned with regards to data and how it can sometimes be held back if it does not fit in with the 'status quo'?. Do you think that type of issue has a negative effect on the development of smart cities?

C - Absolutely. And I think that the public sector should be doing a lot more with the data we are producing. There is a call at the moment to make all data open. Is that a step too far? I personally do not think so but others might. The question is what is personal data? What is sensitive? But if you can control how and what data is released then you can work through those issues to get to the real rich data that can make a difference. But again the governance of the cities at the moment do not want to do that because they want to work within the way the system currently is.

R - This is again coming back to the accountability of the public sector and the services they offer.

1.

Focused Coding

Data Consultancy Performance (private) Interview Transcript

04/08/2016

Researcher – (R)

Participant – (C)

R - So if we could begin with a background as to what it is you do here at Data Consultancy Performance and how you work with data and the development of the smart city.

Private sector supplying public sector

C - So I've been working in the field now for six years looking at how the public sector works, the public sector procurement strategy and development in the technology space. Now a lot of this work is around developing a system of how the local authorities and the NHS work together. This is because the way the public sector is is that it works in isolation a lot of the time. So there is no interoperability model. Now the concept of smart cities didn't start to come into this area until 2011/2012 and I had been speaking with the likes of IBM around what I was trying to do and that is when they introduced the smart city space. What this did was to form a road map as to what I was trying to achieve. Essentially this was to create a more coordinated and data driven outcome framework. So I carried on this work developing a design specification for a smart city model and a smart city platform where data would go into the model and be analysed.

Larger companies facilitating development of SME's

Data integrated business model

R - So was it the data that led you into the smart cities sector?

Issues with handling data

C - Well I'm actually an electrical engineer by trade but if we go back a couple of years I had my own company and worked with the public sector a lot and this brought about a number of issues with regards to the way data was used in the public sector. I found the organisation inept as an instance. As an example, there was an accident on a site and both myself and the hospital received a letter from lawyers representing the claimant. Now from the day of that letter to the matter being resolved there was a period of 14 months and that was because the data was everywhere. Not from us as a company but the issue was that we could not prove there wasn't an accident, but more importantly when the hospital was looking for their data it was located in another department or another department. When the investigators were coming out and taking statements they were asking for other types of information and data. What this did was lead me to think surely there is a process in

Using data to inform decisions

Lack of system for new environment

Using data to create new solutions

Lack of integration of sectors in PS

Handling of data for contributing use

Organisation not adapted to new environment

Quality issues of data

Private sector supplying services to public sector

the public sector for when these things happen. So what is the next action plan? What is the governance around it? And what we found was that there was nothing. And eventually the person got paid out as the hospital did not have enough evidence to support that there wasn't an accident. Now we as a company had all of our records and we could prove that the likelihood of it happening may have been there but because there was no logging system with regards to the hospital and it's lifts nothing could be proved. And when I looked into this I found that this was going on right across the country - people were making small claims and the public sector was paying out so much. So everything I've been doing in terms of smart cities is around the development of policy which is underpinned by process and the process is underpinned by data. So you create the agent, site, asset, the person, i.d. - if you can get that right and then develop a framework that can be replicated everywhere else what you are doing is making a standardised approach to delivery. The way the public sector works right now is that it just does not happen because each individual authority whether it be police, ambulance, environment all have their own systems and own way of doing things which means there is no system of way to communicate across boundaries. That is unless you start to pay more consultancy fees for people to start making that integration. So what I set out to do is build a platform that can handle that information layer to develop that and pull the information in for the public sectors presentation.

R - It is interesting you mention the public sector and as one of the reasons I am doing this research is because I used to work in the planning department of the public sector and as you say the ability of the council to adapt to the increasingly data driven environment is simply not there.

C - Yes I agree and it is massively behind. Right now we are working with Liverpool City Council and there is no interoperability across planning, health and care etc. they work off excel spreadsheets. When working on reports people waste many hours looking for data and once they get that data it is often poor in quality. So from my perspective we are now in a position where we needed a city to come online because you cannot build this platform with your own perception. You have to understand what the intricacies are within each individual department. So I am working with Blackburn and Darwin to create a case study for this model and effectively we have a demographic of 190,000 all together and are looking at how we can link each of the cities in terms of data, services and outcomes. Because again the model we have developed is based around social

3.

Smart cities focus is
technology-driven

Localisation of challenges

Introducing technology
to gather data

Assessing need for new
technologies

Targetting solutions
to specific outcomes

Assessing impact of
SC projects

Adapting business models to
new environment

Defining who owns the
data

value and social outcomes. Smart cities of today is all about technology and it is driven by the large technology companies who want to get a foothold in the market. Smart cities is a buzzword but when you turn it around cities are not smart. Technology is smart but cities are not so we have to turn that around. We have to make cities smart before we buy smart technology. I will give you another example, companies will go around and say you need to measure the air quality across a city. Why? Because Liverpool and Manchester have been designated the two worst polluted areas in the UK. Well how and why would do I do that? Well it has been proven that air quality has a number of effects on things like health. So by measuring it you can get a baseline or outcome as to where you are today compared to where you want to be tomorrow and you can then develop a policy that outlines how you plan to reduce air pollution throughout the city. And that could be by transport measures, it could be from renewable technology, or it could be from any range of impacts such as biking schemes. Now a technology company may come and say we will put 1000 sensors around the city at a cost of X and the politicians will go that is great. But what they do not realise is that the sensors are already available in the city because you can measure air quality through CCTV. Now they don't necessarily know that, they don't know about that type of research. So public money is then spent on something that is not required or needed. The model we have developed is around social outcomes, firstly how do we save money for the public sector and secondly how can we prevent what I call visions of vanity where a project is implemented without a real need for it.

R - Almost asking the question before investment is made about is there really a need for this and what impact will it have.

C - Exactly. And the model we are developing looks at how we can measure impact and if a city-wide WiFi mesh is proposed who is going to do it? Why are they going to do it? What commercial gain will the city get from it, for example, is there simply a capital cost and no benefit? Or actually can we use the existing assets to commercialise that and lease out its use.

R - I suppose there is also the issue of who owns that data almost as well.

C - Yes so we propose that the city owns the data. Nobody else. because if you look at the current model for the UK it is British Telecoms (BT) that want to own the city infrastructure as a service, including owning the WiFi systems among other things, and then

Existing model controlled
to big businesses

Sharing of data
issues

Using data for
future decisions

How is implementing
project affecting city

Showing a return on
investment

Social outcome approach
to project value

Directing outcomes for
solutions

Using data for efficiency

Defining outcomes
pre-design stage

own data sensors as well as the platform as a service where all the analytics is carried out and finally the software as a service. That would mean they own all the data and what that means is they will own the city. They will hold the data and distribute as they please. So by owning the platform as a service we deliver the information straight to the client which is neither good or bad information - just data. A neutral layer that allows the city to make more informed decisions based on data. This is because if you put a scheme in across a city and you don't develop the road infrastructure it may provide a clear outcome but you may not necessarily be ready for that outcome. For example, more bikes on the road and not a good enough standard to facilitate that means that your creating the danger of possibly more accidents. By causing more accidents there are more costs to the NHS, as well as the costs of the bikes themselves, maintenance, theft etc. all of these things that very rarely get factored in at the sales stage. And then you look at the whole life cost of that and the benefit compared to the actual initial cost.

R - It is interesting you mention that because one of the issues we have picked up on during this research is the issue of showing a return on investment for many of the smart city initiatives out there, or which are at least proposed, and the effect this may be having on the development of smart cities.

C - The approach we have taken to that is to develop a piece of software that provides a social return on investment. We have worked with Liverpool City Council to develop their social value policy and framework. By understanding what the outcomes are i.e. we want to create more jobs here in Liverpool, or reduce air pollution levels here in Liverpool. Once you have those KPIs you can then source the data. And you can do it in a much more efficient way. However, if it was given to planning as is currently the case they will purchase a piece of software that another department in the council may already have. So they are paying for it twice when they could get the data elsewhere. We are aggregating the data in order to present more efficient information.

R - If I could just pick up on the social value aspect you mentioned there.

C - Everything that we do is with the aim of a special purpose vehicle. The special purpose vehicle will procure the smart element to the city. It will look at what the outcomes are required in terms of the vision of the city. The special purpose vehicle will go away and set

5.

Demonstrating a return on investment

out how to procure that. Always in mind is that there is a social return on investment from it. You need to return a process at a local authority level for them to save money. This then allows for the investment to go away and build the infrastructure levels required for that city. Efficiency will allow the city to pay that back. If you do not create efficient social return you will not be able to pay that city back creating a negative equity. The platforms enables a detailed review of how those outcomes can be met. The Blackburn situation at the moment, one of their outcomes is to try and get people more healthy. Now one of the ideas is to tackle obesity through a demonstrator model of how local authority care and primary care at a hospital level interact. The question is how do we create the interoperability between the two in terms of efficiency of data. That is fine in one element but we also have to understand what the cost is to the NHS for people with obesity and what are the further outcomes from it, and why you would invest in this to create a resolution. One pathway is that you have a policy that says we want to reduce obesity across the region and these are processes and pathways. One pathway we are looking into is the creation of a single specific dietary plan for an individual that is enabled by a personalised application. The application however uses scientific data that goes a step beyond the current dietary regulations. Sensor technology for example will have a role to play and this can act as a checking process to make sure they are doing simplistic things. These are an example of how you use smart technology to then be smart at a city wide level creating social return on investment.

Abstracting local context when providing solutions

Technology role in personalising solutions

Introducing new technology for solutions

R - There is more than just the technology then is what you are saying.

C - There is lots more. For example if a city introduces a leisure plan, and each individual gets a leisure card with free access to gyms and bikes they can then start to use the city. It is trying to incentivise people to start looking after themselves. The impact of that is the burden on the NHS is reduced, the burden on adult care and services is reduced and that frees up budget to use in other areas.

Using technology to shape behaviours

Reducing costs for PS

R - If I could just pick up on something you spoke out which is the interoperability of data. To give some insight to what we are doing in the quantitative phase of the research we are taking two data sets - health and transport - to work off a framework for providing services back to the city from the network effects that are created through taking these two data sets and working with them to provide a solution.

Analysing data as big market

Ensuring security of data as big concern

Assessing local context to provide solutions

Understanding effect of actions through project implementation

Gathering data to inform on decisions

Introducing new technologies for solutions

new services through the SC

Analysing data

Designing projects for citizens

Outcomes directed to cities local context

C - Yes so data science is going to be one of the biggest industries over the next ten years. How we use data such as ONS data, using transport data etc. There are ways now in which we can plug them in through APIs. Being able to plug those data sets in and use Hypercat protocols to catalogue that data and then reference that data into an analytics engine is what we do. Creating a security layer around that is also important, as well as making open source data. Now I think the reality and worry may be that we have to look at as many inputs as we possibly can to get a clear idea as to what the issue is. Working with your example, if you are looking at loneliness, you cannot just look at transport. You also have to look at alcoholism, divorce rates. What are the reasons for somebody to feel lonely? And that comes back to the people consortia. We are a very diverse variable and we are not the same. To create assumptions around a percentage would be very dangerous. If you make an assumption for people feeling lonely because of XYZ then the people feeling lonely for something else will feel isolated. So then you create a secondary problem.

R - So the key is to be as well informed as possible with as many variables as possible.

C - Yes and going back to the work we are doing we are trying to plug in as much data as we possibly can to the model in order to look at the inputs. There is also a need then to talk to people and see why it is we are seeing what we are. Data science then becomes even more important because you can start to build algorithms around that and developing for example artificial intelligence. You can start to build apps whereby people who are identified as being depressed or lonely could actually be given an application as a service. That is giving feedback and by giving feedback you are working towards resolving some of the variables that are issues. You need to understand the variables that are relevant and that are not relevant in order for the analytics to be successful.

R - So your model takes all these data sets and with the benefit at the end of returning some sort of benefit for citizens.

C - Absolutely yes. Because again if you look at the definition of smart cities, citizen centric is what it is. It is about people and not about selling technology, it is about making life better for people. and making your city smart so that the lives of the people within that city is much better and improved.

7.

R - Could you speak a little bit more about the role data has to play in the development of future policy? From the research we are undertaking we have developed a framework that consists of three principles being accountability, efficiency, and innovation.

C - We work with a process classification framework. This means you develop a policy and then you develop the processes underneath those policies that include people and potential outcomes that feed into the main outcome. As I say you do not look for example at obesity on one level but you look at all of the different pathways but each time there is data and governance coming into it. There is a cost to all of this. Each one of those processes are referenced and underpinned by the main policy. Once that framework has been made you can replicate that to any city in the world. It provides a standard from which other cities can learn about each individual process. It may be that there is a better way of doing something and another city is doing it that way. It is working towards connecting cities up by being smart and with better outcomes.

Replicating solutions across cities
"Guinea Pig" approach

R - So it is not just internal communication within the city but external as cities can learn from one another.

C - Exactly. If you think about global warming by connecting for example Liverpool and Bilbao, or any other port area, by looking at a demographic and one average temperature is ten degrees more the other. A global warming takes place the culture to live and work in hot conditions is different to the other. But in ten years time if that situation is reversed what you can do is look at the lessons of the one to teach the other. The processes that are in cities that have encountered this can start to impact upon where you are today.

Networking across cities with similar local contexts
Matching of cities
Using data for future decisions

R - That is a good point you make with regards to learning from other cities.

C - You have to think about what the bigger game is. What is the holistic perception of all this? You cannot make just one city smart. All smart cities now do it for themselves and they are not learning as such. Funding and an increase in technology has resulted in kudos. A lot of that is because of politicians. Sometimes the introduction of a smart city programme can create another social problem. An example is the introduction of the WiFi mesh in New York. Although it was a great idea that improved connectivity for a lot of people what was happening is that homeless people began to sit all day at the beacons - congregating around the kiosks. The problem was not with them being there but using the network to download large

Creating a network approach to cities
"House of Cards"
Understanding effect of introducing new technology

television shows which reduced the speed across the whole network because it did not have the capacity. So you have got to think about a lot more than just the project you are pursuing. Each input has separate outcomes.

R - Yes the cause and effect relationships of smart city initiatives.

"Guinea Pig" approach

C - Yes so if we were to do that in Liverpool, I would ask the question would I do it in that way? The answer is that I most probably wouldn't.

R - There is also the case I suppose of fitting in with the planning regulations. Do you have any experience of how receptive the council are to the introduction of technology into built environment projects?

Learning from practices of other cities

"Guinea Pig" approach

C - You have just touched on a very good point. The smart city catapults that you see around the country at the moment - Bristol which is quite a way ahead of everybody else because it has been funded - are coming up with the case studies. However, if Liverpool was to introduce a similar scheme it would go out to procurement so it means the companies with the expertise and experience do not necessarily get the opportunity. The bid would have to go out for tender because of EU procurement law. Future cities did a study in Hyde park for air pollution, a lot of money was spent and the result was that 10% of sensors were destroyed by squirrels and 10% destroyed by vandals. Now if you were to put that across a city-wide area you would lose 20% of your access as well as 20% of public money gone into the project. Again this is why you have to think about what you do before actually doing them. It is about taking a holistic approach and that is where cities can learn from one another. For example they can say, do not do that we have tried that and it didn't work. or these are the lessons we have learnt and introduce these safe guards. Because what this does then is allow for different cities to pursue different specific areas that increases the knowledge for all. Is there really a need for two cities to both obtain funding for the same project? Why not come up with two different projects. It is also worth remembering with regards to data that some people may not want to release data because it goes against what they are saying or have worked towards for many years. They may have systems in place that are not efficient enough but they do not want to get rid of them. So these are things that the social science element will have to work with.

Introducing new technologies

Creating a network of cities to learn from

"House of Cards"

Issues with sharing data

9.

R - To bring the interview to a conclusion if I could just pick up on something you mentioned with regards to data and how it can sometimes be held back if it does not fit in with the 'status quo'?. Do you think that type of issue has a negative effect on the development of smart cities?

Extracting the value
of data

Sharing data to
release value

Governance needs to
adapt to new
environment

C - Absolutely. And I think that the public sector should be doing a lot more with the data we are producing. There is a call at the moment to make all data open. Is that a step too far? I personally do not think so but others might. The question is what is personal data? What is sensitive? But if you can control how and what data is released then you can work through those issues to get to the real rich data that can make a difference. But again the governance of the cities at the moment do not want to do that because they want to work within the way the system currently is.

R - This is again coming back to the accountability of the public sector and the services they offer.

X.ii.iv Interview (D) Initial and Focused coding

Initial Coding

05/08/2016

Researcher – (R)

Participant – (D)

R - If we could start with a background to what it is you do at Transport for Greater Manchester and how data and the smart cities movement is influencing your role.

- Public sector contracts in private
- Development of new specialised department
- Structured specifically for SCs
- Creates roles + responsibilities
- Adaptation to new environment
- Role of data in shaping strategies
- New possibilities due to technology
- New collaborations across sectors
- Diverse skillset within team
- One role increasing involvement + data community
 - New data networks
 - Communication of data on platform
- New partnerships/collaborations
- Adapting to environment
- Value of data needs extracting
- Value of data to organisation
- Proactive to respond to environment
 - Collaborative discussions
 - Strategy for collaboration + data sharing
 - New partnership development
- New services provided through SC
- Learn from best practice
- City network partnerships - overseas
- Get ahead of competition
- Policy adopted to fit new environment + provision of services
- Alternative business models

D - Yes so I am on secondment four days a week at Transport for Greater Manchester and it is quite unique in the sense that we have established an innovation department. You will find that most transport authorities have not structured themselves yet around smart cities in terms of individual roles and responsibilities. So it is good that Transport for Greater Manchester have taken the initiative to recognise the way the transport markets are shifting to focus on data and other possibilities that are coming together such as different technology and applications. We have seen interesting collaborations across different sectors. Within TfGM we work within a team for innovation that comprises of a head and three roles within that team. Building communities on the technology side is one and this is things like open source of data, working on the open data platform and interestingly enough he has set up and off-shoot partnership called travel spirit which is all about pushing forward open source data and engaging with the technology community. This is something other transport organisations probably haven't done yet. There is a recognition that all this data is going to be really valuable to the work we do, it can help us a lot figuring out cost when we are working with programmes and operations. So instead of having things happen it is better to engage and make things happen. Even just making sure you are involved in all of the discussions. If there is any strategy meeting taking place you can present your development ideas or future policy and what organisations could do to support open source communities and explore different innovations, obstructions and challenges - the role also looks at developing partnerships. A lot of work is looking at mobility as a service as well which is gaining a lot of traction. We had somebody come over from Finland where the government have adopted it as a policy. They have changed their legislation to support it and mobility as a service will be the idea that as a customer you will have one transport or mobility and account and you will be able to pay for different packages based on usage and different

- New software packages
- Provides better provision of new services
- Alternative payment models
- New technology allows new finance
- Plenty of new services
- Improves competition in marketplace
- Choice for consumer in marketplace
- PS facilitating SC development
- Data is integrating into the market
- Tech push increases app pull
- More supply gives more demand
- Integration of tech to the environment
- Advertising communication through visual designs
- Increase tech to allow for better access

packages. Online systems where you can choose the package you want whether it be business or leisure and the concept is that you can seamlessly move between modes such as taxi, bus, train, cycle share, car club - everything, and it will all be in your account that can be prepaid or pay as you go. And although it is a concept you can see now how it can now happen but for a mobility as a service to work it needs a lot of car share alternative services to fill the gaps and bike share as another option to give people choice and flexibility. So we are really looking at those areas which is all new, it is integration and we have found that a lot of the operators in those different sectors have come along to travel spirit work shops. They are all open to innovation because it pushes more customers towards their mode as well. There is also an urban design and digital advertising role. This is like way finding with a standardised mapping background where companies can add and share data on the mapping background but it also helps people to navigate around the cities. By making it available to people on their phone or visual screens it is making it more available to people.

R - Like an additional layer almost to the city.

- Integration of tech with physical
- Combination of the two layers
- New service provided
- Integrated with tech
- Tech allows for new devices
- Copying data through SC project
- Providing infrastructure for private market
- New data streams created

D - Yes so it is a physical layer as oppose to just digital and it helps people move around. In terms of my role I am looking at shared mobility which is developing things like bike share and innovation that goes onto that bike. I am almost developing a tender on extending the public electronic vehicle charging network which again is another data stream and another data source. And all vehicles will eventually be ultra low emission battery plug-in and again vehicles in terms of technology are massively improving and different data streams are creating another layer.

R - It is almost as if you are planning ahead so that when these technologically enabled cars are on the streets you have the infrastructure in place to facilitate that need.

- Planning for future
- Provide facilitation for private
- New environment, new technologies
- Learning from other countries
- Targets set by government direct market
- Outcomes are for social value e.g. environment
- Policy plays role in shaping future direction

D - Exactly yes. So we have done forecasts so governments have set the target that by 2040 petrol and diesel will be banned. But there are countries like Norway that are banning petrol and diesel by 2025 so we are behind in that sense. Now London is going to define an ultra low emission zone so in central London you will only be allowed zero emission taxis, zero emission battery single-decker bus's and you will probably find although there is a target for 2040 other areas are looking at policy to support it with a mandate that says by 2020 it has to be plug-in taxi and that is the way it will develop.

3.

- Technology outstrips current environment
- Phasing in process
- Provision of new type of service
- Takes current model, exports to digital sector
- New partnerships between companies
- Existing hardware, new software
- Cost of city catching up
- Digitisation of services
- New solutions to existing problems
- Improvisation of existing systems
- New benefits
- Increased regulation through new data streams
- Easier process to regulate
- New payment models
- Reduce cost
- Increase efficiencies through new possibilities

- Lower costs to public sector
- Improved regulation efficiency
- More frequent data provides better picture

- More efficient process
- Better developed network
- New tendering factors
- Reflects new environment

- Attracting new type of companies
- New sectors diversifying markets
- Cross sector collaboration
- Adaptation of business model
- Growing market in UK

R - So a phasing in strategy with regards to technology and the services to the city?

D - Yes so all that is currently happening. We are also creating a Greater Manchester car club framework. Car clubs are interesting because there has been a lot of innovation in those. You will see in Liverpool there are a couple of car clubs left on the highway - designated bays with car club written on. They are just petrol and diesel at the moment and in fixed bays but there are companies such as Drive Now who are partnering with BMW and instead of having to find a fixed bay, which in the public sector you have to cover traffic regulation orders, sign and lines meaning it is difficult to find a space on the highway, they are digitising everything now on the satellite navigation. So they will speak to the public sector to say we would like to leave vehicles anywhere within this zone and you agree that with the highways authority and geo-code or geo-fence a zone within the city. This means you can also mark out streets you shouldn't be using and that way if customers still try to park a car where they shouldn't they will get warnings and if they continue then you can pass enforcement and parking charges through to the member with their subscription. So with that system you can start to do enforcement remotely rather than having to have people wondering the streets.

R - When you think about the impact of that it actually cuts costs in terms of man hours.

D - Yes and technically, although it shouldn't be the main reason, you are less likely to miss something if everything is tracked and you can see in real-time where everything is.

R - Creating a more efficient process.

D - Yes managing the network and the use of the network better as well. So that is happening and we will ask question in the tender about innovation as well as operationally what kind of innovations are appropriate.

R - Is that a tender that goes out to third parties?

D - Yeah it will go out to any interested companies. There is a whole stream of operators, on the electrical vehicle side you will get the energy sector looking to invest because the market is lifting now and more people are buying fully and hybrid. The forecasts are the UK market is massive with 2.6 million new vehicles registered every year

- Expanding market, new solutions
- New technologies provide that market

- New department responsible for work
- Established markets already
- New innovative ideas
- How to implement to outcomes
- New roles for the process

- No innovation parameter as yet
- Streamline of markets
- Collaborative solution within same sector
- Plus diversified cross-sector markets
- Expanding market
 - Trying to maintain competition
 - PS have influence due to tendering process
- More options makes better services
- Competitive market
- New payment methods
- New business models
- Conditions to funding
- Alternative revenue streams
- Free introduction increases usage uptake
- Digitisation provides new services
- New services mean new business models
- Future maintenance less due to digitisation
- Flexible approach to solutions
- Choice for consumer in market

and they are saying by 2020 9/10% of that is going to be plug-in. So it is a really growing market that is only going to lift.

R - So is all this work going on through the innovation department that has been newly formed?

D - It is yes and it is interesting really because there are car clubs established which the transport strategy and organisations will do. But our particular focus is on innovation so it is how do you maximise or capture the best innovation and do that more efficiently.

R - Just for sake of clarification, when you mentioned about the tendering process, have you introduced a new parameter to reach which is innovation? In terms of sections of requirements when submitting bids?

D - Not yet no. The one we are working on is quite complicated in that we are technically taking electrical vehicle network and car club together because in places like Paris you have companies that can invest in and expand the electrical vehicle charging infrastructure and will also bring in an electric vehicle car club. But we are structuring it so that it is two separate lots so therefore if car club operators come in with a really great value offer and energy companies or electrical vehicle infrastructure companies that can do first lot you can word them individually but recognise that there is somebody who can do both. So it just increases the flexibility. Because within the electrical vehicle infrastructure side we are looking to bring in private investment and introduce a customer access fee because it is free to use which is a problem at the minute because people will park all day and not move on. It was a condition of the grant where we had 2.3 million pounds from government to install the network but the funding condition was that it has to be free to use for the first couple of years. We have gone past that now and the customer usage is ramping right up so it needs to be managed. And also the car club because there are different models, the free-flowing model which is the digitised model so you don't need any bays which are expensive (this is great because the cost is reduced) then you have got companies that need bays so there are companies that do that. There is something called back to base so you tick out of one bay and come back to the same bay which isn't flexible. And then you have got station to station where you still need bays but they can go into any bay but it is still has to be a designated bay and much of the time they come back to the same one. So because it is so complicated what we are saying is it is going

5.

- Outcome based tender process
- Evaluate situation now
- Shape direction for future
- Private fills the gap
- Phasing in of technology to ensure uptake
- Where does the data go to is important

to be an outcome based tender that says here is what we have at the moment, we want innovation and these are the type of things we would like to see but really it will be up to the applicant to say how would they develop car club over time and how would they phase it? What type of fleet they would introduce? How much will be electric? What do they do with all the data?

R - That is a big issue as well isn't it, what happens to the data that is collected.

- Use of data important
- Regulation of data in tender process
- How does proposal fit existing situation
- Phasing strategy
- New business models

D - Yes it is and we will frame it so there will be questions on governance arrangements, operation model, business model and there will be a section on innovation talking about potential integration in the future with other modes and data streams.

R - Data interoperability is a big issue isn't it.

- Interoperability of data an issue

D - Yeah so we will be looking for a response.

R - So Manchester really is taking a leading role.

- Manchester leading implementation
- New initiatives launched on national scale
- Creating data community
- Engaging with groups
- New partnerships
- Development of strategy linked to data

D - Yes definitely on things like transport, and even travel spirit which has been created so it is national. It has just been launched and it is about creating a whole community on the data side of things. It does mean that it is also an engagement group too if you are developing a strategy or policy you can reference back to travel spirit and ask for their views on innovation or clicker challenges.

R - That is something that reflects the emerging community across the whole smart cities sector isn't it.

- Data community reflects SC's
- Data important for public sector
- PS needs to engage with new networks
- formulate new partnerships
- Needs to respond to issues
- Adapting to environment

D - Yes it is and we are working within it and it is the first time we have stepped back and thought this is important also for all those reasons because if public sector doesn't engage then it not going to be able to address their key issues. This is something that can help with that.

R - I suppose it is a case that the public sector does have to adapt to the increasingly data driven environment.

- PS has to adapt to data environment
- Role of data in future policy
- Role of data reducing costs

D - Exactly it does. Because if we are carrying out future procurement you need to be aware of what is possible and managing budgets to produce cost savings.

- metropolitan area helps SC develop*
- More opportunity to develop
 - Area by area development leads to fragmentation
 - Provide infrastructure across large area, allow private to fill gaps.
 - Fragmented process complicates development
 - Area ok for testing
 - Metropolitan better to scale
 - Manchester learns from London mistakes
 - First city acts as guinea pig
 - Streamline of process for metropolitan
 - Long term contract allows for certainty
 - Better return on investment
 - More likely to invest

- Simplify the process
- Competitive market with lead role
- City plus surrounding areas
- Provision of new services
- Partners of areas
- Win funding based on cooperation
- Larger area is more funding
- Sector Names
- Areas/services within names
- Creates the sector
- New technology new insight
- Tech providing safety
- Data informing safety
- Data providing new insights

R - Yes, just in terms of something I wanted to pick up with regards to Transport for Greater Manchester, do you think the metropolitan area helps as a structure? The reason I ask is because Liverpool will soon become a metropolitan area. Do you think the change may effect the capability of the region in terms of their development into a smart city?

D - Definitely there is a lot more opportunity because using the electrical vehicle network as an example, in London each of the districts are developing their own individual infrastructure contracts and operating contracts which means you have a mixed bag of solutions. So what Transport for London did was to bring in a company to take over the network. That company thought they were buying the whole network but in theory there are actually only buying the name as a brand. Having realised this they had to go back and negotiate to buy out each individual contractor for each district. So in terms of scaling a concept or growing something it has been difficult there because of the different solutions and contracts. So for Greater Manchester we are in a better position through Transport for Greater Manchester on the electrical vehicle network because we can just contract a singular operator to bring in investment and manage the whole network. That is better for them because if they have a long term contract then they have enough breathing space to bring in investment and get a return over time with the scale to bring in enough.

R - So in a sense, streamlining the process and making it as efficient as possible is best for returning results.

D - Yes so we try to simplify it as much as possible. It may be the case that there will be multiple suppliers and contractors but we will just deal with one operator and they will be in a lead position. Then one for a Greater Manchester scale as well. The other thing we have been looking at is cycle share which again is about shared mobility. In Manchester there was a whole partnership bid that went in and successfully received 20 million pounds from Innovate UK for the city scale internet of things demonstrator. Within that there is a transport thematic and then within the transport thematic there are different things we are exploring in terms of innovation. A couple of talking bus stops, sensing trams because Piccadilly has a lots of people passing over the tracks and it will prompt people who are on their phone with headphones in there is a tram coming. This leads into platform safety and that type of stuff. There is a public safety project looking at telematics data to investigate other ways you can use that data to produce different things on the traffic side.

7.

- Projects designed to create data
- Understand how to use that data
- What value does it provide
- Gathering more data
- Increase evidence base
- New insights
- Interoperability of sectors
- Value to each other
- The data infrastructure
- Data creating new insights
- Makes services better for citizens
- Innovative solutions to existing services
- Expands the service
- Evolution of service in digital era
- Gathering new data
- Increase frequency of data
- New technology capturing new data
- Adapting existing devices
- Open up new markets through digital layer
- New business opportunities
- Different funding in new area
- Data can make up lack of funding
- New insights provide practical solutions
- New ways to facilitate services
- Reducing costs
- Better supply to meet demand
- Flexible approach
- Gamification incentivise behaviour
- Technology facilitates service
- New tech overcomes challenges
- Less public sector cost

R - That's a really good point. Because we are looking at how alternative data sets can also help develop transport and smart city solutions.

D - Yes we want to capture some projects that will create particular data and then understand how that data can be used for a variety of purposes. So although within this project there will be specific use cases and I will be looking after bike share innovation, we will also look at cross fertilisation across all new data streams and existing data streams and you can link cycle share with something in health and that thematic doing bits and bobs in other areas. So it is not just thinking about data for a particular mode it is if something cycles past a talking bus stop or a docking station near then you can tell people. You can look at all those different types of interactions to create new products and make that system easier for people to use. So cycle share I am keen to explore lots of innovation so there is a couple of applications within cycling generally. It would be good to test out those to capture new data streams and then look at how that can be used for different things. So for example, there is a number of real-time tracking devices available on the market so people can buy those and attach them to bikes, a lot of people carry phones so a lot can be done there. There are new smart locking devices which are app enabled and there are some companies interested in how you can make use of your own assets. So if you have a private bike that sits in your shed 90% you could use smart locking devices to share and make some income from it. You can then charge prices and still control access. But I am interested in the context of bike share - if sometimes less capital funding is available for docking stations is that almost helpful in terms of being an extension of a core docking station solution. If you don't have a lot of funding you have to be innovative and have a handful of key locations and then support that by flexible parking, smart bike locks and maybe even geo-fence it so if you go too far out of a zone then you can charge more. This in a sense is thinking about cost systems and how do you remove as much cost as possible, and this moves onto the managed distribution of bicycles which is a big cost in terms of moving them around to where the demands are. As part of that we will look at gamification too, to incentivise the individual. Things like that if you look at bike share schemes traditionally on an annual basis one of the biggest costs is the distribution, redistribution and restocking of bikes around docking stations. If you can use innovation, tracking, incentivisation, gamification you should be able to find ways to control your costs. Therefore, you will need less public sector subsidy, less sponsorship and you can create more

- Create commercial value
- Sponsorship of schemes
- Large costs for implementation
- Continued cost beyond implementation
- Learn from London mistakes
- Use technology for new market
- Reduce costs offset to existing market
- Flexible approach to business models
- Outcome for citizen
- Increase usage
- Provides return on investment

commercial value in the scheme and therefore it may become more valuable for a lot more areas. because at the minute if you look at London for 10,000 bikes it will cost 225 million pounds in terms of installation and equipment. It will then cost 26 million pounds per year to operate. SO when you see sponsors such as Santander they will provide sponsorship of say 7 million but there is still a 19 million shortfall. You will get so much from membership and tourist usage but at one stage there was an 11 million pound gap in funding. Firstly, however, it should not cost that much anyway but on smaller scale schemes you may only need subsidy of hundreds of thousands of pounds which in comparison to public transport services and other subsidy is not that much. So again if you can use the technology and innovation while also reducing your capital costs, making the scheme flexible, more customer focused, attract more users it should be a more cost-effective solution.

R - I suppose the more users you can attract the more data that is produced. And the bigger the data set, the more informed you are.

- More users gathered more data
- More data makes more insight
- Begin to gather regular data
- Frequency of data is better
- Continuous streams of data
- Commercial opportunities expanded
- Flexible approach to services
- New business models
- Sharing economy
- Gamification of service
- Increase usage
- Incentivisation to increase usage
- Tech reduces costs
- New solutions in environment

D - Yes and as well as part of that there is so much opportunity that you could do then. You will create more data about customer and cycling behaviour, so again there will be lots of other surveys and questionnaires sent out about cycling generally but you will start to have streams of data. As part of bike share as well, if you are providing a fleet of bikes on the network there will be a host of other commercial opportunities that will develop from that. For example, with deliveroo instead of buying the bike you could provide shared access if the companies has business insurance. You can always use a fleet to support other businesses. Uber and amazon are looking at last mile deliveries for freight logistics. If you have a bike share scheme you can incentivise the usage and have it open so people can actually earn money using it and as part of that incentivisation having the individuals redistribute the bikes so you are not spending money doing that.

R - So it is almost sitting within the sharing economy.

- New economy means new business models
- Tech allows greater insight
- Generates more data
- Better understanding

D - Yes and that is all enabled through the tracking of the bikes, knowing where all of the equipment is and where the bikes are.

R - Underpinning all of this new economy and revenue streams is data I suppose.

- Data underpins new economy
- Commercial revenue for physical side
- Still exists a digital side
- New business opportunities

D - Exactly and I suppose with bike share schemes as well you try to bring in a commercial sponsor but that is only on the physical side of

9.

- Technology facilitates new solutions
- Physical layer for commercialisation
- Also digital layer for commercialisation
- Produces new business opportunities
- New revenue streams
- Gamification means revenues
- Digital layer maximises usage
- Increased usage gives return on investment

the scheme for example the red bikes of Santander in London and you can design docking stations to combine anything you need. But if you include digital streams, which you can do at docking stations, there is a whole stream of commercial operations, funding and revenue streams there. Also if you are creating applications, gamification, cycling user profiles and things then you have a new stream there of commercial operations and revenues. So you really are maximising the potential through the technology as oppose to simply the physical branding.

R - Would you say that the aim of all this is for the city and their ability to reduce costs for the public sector while also improving services provided to citizens?

- Outcome if citizen orientated
- Better services offered
- Better regulation of existing systems
- More adaptable operations
- Cross-sector benefits

D - Yes it is all about providing a good solid cycling alternative for people as well in terms of getting around. It also helps to manage traffic flows which is an overall aim avoiding congestion and improving air quality, improving health and all these things.

R - Does that link back to the interoperability of investment in transport possibly benefiting other areas of the city such as health?

- New services gives new outcomes
- Outcomes are cross sector
- New provision of services
- Linked sectors of health/transport
- PS facilitates direction of service
- New services allow new outcomes
- More data available for decisions

D - Yes because you can start to then think about, again in the context of bike share, there is examples of established programmes such as cycling for health where there are things emerging from Manchester and Merseyside where people are developing cardio vascular disease or are recovering from surgery who get prescribed cycling for their rehabilitation but in those cases people will be given a bicycle and go out when they want like once or twice a week for example but that is not getting you all the data or information that the doctor might need. If you had through customer profiles and applications on the health side and bike share all linked together you could see what people have actually done in terms of following the regime. You can track progress and monitor health and be more informed. And that is something that can be done generally for everybody in terms of health but also specifically for people who maybe need to be prescribed that kind of exercise regime.

R - Does that represent a much more personalised approach or service?

- Improved regulation
- Increase evidence base
- More data results in better information
- Personalisation of service available

D - Yes. A lot of the stuff on Innovate UK focuses on creating personal customer profiles and data.

- Personalisation is new possibility
- Data produced from this

- More data integrated funding
- Reduction of costs
- Public sector saving
- Has to be a purpose
- Why gather the data
- Build up profiles
- Allows for accountability
- more engagement with people
- Benefits to citizens
- Included in process
- Allows gamification
- More benefits
- Incentive to shape behaviour
- Link this behaviour to outcomes

- Projects link to wider city vision
- Build more networks + partnerships
- Funding linked to partnerships

- Local contextual analysis required
- Still a learning process
- Understand partnership
- Play to strengths, cover weaknesses

- New partnership developed
- Expand network
- Review of partners
- What are priorities
- What is the focus of attention
- Not technology for technology sake
- Ground in local context
- Link to overall strategy

R - Because that is something I wanted to ask you about with regards to funding. Innovate UK is one of the main distributors of funding for smart cities and do you see almost an onus on generating data through your solutions when applying for funding?

D - It can seem that way but for me it is more focused on managing costs and public sector savings. But also there really needs to be a specific purpose as oppose to people generating data for the sake of it. Things like if you have a customer profile or they are sharing a private bike and you provide feedback through scores or you assess your landlord these types of things start to build up profiles which results in a social community and get people engaged in that activity whether it be cycling or anything you are focused on. You can begin to see merits in it this way because you can start to reward people on the users of bike share, distance covered and give recognition. So it depends what your overall aims are, our overall aims are to get more people to cycle because of the health benefits and congestion and improve air quality and those types of things so as long as you still focus on the outcomes of the project.

R - Does that link in with the wider vision or aims for the city?

D - Yes, so we have been doing a lot of work on innovation. I think the key is trying to build the correct partnerships as well. Sometimes funding streams just pop up and there still needs to be a structured approach towards building partnerships because often it is a coalition of the willing where people come on to say I will bid for it. But I think you need to take a review of what is available in your area in terms of skills, resources, capabilities, experience because a lot of this is new for the transport sector and their engagement with the technology side and you need to have a solid understanding of what different communities and organisations can do.

R - So is that something you have seen develop is partnerships with new organisations or technology companies for example?

D - Yes there has been more of that but I think there needs to be some kind of critical review of partners and I think there is still a lot more work to do for organisations to be really clear on what the priorities are, such as what things to focus on. And then which partners fit with that. Because sometimes it works the other way where people say I have got this idea lets bid for it. And I think you need to sit back for a bit and think well in terms of transport we have a strategy and a vision and things we want to achieve in terms of multi-modal journeys and things like that. So thinking about the

11.

- Value of project to outcomes
- Impact in terms of objectives
- Collaborate with experienced partners
- Holistic approach required
- Link to overall strategy

- Still a new market
- Direction required from higher levels
- Role of gov. in shaping priorities
- Gov. needs to support regional areas
- Funding centralised
- Need centralised strategy for sector of SC's
- Policy for SC's in each sector
- Will help with funding
- New revenue streams
- No funding for trials
- Hold back development
- Trial funding will aid development
- Reduces risk
- Allows for failure
- Not public LA money

- Ecosystem of SC market
- Themes for funding
- Would like to be more efficient
- Go into more detail
- Require/target specific tech for specific outcome solutions

- Improving standards is missing
- Standards improve certainty
- Certainty provides confidence in market
- Gives a purpose for solutions
- Guidance needed for SC's
- Provides development initiatives

priorities of which will bring most value against the objectives and which will make the most impact. And then you have to put out a call interested organisations who have got the experience to support the objectives. Because a lot of the time it is a lot too specific and niche sometimes that you almost have to take a whole comprehensive wider review and I don't know if anybody has done that yet anywhere.

R - I suppose the smart cities movement is quite new and everybody is still trying to figure out what it is.

D - That is true and it is also the case that the Department for Transport and organisations like that have to be more clear on what their role is within that and how they should be supporting the regional areas of Merseyside and Greater Manchester with regards to smart cities. I think they are looking at that now and preparing reports saying what they should be doing. Innovate UK has been working for a couple of years but Department for transport really need to come out with a clear policy and guidance potentially with funding streams as well because Innovate UK is quite restricted in terms of match and expectations. I think the problem with the public sector on the innovation side is you very rarely obtain pot funding to trial things. City verve was unique for us in this sense as there was funding there to explore these different things. Because normally for instance we might get funding for bike share but we have not had the chance to trial different types and look at the differences.

R - And I suppose there is a whole ecosystem that goes along with that - not just bike share.

D - Yes exactly. In terms of tenders we may be able to write we welcome innovation in all these types of themes but we would like to have the opportunity to review those understanding and then be really specific to say it must have, for instance, tracking devices or this product or this many docking stations.

R - Do you view that as a way of improving standards?

D - Yes and I think that is missing. And I suppose even with the internet of things there are different communication networks and then there still needs to be an understanding as to which are the right networks to use and for what purpose. Even with smart cities there is still a lot of work to do in terms of standards and guidance to break it down. Again to pick up on the electric vehicle charging infrastructure there is a huge range of infrastructure and it is hard

- Gives direction to market
- Guidance gives new solutions
- Standards provides certainty
- Certainty gives investment
- Provides best practice
- Allows for learning

- Public sector has to take risks
- Competitive environment
- New technologies
- Often no existing user base
- Private sector un-willing to enter
- Test-bed for schemes required
- PS take the step
- Define + shape the market
- Usage takes time to uptake
- Need confidence to test
- Gets to stage of commercialisation
- Benefits had through long-term investment
- Data used to forecast growth
- PS take risk
- Private sector then commercialise
- Development process

- City has to take leadership
- Introduction of new technology
- Generations to development
- Test and scale
- Large costs at beginning
- Recoup investment from private sector
- Secure return, remove costs
- Allow for future revenue from private development

for people to keep up to date. Businesses that often come to the public sector and say we are interested in electrical vehicle charging but which is the right method to use and what type, specification etc. on that side alone there is a huge amount that goes into that exercise of trying to break that down and show what is available and how it can be used. That is the same with a lot of technology and innovation is letting the public sector which is the right products.

R - It almost seems as though the public sector needs to adapt in terms of where it is now and where it needs to be as there is a big gap.

D - And also the public sector is really valuable in terms of taking early risks. On the electrical vehicle network as an example, when the funding came through from government it was a competitive fund. There was an almost non-existent vehicle plug in customer base where hardly anybody had electrical vehicles so the private sector, such as technology companies, wouldn't take the commercial risk to put out a big scheme but you needed to show a scheme that had a range of utility and show there was an infrastructure there to encourage the market along. So now that that has been done and there has been a network in there for over three years now it is at the point where customers are joining at a rate of 50 per month and utilisation is going through the roof with tonnes of electricity being drawn from the network. It is now at the stage where we can commercialise it, so we can bring customer access fees into it, we know which way customer foresight and growth is going and therefore the energy sector is now willing to invest because we have taken the risk out of it by getting it set up and taking it to a certain point of its development.

R - So what your saying is the city has to take a leadership role in some cases to get it to a point where the private sector is then willing to invest?

D - Exactly yes because with anything it is first generation risk. So that is first generation infrastructure there will also be first generation sensors and solutions and things that you almost have to kick start or enable to scale up from. It involves covering the heavy costs at the beginning, mobilisation and all the kind of stuff. As long as you get a good enough deal with the private sector who then come in to take that on further and you have secured your return then you have removed those costs.

13.

- Outcome is service to citizens
- PS takes leadership role
- Strategy, vision, purpose
- Development of policy
- Build new networks
- New partnerships
- Central funding

- Actively tracking funding opps
- Building partnerships now
- Partnerships for funding
- International partnerships
- Regional partnerships
- Data used to improve service
- European funding essential
- Lack of national funding
- Multi-sector based funding

- New services
- Data platforms
- Increase exposure to get partners
- More partners results in funding opps.
- New services offered
- Funding works data capture
- Funding works collaborations
- No UK funding for new services
- Private/business led only in UK
- Need to manage risk

R - You have also provided a new service to the citizens as well I suppose.

D - Yes so that is where the public sector is key in terms of the strategy, policy, vision. Helping build collaborations and communities like travel spirit and taking the risk out. A lot of that funding may come from central government so we go back to Department for Transport.

R - On the issue of funding as I know both of us have attended the Urban Mobility Action Network meetings, a lot of that was European Union funding but as we know that will not be there in the years to come, who or what do you think will fill that gap?

D - At Transport for Greater Manchester we have got a bidding role so I was tracking all of the funding opportunities. We were building partnerships and submitting bids. We put one in recently and it was a partnership with the Netherlands and France and we were looking at freight optimisation telematics in the Port of Liverpool to Greater Manchester so we were looking at HGV data, extracting it and connecting it to the traffic signals to smooth out the journeys and reduce the delivery time. So that was a 6 million euro project and we have submitted that and are waiting to hear back so that will probably be the first test as to what effect that may have and what is likely to happen. But European funding as I have been tracking and logging it as well as submitting bids, we had a funding opportunity since October until now of 60 million euros in projects we were involved in with partner bids, having looked at the stats as well and tracking partners that involves over 150 organisation from public, private, SME's and a lot of involved innovation and technology, building data platforms and mobility as a service. So all these organisations across most countries in Europe means all these different bids and partner bids so there is a massive impact that was getting Transport for Greater Manchester and Manchester's name out with people wanting to partner with us to do projects. We were successful on the first stage of two Horizon 2020 funded mobility as a service projects so we are still working on the full bid submissions for September but that is good because in that sense that funding was specifically for mobility as a service and innovation with connecting data and bringing in different operators together. On the UK side there hasn't been anything yet that has directly come and said here is the funding competition for mobility as a service, there will be bits in the UK but that is going to be mostly private or business led and it has to be commercial. But sometimes there is a bit of managing the risk involved. So all we can do when we engage

- Need more direction from gov.
- Centralised policy
- Centralised funding
- Increase of partnerships
- Solutions through new services
- Facilitated by tech
- New revenue streams
- New commercial opportunities
- Need to be able to test
- Providers sustainable so when
- Adaptable to city context
- Solutions provide commercial products

- Larger corporations facilitate development
- Role of large companies in data
- Provide the infrastructure
- Gathering new data sources
- Role of public sector
- Large corp supply tech
- MS integrate tech
- Test out projects
- Data feeds into central hub
- Gather new data
- Mix with existing data
- New partnerships create layers
- Tech community
- SME's
- Collaborative effort
- Each have own roles
- Outcome solution based
- New data streams
- New data frequencies
- How can relate to outcomes via solutions
- Data distribution
- Open data ethos
- Make us of data

- Open ethos to data
- Issues with data
- Reliability of source
- Frequency of data streams
- Data capture coverage

or respond to scrutiny committees from Department for Transport or performance is to say ideally we as public sector would like to enable this, we know what we are doing, what partners are out there but with direct funding we would like to run these programmes.

Eventually, Transport for Greater Manchester will procure a bike share solution but as part of that we want to look at how we can manage all of the costs and obtain capital flexible schemes and look at what revenue and commercial opportunities it can bring in. But we would like the opportunity to do things like this to test out what works and to make sure you are developing something that is sustainable and you can adapt it. With these solutions you create commercial products that you can then retrofit onto other system everywhere.

R - Is that (points to work on the table around Manchester's internet of things infrastructure) British telecomms supplying the data hub?

D - Yes so in terms of the tender Cisco are the main project leads for the whole project management structure of it and British Telecomms role is focused on the development and creation of the data hub. SO on our side we will be looking at the new data sources including sensors, tracking devices, smart locks and smart docking stations - everything you can do if we get the funding - we will test it all out and that will be new data fed into the hub. The hub will have all this new data from all the different projects but it will also have existing data from traffic systems, ordnance survey is a partner and they are giving all of the latest mapping products and data layers as a base. And then that will come out to the other side so we will have in one case cycle hackathons and we have got the Manchester technology companies and application developers on that side. So for cycle share we will say things like we want to improve cycle safety, here is all this new data we have real-time tracking, what can you do with it? We have got bike share but distribution and redistribution is a big issue - here is all the data how would you address that through innovation solutions and stuff. So it is just getting this available and the idea is to make most of this data, or as much as possible, open source as well.

R - That is something I wanted to pick up on was the open source and whether there was that open ethos in Transport for Greater Manchester?

D - I think in our case there generally is but the problem at the minute is that reliability, frequency and coverage of data. In some cases you almost need some of these products to give you a stream

15.

- Products provide data
- Consistent stream required
- Projects provide opportunity
- Integrate tech
- Capture data
- Frequency of data important

- New data streams
- Improved frequency of data
- More data to make decisions
- New solutions through technology
- How to create opportunity in product

- Assess requirement for technology
- Increase exposure through design
- Open commercial opportunities

- New technology adoption
- Improves design of solution
- Learn from mistakes of other cities
- Flexibility of scheme
- Allows for future adaptation
- Future proof design
- Minimise future costs
- How can tech be implemented
- Ecosystem fits with existing services
- Link to existing infrastructure
- Make streamlined process
- Allow for easy communication
- Interoperability issue for increased interaction

- Creating a seamless experience
- Novel technology increases usage
- Allow for introduction of technology
- Allow for failure in project
- Learn from mistakes of cities
- Too much tech is bad
- Those in development

that you want and have always wanted in the first place. So there is some stuff that is available that is static information and it is probably not as useful for some of the things you would like to do. but this project again gives you the opportunity to create real-time streams.

R - So all of this investment is enabling you to have new data streams, with more real-time information at different frequencies, which then you will have a whole new abundance of data really to then take on develop further?

D - Yes because having taken a comprehensive view of the whole bike share operation, design, provision and stuff if I was to start again to develop a solution, how would I do it differently? And how would you make it so that it pulls in as much opportunity as possible. You would start with first, is a docking station needed? Technically not but you would probably want high visibility communal cycle parking so that you can place the physical branding on there and have commercial opportunities that way. Everything is so low powered these days that you don't need cabling on posts and solar panels. The London scheme is extortionate because you are taking up a highway fitting cables in and doing all kinds of new work that way. It is almost as if they over engineer when they don't need to. Whereas the Liverpool scheme is really flexible where you have bolt down and take up. But what we are saying is OK that's good but what other technology can you add? There are night beacons and then shops that can pick up movement to engage with customers and then once a user is on the bike you can link them with shops and discounts and offers. So one of the potential add-on's could be that at the minute Liverpool's scheme is pretty good but you want to remove as many customer steps as possible so that instead of attaching your phone it recognises your phone and recognises you and links to maybe your PayPal or Google Pay.

R - A seamless experience almost.

D - Yes and there are some developments and companies looking at how you can attach your phone onto the bike and as you are cycling it is charging your phone through kinetic energy. Now once that is in that will be the phone also fixed to the bike where you can display all of your navigation and applications. So there is a lot that can also happen in terms of innovation going wrong. An example is Copenhagen which is recognised as world-leading in terms of bike share but the other year they pushed too hard in trying to create a fourth generation solution. Now what that enabled was putting

- Link tech to outcomes
- Minimise costs in future
- Future proofing of project

iPads attached to bikes, at great expense, which they didn't need to do. But after it was demonstrated and trialled for a while there was far too much damage and vandalism resulting in cost and expense.

R - So too much innovation could actually be bad?

- Not tech for tech sake
- Phase-in development
- Test and scale model
- Has to be a purpose
- Purpose linked to outcomes
- Outcomes targeted to specific areas
- Increase interaction
- Promote as much usage as possible
- Strategy in place for development
 - Gamification
 - Incentivise usage
 - Link incentives to behaviour change
 - Behaviour change to outcomes
 - Outcomes targeted

D - Yes because my whole focus on all of this is to get a low cost, scale-able solution or series of solutions such as smart locks and connectivity with phone tracking as well as other things. But it has got to be really low cost and you have got to understand the purpose. In that case the purpose is that we want to be able to have tourists come along, take the bike, and be taken along a route. Therefore, if you just created something whereby the tourist could attach their phone and you waved roaming charges at an expense to provide an app then you have done the same thing at no extra money or expense. So it is thinking about what you would like to do and then about costs and how you can manage it better. So there are lots of things you could do on just that example of bike share to make it far more viable. If you did the gamification then you are attracting people that may not cycle and our whole objective is to get more people cycling.

R - Is that a Transport for Greater Manchester objective or a city objective?

- Objectives in place for sector
- Each sector has targets
 - Cross-city approach
- Tech to gather data
- Need to gather consistent data from citywide
- Targets should be set to consistent data stream
 - Full picture, not part of picture
- Data used to improve services
- Frequency of data
- Better scale means scope done
- Interoperability maximisation

D - It is from the transport strategy that aims for more cycling and more walking. And then you will have targets within those. What tends to happen is at the minute you will have a cross-city handful of automatic cycle counters but they are in fixed locations, sometimes random locations, and if the cyclist rolls over it will count the cyclist. But that is only giving you a really very vague snapshot of the picture. So you can set targets of 10% growth by such a date but it is probably based on data like that so you might not make any real insight as there might be more cyclists in the next street. So again if you need data you can do tonnes of things such as traffic signals, you can then prioritise flows and improve safety. In London for example there have been a lot of heavy goods vehicle cycle collisions but if you have got a cyclist that has been detected in real-time then you can start to link that data into satellite navigation displays to prompt that driver in advance.

R - And looking into the future I suppose there will be automatic breaking eventually for the next generation of autonomous vehicles.

17.

- Data allows new opportunities
- Need to create data stream
- Create purpose for gathering data
- How to use data
- New technologies always introduced
- Value not in product
- Value in data produced
- Create value through insight of data
- Value in data, product is means to end
- Consistent flow of new technology

- Data production is valuable
- How you use that data
- For what purpose
- Tech introduction allows gathering of data
- Value in use data, not the product

- Guidance required from central gov
- Filter guidance out to regions

- Central gov. leadership role
- Local contextual solutions to local context. problems
- Funding required to meet those objectives
- Current practice ^{is} funding idea to funding
- Should be funding to idea
- Local solutions to local problems

D - So there is endless stuff that you could do with the data stream but it is just that it doesn't exist yet. And if you have got that data stream then what can you use that for? You start to think about the data. I think that is another point to make that you get some companies that focus on their product, they say we have got this device and you can attach it any bike and it will track that cyclist. But that product is always going to be replaced or there are different costs and different pricing so the real value is in the data. If one company comes in and says we will take the data from all those different products then actually the value is in the insight of you can do this a,b,c,d with all that data - that is where the real value is. Because even with all this technology there is always something else.

R - So the value is not necessarily on the technological solution itself it is from the data that is produced from it and the insight that is created? So then it is about how you use that data.

D - Yes it is like the application of that data. For us it is a case that we need something to start with so the first product is the value but then somebody else may create something cheaper at a different price so it is the value not in the product but in the data and how you use it.

R - That is all great stuff, is there anything else you would like to add?

D - I suppose there is a lot of stuff that could be done in terms of guidance from central government to Merseyside and Greater Manchester.

R - Maybe taking more of a leadership role?

D - Yes and equally you almost want to equip public sector. Because we know locally what our objectives are, what our priorities are, when you look at the network and where the challenges are. So ideally you would want the funding to come to us to set the challenges and we can still do Innovate UK type challenges but you can frame it to your particular need. Because sometimes you are shoehorning an idea into a funding call which may not be appropriate.

R - So an approach whereby central government funding is filtered to the regional area who then distribute it as they see fit in terms of meeting their challenges?

- Requirement for more regional funding
- Funding too centralised through Innovate UK
- Narrow focus of funding
- Missed opportunities
- No funding for future generation of products
- Still at test + implementation phase
- Managing costs an issue
- Tech can provide solutions
- Tech allows for greater adaptability
- Better usage of data
- Reduces costs
- Use data to maximise income
- Remove costs to public sector by commercialisation
- Set out strategy to achieve objectives

D - You can still do both but it is just that at the minute it seems to mostly just be one way. And I think there is a danger with all of the funding coming from Innovate UK because there is just so much criteria and restrictions applied to that, that it narrows down the potential. I don't think there is anywhere yet that we could approach to say we would like to develop a fifth generation bike share solution - you would probably get one element of this but it is not the whole solution and as long as a need is set out by possibilities, because that has got potential commercial value from lots of companies. I suppose to conclude the main thing for us is managing costs so car clubs, flexible digitised solutions means we don't have to pay for signs and lines which cost about 5-6 thousand pounds per piece for each bay because there are so many regulations. And you have to maintain those as well as them being fixed so you can't move them around to fit demand. You also cannot scale up the solution because you have got to find the space so you can remove capital costs, infrastructure costs, reduce costs and then you can manage your on-going operational costs just through better usage of data. And then using the data to maximise incomes in order to remove all potential costs to the public sector but still achieve your overall objectives.

1.

Focused Coding

Transport for Greater Manchester (public) Interview Transcript

05/08/2016

Researcher – (R)

Participant – (D)

R - If we could start with a background to what it is you do at Transport for Greater Manchester and how data and the smart cities movement is influencing your role.

Established new
innovation
department

Structuring designed
around SCs

Adopting to data
enviro.

Using data a lot in
daily activities

Creating new initiatives
facilitating sharing data

Extracting the value
of data

Developing new
partnerships

"Citizen Pig"
approach

D - Yes so I am on secondment four days a week at Transport for Greater Manchester and it is quite unique in the sense that we have established an innovation department. You will find that most transport authorities have not structured themselves yet around smart cities in terms of individual roles and responsibilities. So it is good that Transport for greater Manchester have taken the initiative to recognise the way the transport markets are shifting to focus on data and other possibilities that are coming together such as different technology and applications. We have seen interesting collaborations across different sectors. Within TfGM we work within a team for innovation that comprises of a head and three roles within that team. Building communities on the technology side is one and this is things like open source of data, working on the open data platform and interestingly enough he has set up and off-shoot partnership called travel spirit which is all about pushing forward open source data and engaging with the technology community. This is something other transport organisations probably haven't done yet. There is a recognition that all this data is going to be really valuable to the work we do, it can help us a lot figuring out cost when we are working with programmes and operations. So instead of having things happen it is better to engage and make things happen. Even just making sure you are involved in all of the discussions. If there is any strategy meeting taking place you can present your development ideas or future policy and what organisations could do to support open source communities and explore different innovations, obstructions and challenges - the role also looks at developing partnerships. A lot of work is looking at mobility as a service as well which is gaining a lot of traction. We had somebody come over from Finland where the government have adopted it as a policy. They have changed their legislation to support it and mobility as a service will be the idea that as a customer you will have one transport or mobility and account and you will be able to pay for different packages based on usage and different

Introducing new technology
creates new services

Flexibility within the
market place

Presenting data in
new visual
ways

Adding additional layers
of services

Improving quantity of
data

Collecting new forms
of data

Using data to forecast
future planning

Competitive nature of
countries leading
market

Governance setting
targets to shape
behaviour

packages. Online systems where you can choose the package you want whether it be business or leisure and the concept is that you can seamlessly move between modes such as taxi, bus, train, cycle share, car club - everything, and it will all be in your account that can be prepaid or pay as you go. And although it is a concept you can see now how it can now happen but for a mobility as a service to work it needs a lot of car share alternative services to fill the gaps and bike share as another option to give people choice and flexibility. So we are really looking at those areas which is all new, it is integration and we have found that a lot of the operators in those different sectors have come along to travel spirit work shops. They are all open to innovation because it pushes more customers towards their mode as well. There is also an urban design and digital advertising role. This is like way finding with a standardised mapping background where companies can add and share data on the mapping background but it also helps people to navigate around the cities. By making it available to people on their phone or visual screens it is making it more available to people.

R - Like an additional layer almost to the city.

D - Yes so it is a physical layer as oppose to just digital and it helps people move around. In terms of my role I am looking at shared mobility which is developing things like bike share and innovation that goes onto that bike. I am almost developing a tender on extending the public electronic vehicle charging network which again is another data stream and another data source. And all vehicles will eventually be ultra low emission battery plug-in and again vehicles in terms of technology are massively improving and different data streams are creating another layer.

R - It is almost as if you are planning ahead so that when these technologically enabled cars are on the streets you have the infrastructure in place to facilitate that need.

D - Exactly yes. So we have done forecasts so governments have set the target that by 2040 petrol and diesel will be banned. But there are countries like Norway that are banning petrol and diesel by 2025 so we are behind in that sense. Now London is going to define an ultra low emission zone so in central London you will only be allowed zero emission taxis, zero emission battery single-decker bus's and you will probably find although there is a target for 2040 other areas are looking at policy to support it with a mandate that says by 2020 it has to be plug-in taxi and that is the way it will develop.

3.

Introducing new services to city

Newly formed collaborations between private companies

Digitising services for better outcomes

New technologies allows for greater regulation

More frequent data allows for better operational capacity

Tendering process reflects new environment

Public sector facilitating private sector investment

R - So a phasing in strategy with regards to technology and the services to the city?

D - Yes so all that is currently happening. We are also creating a Greater Manchester car club framework. Car clubs are interesting because there has been a lot of innovation in those. You will see in Liverpool there are a couple of car clubs left on the highway - designated bays with car club written on. They are just petrol and diesel at the moment and in fixed bays but there are companies such as Drive Now who are partnering with BMW and instead of having to find a fixed bay, which in the public sector you have to cover traffic regulation orders, sign and lines meaning it is difficult to find a space on the highway, they are digitising everything now on the satellite navigation. So they will speak to the public sector to say we would like to leave vehicles anywhere within this zone and you agree that with the highways authority and geo-code or geo-fence a zone within the city. This means you can also mark out streets you shouldn't be using and that way if customers still try to park a car where they shouldn't they will get warnings and if they continue then you can pass enforcement and parking charges through to the member with their subscription. So with that system you can start to do enforcement remotely rather than having to have people wondering the streets.

R - When you think about the impact of that it actually cuts costs in terms of man hours.

D - Yes and technically, although it shouldn't be the main reason, you are less likely to miss something if everything is tracked and you can see in real-time where everything is.

R - Creating a more efficient process.

D - Yes managing the network and the use of the network better as well. So that is happening and we will ask question in the tender about innovation as well as operationally what kind of innovations are appropriate.

R - Is that a tender that goes out to third parties?

D - Yeah it will go out to any interested companies. There is a whole stream of operators, on the electrical vehicle side you will get the energy sector looking to invest because the market is lifting now and more people are buying fully and hybrid. The forecasts are the UK market is massive with 2.6 million new vehicles registered every year

Targetting goals based on future introduction of new technologies

Creating a focus for departments to work towards

"Guinea Pig" approach

Creating flexibility within market place

Funding received from central government

Digitisation of services allows for greater flexibility

Technologies allow for greater gathering of data

and they are saying by 2020 9/10% of that is going to be plug-in. So it is a really growing market that is only going to lift.

R - So is all this work going on through the innovation department that has been newly formed?

D - It is yes and it is interesting really because there are car clubs established which the transport strategy and organisations will do. But our particular focus is on innovation so it is how do you maximise or capture the best innovation and do that more efficiently.

R - Just for sake of clarification, when you mentioned about the tendering process, have you introduced a new parameter to reach which is innovation? In terms of sections of requirements when submitting bids?

D - Not yet no. The one we are working on is quite complicated in that we are technically taking electrical vehicle network and car club together because in places like Paris you have companies that can invest in and expand the electrical vehicle charging infrastructure and will also bring in an electric vehicle car club. But we are structuring it so that it is two separate lots so therefore if car club operators come in with a really great value offer and energy companies or electrical vehicle infrastructure companies that can do first lot you can word them individually but recognise that there is somebody who can do both. So it just increases the flexibility. Because within the electrical vehicle infrastructure side we are looking to bring in private investment and introduce a customer access fee because it is free to use which is a problem at the minute because people will park all day and not move on. It was a condition of the grant where we had 2.3 million pounds from government to install the network but the funding condition was that it has to be free to use for the first couple of years. We have gone past that now and the customer usage is ramping right up so it needs to be managed. And also the car club because there are different models, the free-flowing model which is the digitised model so you don't need any bays which are expensive (this is great because the cost is reduced) then you have got companies that need bays so there are companies that do that. There is something called back to base so you tick out of one bay and come back to the same bay which isn't flexible. And then you have got station to station where you still need bays but they can go into any bay but it is still has to be a designated bay and much of the time they come back to the same one. So because it is so complicated what we are saying is it is going

5.

Outcome based
tendering process shows
city leadership

to be an outcome based tender that says here is what we have at the moment, we want innovation and these are the type of things we would like to see but really it will be up to the applicant to say how would they develop car club over time and how would they phase it? What type of fleet they would introduce? How much will be electric? What do they do with all the data?

R - That is a big issue as well isn't it, what happens to the data that is collected.

Designing projects with
future in mind
collecting data through
projects

D - Yes it is and we will frame it so there will be questions on governance arrangements, operation model, business model and there will be a section on innovation talking about potential integration in the future with other modes and data streams.

R - Data interoperability is a big issue isn't it.

Solving issues around
handling data

D - Yeah so we will be looking for a response.

R - So Manchester really is taking a leading role.

Creating new communities
to facilitate SC
development

D - Yes definitely on things like transport, and even travel spirit which has been created so it is national. It has just been launched and it is about creating a whole community on the data side of things. It does mean that it is also an engagement group too if you are developing a strategy or policy you can reference back to travel spirit and ask for their views on innovation or clicker challenges.

Offering leadership roles for
best practice

R - That is something that reflects the emerging community across the whole smart cities sector isn't it.

Public sector taking leading
role in SC sector

D - Yes it is and we are working within it and it is the first time we have stepped back and thought this is important also for all those reasons because if public sector doesn't engage then it not going to be able to address their key issues. This is something that can help with that.

R - I suppose it is a case that the public sector does have to adapt to the increasingly data driven environment.

Governance adapting to
data-driven environment

D - Exactly it does. Because if we are carrying out future procurement you need to be aware of what is possible and managing budgets to produce cost savings.

R - Yes, just in terms of something I wanted to pick up with regards to Transport for Greater Manchester, do you think the metropolitan area helps as a structure? The reason I ask is because Liverpool will soon become a metropolitan area. Do you think the change may effect the capability of the region in terms of their development into a smart city?

Metropolitan area advancing
SC development

"Griffin Pig"
operable

Providing long term contracts
to Suppliers to ensure
return on investment

D - Definitely there is a lot more opportunity because using the electrical vehicle network as an example, in London each of the districts are developing their own individual infrastructure contracts and operating contracts which means you have a mixed bag of solutions. So what Transport for London did was to bring in a company to take over the network. That company thought they were buying the whole network but in theory there are actually only buying the name as a brand. Having realised this they had to go back and negotiate to buy out each individual contractor for each district. So in terms of scaling a concept or growing something it has been difficult there because of the different solutions and contracts. So for Greater Manchester we are in a better position through Transport for Greater Manchester on the electrical vehicle network because we can just contract a singular operator to bring in investment and manage the whole network. That is better for them because if they have a long term contract then they have enough breathing space to bring in investment and get a return over time with the scale to bring in enough.

R - So in a sense, streamlining the process and making it as efficient as possible is best for returning results.

Introducing new technology
brings new services

Partnering with other areas
to gain funding

Introducing new technology

Data generated used to
improve safety

D - Yes so we try to simplify it as much as possible. It may be the case that there will be multiple suppliers and contractors but we will just deal with one operator and they will be in a lead position. Then one for a Greater Manchester scale as well. The other thing we have been looking at is cycle share which again is about shared mobility. In Manchester there was a whole partnership bid that went in and successfully received 20 million pounds from Innovate UK for the city scale internet of things demonstrator. Within that there is a transport thematic and then within the transport thematic there are different things we are exploring in terms of innovation. A couple of talking bus stops, sensing trams because Piccadilly has a lots of people passing over the tracks and it will prompt people who are on their phone with headphones in there is a tram coming. This leads into platform safety and that type of stuff. There is a public safety project looking at telematics data to investigate other ways you can use that data to produce different things on the traffic side.

7.

Capturing new forms of data through project design

Understanding data in new ways to create impact

Using data to return outcomes to people

Testing out projects to demonstrate impact

New technologies providing new capabilities & services

Using data to provide solutions for funding shortages

Reducing costs to a factor in project design

Incentivising individuals to shape behaviour for specific outcomes

R - That's a really good point. Because we are looking at how alternative data sets can also help develop transport and smart city solutions.

D - Yes we want to capture some projects that will create particular data and then understand how that data can be used for a variety of purposes. So although within this project there will be specific use cases and I will be looking after bike share innovation, we will also look at cross fertilisation across all new data streams and existing data streams and you can link cycle share with something in health and that thematic doing bits and bobs in other areas. So it is not just thinking about data for a particular mode it is if something cycles past a talking bus stop or a docking station near then you can tell people. You can look at all those different types of interactions to create new products and make that system easier for people to use. So cycle share I am keen to explore lots of innovation so there is a couple of applications within cycling generally. It would be good to test out those to capture new data streams and then look at how that can be used for different things. So for example, there is a number of real-time tracking devices available on the market so people can buy those and attach them to bikes, a lot of people carry phones so a lot can be done there. There are new smart locking devices which are app enabled and there are some companies interested in how you can make use of your own assets. So if you have a private bike that sits in your shed 90% you could use smart locking devices to share and make some income from it. You can then charge prices and still control access. But I am interested in the context of bike share - if sometimes less capital funding is available for docking stations is that almost helpful in terms of being an extension of a core docking station solution. If you don't have a lot of funding you have to be innovative and have a handful of key locations and then support that by flexible parking, smart bike locks and maybe even geo-fence it so if you go too far out of a zone then you can charge more. This in a sense is thinking about cost systems and how do you remove as much cost as possible, and this moves onto the managed distribution of bicycles which is a big cost in terms of moving them around to where the demands are. As part of that we will look at gamification too, to incentivise the individual. Things like that if you look at bike share schemes traditionally on an annual basis one of the biggest costs is the distribution, redistribution and restocking of bikes around docking stations. If you can use innovation, tracking, incentivisation, gamification you should be able to find ways to control your costs. Therefore, you will need less public sector subsidy, less sponsorship and you can create more

Commercialising products
to services creates
new business model

Introducing new revenue
streams to existing
services through
digitisation

Implanting technology
to reduce costs &
operations

Collecting data in order
to make better insight

Beginning to provide a
constant flow of data

Digitisation & technology
create new markets
in economy

Incentivising use of
solutions for
business model

Increased operational capacity
due to using data

Introducing new revenue
streams via two layer
process

commercial value in the scheme and therefore it may become more valuable for a lot more areas. because at the minute if you look at London for 10,000 bikes it will cost 225 million pounds in terms of installation and equipment. It will then cost 26 million pounds per year to operate. SO when you see sponsors such as Santander they will provide sponsorship of say 7 million but there is still a 19 million shortfall. You will get so much from membership and tourist usage but at one stage there was an 11 million pound gap in funding. Firstly, however, it should not cost that much anyway but on smaller scale schemes you may only need subsidy of hundreds of thousands of pounds which in comparison to public transport services and other subsidy is not that much. So again if you can use the technology and innovation while also reducing your capital costs, making the scheme flexible, more customer focused, attract more users it should be a more cost-effective solution.

R - I suppose the more users you can attract the more data that is produced. And the bigger the data set, the more informed you are.

D - Yes and as well as part of that there is so much opportunity that you could do then. You will create more data about customer and cycling behaviour, so again there will be lots of other surveys and questionnaires sent out about cycling generally but you will start to have streams of data. As part of bike share as well, if you are providing a fleet of bikes on the network there will be a host of other commercial opportunities that will develop from that. For example, with deliveroo instead of buying the bike you could provide shared access if the companies has business insurance. You can always use a fleet to support other businesses. Uber and amazon are looking at last mile deliveries for freight logistics. If you have a bike share scheme you can incentivise the usage and have it open so people can actually earn money using it and as part of that incentivisation having the individuals redistribute the bikes so you are not spending money doing that.

R - So it is almost sitting within the sharing economy.

D - Yes and that is all enabled through the tracking of the bikes, knowing where all of the equipment is and where the bikes are.

R - Underpinning all of this new economy and revenue streams is data I suppose.

D - Exactly and I suppose with bike share schemes as well you try to bring in a commercial sponsor but that is only on the physical side of

9.

Enriching of digital +
physical creates new
revenue streams

Creation of profiles
increases interaction +
usability

Digitalisation creates new
markets

Providing solutions to
shape new behaviours
linked to city aims

Designing projects in
order to benefit other
areas

Localising solutions
to local problems

Creating profiles for
personalising services
to citizens

Using data to be
more informed

Funding aims to
shape projects for
data gathering

the scheme for example the red bikes of Santander in London and you can design docking stations to combine anything you need. But if you include digital streams, which you can do at docking stations, there is a whole stream of commercial operations, funding and revenue streams there. Also if you are creating applications, gamification, cycling user profiles and things then you have a new stream there of commercial operations and revenues. So you really are maximising the potential through the technology as oppose to simply the physical branding.

R - Would you say that the aim of all this is for the city and their ability to reduce costs for the public sector while also improving services provided to citizens?

D - Yes it is all about providing a good solid cycling alternative for people as well in terms of getting around. It also helps to manage traffic flows which is an overall aim avoiding congestion and improving air quality, improving health and all these things.

R - Does that link back to the interoperability of investment in transport possibly benefiting other areas of the city such as health?

D - Yes because you can start to then think about, again in the context of bike share, there is examples of established programmes such as cycling for health where there are things emerging from Manchester and Merseyside where people are developing cardiovascular disease or are recovering from surgery who get prescribed cycling for their rehabilitation but in those cases people will be given a bicycle and go out when they want like once or twice a week for example but that is not getting you all the data or information that the doctor might need. If you had through customer profiles and applications on the health side and bike share all linked together you could see what people have actually done in terms of following the regime. You can track progress and monitor health and be more informed. And that is something that can be done generally for everybody in terms of health but also specifically for people who maybe need to be prescribed that kind of exercise regime.

R - Does that represent a much more personalised approach or service?

D - Yes. A lot of the stuff on Innovate UK focuses on creating personal customer profiles and data.

Funding directed at reducing public sector costs

Building profiles for both sides of market e.g. customer & provider

Incentivising citizens to shape behaviour for targeted outcomes

Creating overall aims to target solutions

Building partnerships to deliver aims of city

Reviewing strengths & weaknesses to match partners

Creating a focus for delivery & choosing partners

Targetting funding based on requirements of local challenges

R - Because that is something I wanted to ask you about with regards to funding. Innovate UK is one of the main distributors of funding for smart cities and do you see almost an onus on generating data through your solutions when applying for funding?

D - It can seem that way but for me it is more focused on managing costs and public sector savings. But also there really needs to be a specific purpose as oppose to people generating data for the sake of it. Things like if you have a customer profile or they are sharing a private bike and you provide feedback through scores or you assess your landlord these types of things start to build up profiles which results in a social community and get people engaged in that activity whether it be cycling or anything you are focused on. You can begin to see merits in it this way because you can start to reward people on the users of bike share, distance covered and give recognition. So it depends what your overall aims are, our overall aims are to get more people to cycle because of the health benefits and congestion and improve air quality and those types of things so as long as you still focus on the outcomes of the project.

R - Does that link in with the wider vision or aims for the city?

D - Yes, so we have been doing a lot of work on innovation. I think the key is trying to build the correct partnerships as well. Sometimes funding streams just pop up and there still needs to be a structured approach towards building partnerships because often it is a coalition of the willing where people come on to say I will bid for it. But I think you need to take a review of what is available in your area in terms of skills, resources, capabilities, experience because a lot of this is new for the transport sector and their engagement with the technology side and you need to have a solid understanding of what different communities and organisations can do.

R - So is that something you have seen develop is partnerships with new organisations or technology companies for example?

D - Yes there has been more of that but I think there needs to be some kind of critical review of partners and I think there is still a lot more work to do for organisations to be really clear on what the priorities are, such as what things to focus on. And then which partners fit with that. Because sometimes it works the other way where people say I have got this idea lets bid for it. And I think you need to sit back for a bit and think well in terms of transport we have a strategy and a vision and things we want to achieve in terms of multi-modal journeys and things like that. So thinking about the

11.

Targetting projects towards challenges

priorities of which will bring most value against the objectives and which will make the most impact. And then you have to put out a call interested organisations who have got the experience to support the objectives. Because a lot of the time it is a lot too specific and niche sometimes that you almost have to take a whole comprehensive wider review and I don't know if anybody has done that yet anywhere.

Holistic view required

R - I suppose the smart cities movement is quite new and everybody is still trying to figure out what it is.

Central government need to take more of a leadership role

D - That is true and it is also the case that the Department for Transport and organisations like that have to be more clear on what their role is within that and how they should be supporting the regional areas of Merseyside and Greater Manchester with regards to smart cities. I think they are looking at that now and preparing reports saying what they should be doing. Innovate UK has been working for a couple of years but Department for transport really need to come out with a clear policy and guidance potentially with funding streams as well because Innovate UK is quite restricted in terms of match and expectations. I think the problem with the public sector on the innovation side is you very rarely obtain pot funding to trial things. City verve was unique for us in this sense as there was funding there to explore these different things. Because normally for instance we might get funding for bike share but we have not had the chance to trial different types and look at the differences.

Strategy in place by central gov. will help development of SC's

More funding options required

Ability to trial required pre-funding stage

R - And I suppose there is a whole ecosystem that goes along with that - not just bike share.

Implementing condition on tenders based on outcomes

D - Yes exactly. In terms of tenders we may be able to write we welcome innovation in all these types of themes but we would like to have the opportunity to review those understanding and then be really specific to say it must have, for instance, tracking devices or this product or this many docking stations.

Introducing new technologies to city solutions

R - Do you view that as a way of improving standards?

Improving standards is required to ensure quality projects

D - Yes and I think that is missing. And I suppose even with the internet of things there are different communication networks and then there still needs to be an understanding as to which are the right networks to use and for what purpose. Even with smart cities there is still a lot of work to do in terms of standards and guidance to break it down. Again to pick up on the electric vehicle charging infrastructure there is a huge range of infrastructure and it is hard

Implementing projects will allow for more "Green fig" approaches

for people to keep up to date. Businesses that often come to the public sector and say we are interested in electrical vehicle charging but which is the right method to use and what type, specification etc. on that side alone there is a huge amount that goes into that exercise of trying to break that down and show what is available and how it can be used. That is the same with a lot of technology and innovation is letting the public sector which is the right products.

R - It almost seems as though the public sector needs to adapt in terms of where it is now and where it needs to be as there is a big gap.

Role of PS + governance in taking risks

D - And also the public sector is really valuable in terms of taking early risks. On the electrical vehicle network as an example, when the funding came through from government it was a competitive fund. There was an almost non-existent vehicle plug in customer base where hardly anybody had electrical vehicles so the private sector, such as technology companies, wouldn't take the commercial risk to put out a big scheme but you needed to show a scheme that had a range of utility and show there was an infrastructure there to encourage the market along. So now that that has been done and there has been a network in there for over three years now it is at the point where customers are joining at a rate of 50 per month and utilisation is going through the roof with tonnes of electricity being drawn from the network. It is now at the stage where we can commercialise it, so we can bring customer access fees into it, we know which way customer foresight and growth is going and therefore the energy sector is now willing to invest because we have taken the risk out of it by getting it set up and taking it to a certain point of its development.

Leadership role of PS in terms of implementing infrastructure to allow for further private development

R - So what your saying is the city has to take a leadership role in some cases to get it to a point where the private sector is then willing to invest?

Facilitating future growth by pursuing JC initiatives

D - Exactly yes because with anything it is first generation risk. So that is first generation infrastructure there will also be first generation sensors and solutions and things that you almost have to kick start or enable to scale up from. It involves covering the heavy costs at the beginning, mobilisation and all the kind of stuff. As long as you get a good enough deal with the private sector who then come in to take that on further and you have secured your return then you have removed those costs.

Phasing in of projects means strong PS influence early on

Future commercialisation provides revenue

13.

Strategy set out by
governance
Building new partnerships
Funding from central
gov.

Funding bids submitted
alongside partners

International collaborations
for EU funding

Collecting data to use
to inform future
decisions

Testing of projects before
scaling

Cross-sector collaborations

Competing with cities requires
building reputation

Providing new services
with facilitation of
technology

R - You have also provided a new service to the citizens as well I suppose.

D - Yes so that is where the public sector is key in terms of the strategy, policy, vision. Helping build collaborations and communities like travel spirit and taking the risk out. A lot of that funding may come from central government so we go back to Department for Transport.

R - On the issue of funding as I know both of us have attended the Urban Mobility Action Network meetings, a lot of that was European Union funding but as we know that will not be there in the years to come, who or what do you think will fill that gap?

D - At Transport for Greater Manchester we have got a bidding role so I was tracking all of the funding opportunities. We were building partnerships and submitting bids. We put one in recently and it was a partnership with the Netherlands and France and we were looking at freight optimisation telematics in the Port of Liverpool to Greater Manchester so we were looking at HGV data, extracting it and connecting it to the traffic signals to smooth out the journeys and reduce the delivery time. So that was a 6 million euro project and we have submitted that and are waiting to hear back so that will probably be the first test as to what effect that may have and what is likely to happen. But European funding as I have been tracking and logging it as well as submitting bids, we had a funding opportunity since October until now of 60 million euros in projects we were involved in with partner bids, having looked at the stats as well and tracking partners that involves over 150 organisation from public, private, SME's and a lot of involved innovation and technology, building data platforms and mobility as a service. So all these organisations across most countries in Europe means all these different bids and partner bids so there is a massive impact that was getting Transport for Greater Manchester and Manchester's name out with people wanting to partner with us to do projects. We were successful on the first stage of two Horizon 2020 funded mobility as a service projects so we are still working on the full bid submissions for September but that is good because in that sense that funding was specifically for mobility as a service and innovation with connecting data and bringing in different operators together. On the UK side there hasn't been anything yet that has directly come and said here is the funding competition for mobility as a service, there will be bits in the UK but that is going to be mostly private or business led and it has to be commercial. But sometimes there is a bit of managing the risk involved. So all we can do when we engage

Requires more direction
IS funding from central
government

Increasing revenue through
provision of new
services

Testing out phases
help development of
SC before
scaling

Collaborative project
involving big private
business

Creating new data
sources

Introducing new technology

Handling of data

Creating 'hackathons' to
involve small business
& citizens

Frequency of data allows
for new solutions

Extracting the value
from data

Sharing data has
obstacles such as
data quality

or respond to scrutiny committees from Department for Transport or performance is to say ideally we as public sector would like to enable this, we know what we are doing, what partners are out there but with direct funding we would like to run these programmes.

Eventually, Transport for Greater Manchester will procure a bike share solution but as part of that we want to look at how we can manage all of the costs and obtain capital flexible schemes and look at what revenue and commercial opportunities it can bring in. But we would like the opportunity to do things like this to test out what works and to make sure you are developing something that is sustainable and you can adapt it. With these solutions you create commercial products that you can then retrofit onto other system everywhere.

R - Is that (points to work on the table around Manchester's internet of things infrastructure) British telecomms supplying the data hub?

D - Yes so in terms of the tender Cisco are the main project leads for the whole project management structure of it and British Telecomms role is focused on the development and creation of the data hub. SO on our side we will be looking at the new data sources including sensors, tracking devices, smart locks and smart docking stations - everything you can do if we get the funding - we will test it all out and that will be new data fed into the hub. The hub will have all this new data from all the different projects but it will also have existing data from traffic systems, ordnance survey is a partner and they are giving all of the latest mapping products and data layers as a base. And then that will come out to the other side so we will have in one case cycle hackathons and we have got the Manchester technology companies and application developers on that side. So for cycle share we will say things like we want to improve cycle safety, here is all this new data we have real-time tracking, what can you do with it? We have got bike share but distribution and redistribution is a big issue - here is all the data how would you address that through innovation solutions and stuff. So it is just getting this available and the idea is to make most of this data, or as much as possible, open source as well.

R - That is something I wanted to pick up on was the open source and whether there was that open ethos in Transport for Greater Manchester?

D - I think in our case there generally is but the problem at the minute is that reliability, frequency and coverage of data. In some cases you almost need some of these products to give you a stream

15.

Developing constant
streams of data
at new frequencies

that you want and have always wanted in the first place. So there is some stuff that is available that is static information and it is probably not as useful for some of the things you would like to do. but this project again gives you the opportunity to create real-time streams.

R - So all of this investment is enabling you to have new data streams, with more real-time information at different frequencies, which then you will have a whole new abundance of data really to then take on develop further?

Learning from previous
project designs
"Guinea Pig"
approach

D - Yes because having taken a comprehensive view of the whole bike share operation, design, provision and stuff if I was to start again to develop a solution, how would I do it differently? And how would you make it so that it pulls in as much opportunity as possible. You would start with first, is a docking station needed? Technically not but you would probably want high visibility communal cycle parking so that you can place the physical branding on there and have commercial opportunities that way. Everything is so low powered these days that you don't need cabling on posts and solar panels. The London scheme is extortionate because you are taking up a highway fitting cables in and doing all kinds of new work that way. It is almost as if they over engineer when they don't need to. Whereas the Liverpool scheme is really flexible where you have bolt down and take up. But what we are saying is OK that's good but what other technology can you add? There are night beacons and then shops that can pick up movement to engage with customers and then once a user is on the bike you can link them with shops and discounts and offers. So one of the potential add-on's could be that at the minute Liverpool's scheme is pretty good but you want to remove as many customer steps as possible so that instead of attaching your phone it recognises your phone and recognises you and links to maybe your PayPal or Google Pay.

Introducing new technologies

Layering of projects
provides new resource
opportunities

"Guinea Pig"
approach

Adding technology to
existing schemes to
improve

R - A seamless experience almost.

Creating seamless experience
via new payment
methods

Integrating new projects
with existing technology

"Guinea Pig"
approach

Too much technology but,
phasing in strategy
required

D - Yes and there are some developments and companies looking at how you can attach your phone onto the bike and as you are cycling it is charging your phone through kinetic energy. Now once that is in that will be the phone also fixed to the bike where you can display all of your navigation and applications. So there is a lot that can also happen in terms of innovation going wrong. An example is Copenhagen which is recognised as world-leading in terms of bike share but the other year they pushed too hard in trying to create a fourth generation solution. Now what that enabled was putting

Trialing period essential
to gauge success
before investment

iPads attached to bikes, at great expense, which they didn't need to do. But after it was demonstrated and trialled for a while there was far too much damage and vandalism resulting in cost and expense.

R - So too much innovation could actually be bad?

Introducing new technology
to provide new solutions

D - Yes because my whole focus on all of this is to get a low cost, scale-able solution or series of solutions such as smart locks and connectivity with phone tracking as well as other things. But it has got to be really low cost and you have got to understand the purpose. In that case the purpose is that we want to be able to have tourists come along, take the bike, and be taken along a route.

Creating a purpose for
the project

Therefore, if you just created something whereby the tourist could attach their phone and you waved roaming charges at an expense to provide an app then you have done the same thing at no extra money or expense. So it is thinking about what you would like to do and then about costs and how you can manage it better. So there are lots of things you could do on just that example of bike share to make it far more viable. If you did the gamification then you are attracting people that may not cycle and our whole objective is to get more people cycling.

Increasing usage of
project

Incentivising people to
shape behaviours linked
to outcomes

R - Is that a Transport for Greater Manchester objective or a city objective?

Current gathering of data
doesn't provide quality
data

D - It is from the transport strategy that aims for more cycling and more walking. And then you will have targets within those. What tends to happen is at the minute you will have a cross-city handful of automatic cycle counters but they are in fixed locations, sometimes random locations, and if the cyclist rolls over it will count the cyclist. But that is only giving you a really very vague snapshot of the picture. So you can set targets of 10% growth by such a date but it is probably based on data like that so you might not make any real insight as there might be more cyclists in the next street. So again if you need data you can do tonnes of things such as traffic signals, you can then prioritise flows and improve safety. In London for example there have been a lot of heavy goods vehicle cycle collisions but if you have got a cyclist that has been detected in real-time then you can start to link that data into satellite navigation displays to prompt that driver in advance.

Designing projects to
collect data for city-wide
assessment

Better quality of data
results in better solutions
& understanding

R - And looking into the future I suppose there will be automatic breaking eventually for the next generation of autonomous vehicles.

17.

Creating new data to
create understanding

Extracting the value of
data

Technologies constantly
evolving means
create a focus for
development

Extracting the value from
data

Using data to create
value within the
data

Analysing data

Central gov. needs to take
more leadership

Funding aimed at outcomes
not current model of
solutions to fit funding

D - So there is endless stuff that you could do with the data stream but it is just that it doesn't exist yet. And if you have got that data stream then what can you use that for? You start to think about the data. I think that is another point to make that you get some companies that focus on their product, they say we have got this device and you can attach it any bike and it will track that cyclist. But that product is always going to be replaced or there are different costs and different pricing so the real value is in the data. If one company comes in and says we will take the data from all those different products then actually the value is in the insight of you can do this a,b,c,d with all that data - that is where the real value is. Because even with all this technology there is always something else.

R - So the value is not necessarily on the technological solution itself it is from the data that is produced from it and the insight that is created? So then it is about how you use that data.

D - Yes it is like the application of that data. For us it is a case that we need something to start with so the first product is the value but then somebody else may create something cheaper at a different price so it is the value not in the product but in the data and how you use it.

R - That is all great stuff, is there anything else you would like to add?

D - I suppose there is a lot of stuff that could be done in terms of guidance from central government to Merseyside and Greater Manchester.

R - Maybe taking more of a leadership role?

D - Yes and equally you almost want to equip public sector. Because we know locally what our objectives are, what our priorities are, when you look at the network and where the challenges are. So ideally you would want the funding to come to us to set the challenges and we can still do Innovate UK type challenges but you can frame it to your particular need. Because sometimes you are shoehorning an idea into a funding call which may not be appropriate.

R - So an approach whereby central government funding is filtered to the regional area who then distribute it as they see fit in terms of meeting their challenges?

Diversification of funding
will help development

Phasing off projects with
future in mind

Digitisation creates
opportunity for better
solutions

Designing projects with
new technology to
reduce costs

D - You can still do both but it is just that at the minute it seems to mostly just be one way. And I think there is a danger with all of the funding coming from Innovate UK because there is just so much criteria and restrictions applied to that, that it narrows down the potential. I don't think there is anywhere yet that we could approach to say we would like to develop a fifth generation bike share solution - you would probably get one element of this but it is not the whole solution and as long as a need is set out by possibilities, because that has got potential commercial value from lots of companies. I suppose to conclude the main thing for us is managing costs so car clubs, flexible digitised solutions means we don't have to pay for signs and lines which cost about 5-6 thousand pounds per piece for each bay because there are so many regulations. And you have to maintain those as well as them being fixed so you can't move them around to fit demand. You also cannot scale up the solution because you have got to find the space so you can remove capital costs, infrastructure costs, reduce costs and then you can manage your on-going operational costs just through better usage of data. And then using the data to maximise incomes in order to remove all potential costs to the public sector but still achieve your overall objectives.

X.ii.v Interview (E) Initial and Focused coding

1.

Initial coding

Red Ninja (private) Interview Transcript

06/09/2016

Researcher – (R)

Participant – (E)

R - Thank you for meeting with us today. I just thought it would be good to start with a background as to what it is you do here at Red Ninja with regards to the smart cities sector.

- Private sector company
- Technology background
- Newly formed company
- multi-disciplined range of background
- Operates in IC sector
- Hardware tech to capture data
- Software tech to interact with customers
- SC outcome to citizens
- Use local city for local solutions
- City as a test for projects
- Innovative approach
- Test in city, scale to others
- Cities as networks
- Targetted IC service to sector
- Increasing interaction with people
- Targetted at visitors
- Had to gather data manually
- No existing tech to gather data
- Manual collection of data
- Created long process
- Data created a product
- Business model for new environment
- Outcome based
- Needed better data to improve
- Citizen involvement in design phase
- Application pull approach
- Citizen feedback in design

E - No problem. So my name is Lee Omar the CEO of Red Ninja. Red Ninja are a design-led technology company based in Liverpool. We have been operating for five years, formed in May 2011. We are a multi-disciplined team made up of designers, software engineers, electrical engineers, data scientists and industrial designers. So we can make physical hardware products such as sensors that use data for smart cities and we can make software products as well such as apps and websites. So we got interested in smart cities around 2012, early 2012 because we were interested in making mobile applications to improve peoples lives in cities and our city which we live and work in is Liverpool. So we thought we want to start using Liverpool as a test-bed or lab to test new innovations, new ideas and new technology. So our thinking was if we can make stuff work in Liverpool we can scale it to other cities both in the UK and abroad. So our first ever app that we made was in spring 2011 and that was the Liverpool tourism guide app. It was a mobile app for iPhones and androids and the idea was it was going to give tourists a better experience of Liverpool. It was going to link them with services in the city, everything they needed really. And for us to do that we had to do it the hard way. We had to collect tens of thousands of data points manually, for example going on google, walking around the city to find out what was there, speaking to people and getting data that way. And it was a very long way to do things but at least we had made a product using data which we had created ourselves. That was relatively successful, it had over 22,000 downloads and it was £2.00 each so we had very quickly turned into a company who made products and sold them to the general public and that was our business model. We realised to make better smart city applications we needed better data and our next iteration on the Liverpool tourism guide was the 'It's Liverpool' smart city app. So we had lots of interest from people who lived in Liverpool saying they want a mobile app to help them. So they like the shopping aspect of the tourism app but the feedback in the co-creation and market research

- Link between sectors
- Sector service outcome approach
- Still navigating the market
- Adopting business model to environment
- Visionary strategy to SC's
- Expanded services to health
- Technology focused SC at the time
- Not a diverse sector
- Technology push at this stage
- Learn from best-practice
- City networks
- Local approach to local challenges
- Contextual conditions of city
- Before design of projects
- Used data to create an evidence base
- Gathered data from secondary sources
- Cross sector strategy
- Directed solutions to challenges
- Used data to increase evidence base
- New technologies introduced
- Set out purpose of vision
- Outcome based for Liverpool
- Cross collaboration with partners across city region
- Collaboration with business
- Academic partnerships
- Set targets for growth
- Medium-term strategy
- Took a leadership role as lacking at time
- Developed a strategic vision

sessions that we had was why is there no an app there to link us with transport networks? Why is there not an app there to link us with health services? So that got us thinking and then early 2012 we started doing more research in the areas of smart cities so for our first year we didn't know what the term smart cities meant. It was an abstract term to us but we looked into the growing sector and we realised as we got our head around it that this was trying to do some of the things that we were trying to do in Liverpool. We felt at the time our agenda was wider so things like health were not included in traditional smart city communities. So if you went for a conference in 2012, which I did, nobody spoke about health. It was five areas really of transport, ICT, waste, energy and water - that was it. And it was a technology company driven agenda so at this time when we got a feel for what the smart city sector was about we took the knowledge of smart cities globally, looked at what other cities were doing, and we looked at how we saw technology changing but more importantly we looked at the challenges and opportunities that the Liverpool city region faced. So Jordy, my colleague, worked very hard with me to create a 140 page document. Now half of that document was: here is the challenges of Liverpool city region - it was things like health inequalities, child poverty, limited growth compared to the rest of the country, less business start ups, less limited companies, high unemployment - in a nutshell. People dying of heart disease earlier and that sort of stuff. So we took all the data that was available to academics, thinkers and strategic people and planners in the city. So we read all the transport plans, the local economy plans, we read everything, all the health plans, so we were as up to date as anybody. But rather than just outline the problems in one document we spent the second half of the document looking at areas such as big data, internet of things, mobile technology, augmented reality - the sort of stuff now which is relatively common - but this was published in 2012. And we set out a start of a vision for what Liverpool could become by 2017. So it was called 'Creating a Smart City' and it stimulated the start of a twelve month co-creation or consultation period where we had this document, done the research and we presented it to key stakeholders in the city in each sector. We presented it to vice-chancellor at Liverpool University, director of the local enterprise partnerships, smart city leads in the council, health people - all the areas we wanted to work we presented it to and asked for their inputs on how do we get to this vision of being a smart city by 2017. And what did that actually do now we are in 2016? From a business point of view we were bold enough to stick our neck out to say we need to do something in the city and that polarised some people towards us and we got a reputation of being forward thinking but what we had to do was actually turn those

3.

- Good pre-development phase
- Lacking in implementation phase
- Public sector resources a factor
- Governance problems
- Reducing costs an obstacle
- RJ not taking leadership role
- Politicist results change
- No funding available
- Opposition to sharing data
- Produced new initiative for open data
- Improve partnerships
- Promote open data ethos
- Frequency of data an opportunity
- Gathered data from other sources
- Frequency of data an opportunity
- Provide product/service via data
- Usability of data an issue
- Non-standardised format
- Frequency of data app
- Developed a prototype
- Tested out possible products
- Opportunity of products due to open data
- Development of partnerships
- No return on investment
- Increased exposure
- New network relationships
- Creation of prototype for future demonstration
- Demonstrator improves future investment chances
- Product development re. new technology
- Expanded to other cities
- Partnerships built through academia
- Collaborative projects
P-P-P

ideas and fledgling seeds of a smart city into action and that was whole different ball game. So I guess Liverpool is a poor city, the public sector is facing major cuts, there is probably structural problems as to the way it is run anyway and I think there is a lot of inefficiencies in the public sector so when someone is coming along and saying be bold and innovate, a lot of people don't want that. I think the vested interests in some of the large public sector bodies are set up to resist change so nobody was going to say lets do this, here are some budgets you can work with or open up the data. So we did everything on our own and created open data Liverpool in 2012 or 2013 and found some data sets ourselves and published them on the internet. We approached Merseytravel and said why don't you open up your real-time transport data? And they ignored us for a year. So what we did as a reaction for not getting any traction with the transport sector as we were getting with other sectors was to take some open data from Network Rail because it was our vision to create a real-time bus app. This was 2012/2013, the transport authority were not going to give us the data but we got a lot of the train data from Network Rail. It wasn't really in much of a usable format it was things like location and status of signal boxes and if we knew where the signal boxes were we could overlay that on some maps and work out where the trains are. So we did some clever maths and created an algorithm and created a real-time train app for the Merseyrail network which was part of Merseytravel. So we had gone out there and it was a prototype but it worked. We presented it at some high profile innovation events in the UK and it got a lot of plaudits but the reason why we did that was because we wanted to visualise what was possible with the use of open data and how new products or services could be developed. Through the council we got a meeting with the chair of Merseytravel and presented it to him, he was obviously very impressed and that helped us have more of a relationship with them. That is just one example of a product we made, didn't get any money from people in the city, didn't get any research grants from anyone we just used our own time and worked late to create some prototypes which could be used as a sort of demonstrator for further investment. Or to grow our profile and capability. So this was the context of where we were maybe three or four years ago. Because we started doing stuff like that and we created some internet of things products with ARM we were getting very good at this sort of stuff. We started to work with other cities around the UK so we worked with Milton Keynes, some work with some of the London boroughs, Lancaster and a lot of our partnerships came through academic relationships that we have had and the first collaborative project we worked with a council in Liverpool, the university and us. It was a project called 'Open

- Use of technology in solutions

- Provides new data
- Increase citizen involvement
- Improve interaction
- Prototype before full development
- Provided citizen involvement
- Citizen centric outcomes
- Using data to increase awareness
- Partnership with LCC
- Open data ethos
- Data creating the product
- Gather data from new sources
- Product reducing costs
- Cross-sector involvement
- Prototype approach
- Evolved demonstration of value
- Co-invest in research projects
- Commercialisation of products
- Data imprint in process
- Health sector involvement
- Technology to provide new services
- Cross-sector discipline
- New partnerships/networks
- Sell hardware and software
- Hardware collects data
- Software uses data
- Make value from data collected
- Cross city networks
- Use of data to provide service
- Technology push up products
- Cross-sector outcomes in health and transport
- Open data underpins projects
- Development of partnerships important
- Public sector business model
- Adapt business to data environment
- Outcome orientated design

Planning' so in a nutshell the hypothesis was how can we use mobile technology, data, to try and democratise the planning application process? We created a prototype that took planning data, visualised it on a mobile app in a nice way, and enabled anybody to get involved in either objecting or supporting planning applications in areas which they were interested in. So it wasn't reliant on you knowing about a development because you had seen a sign outside of the development. The data finds you. That was the start of us working in a good way with Liverpool Council. That led to another open data product which we commercialised, because we were going to use planning application data, we were able to create an application that advised one of the big six energy companies how they can save money through distributing energy. So having the correct electric network and we used some machine learning and open data to do that. That was 2014 so we are starting to go from prototyping stuff just to prove we can get value to co-invest in some research projects to creating a prototype to actually commercialising our knowledge with a big company. That journey took two years so we are very interested in data. In smart cities now, and I include healthcare in smart cities, we are working with the NHS and they are probably our biggest customer. So we use internet of things technologies and mobile technology to create health apps. We work a lot in the transport sector so we have developed a product that can help transport planners in cities and we won the smart city expo innovation prize in Barcelona for that in November. The prize was to work with 'Ferrovial' who are a big Spanish infrastructure company and they own companies like AMEY. So our first customer for that product in Spain is the Madrid council who we are selling the sensors and the service to. We have created sensor for hospitals to prevent falls, we have created sensors that can connect patients across two hospital sites using secure networks which also uses mobile technology. So we have got to the stage now where we have grown pretty fast, there is 15 of us now, and we are based in Liverpool but we have got staff in Cambridge and London, we work on several European projects and Innovate UK projects. We have probably created about between 12-15 products for clients and we have co-created five of our own bits of intellectual property for ourselves, normally with partners. An example of projects we are doing at the moment is in the smart city/health/transport space and it is driven by open data in a transport sense but also in a health sense. So this wouldn't be possible if we didn't have such good relationships with people like James Noakes from Liverpool City Council and the hypothesis is that we can reduce the amount of time that it takes for an ambulance to get to A&E for people who have had a heart attack or stroke. So currently they need to get there within 5 to 8 minutes

5.

- Outcomes based on sectors
- Business model adaptation
- Collaborative solutions
- Integration of technology
- Provide services to the city
- Pilot test in cities
- Demonstrate impact and expand
- Co-investment with central gov
- Large investment required

- Early research before proposal
- Funding essential to realisation
- Product provided as a service

- Built strong relationship with city
- Trust issue of data
- Dealing with sensitive info
- Strong vision in place
- Need to have a purpose
- Outcome for social good
- Social value strategy
- Technology role in impact for good
- Opportunity of tech not realised
- Big data agenda not utilised
- Data analytics has potential
- Have to direct that potential to be outcome based
- Technology used to improve lives
- Outcome based towards citizens
- Need a purpose
- Need a vision/strategy in place for city
- Strategy to be locally context-realised
- Responsibility in tech companies
- Challenge of business model adaptation
- Adapt to new environment
- Create value in projects
- Think ahead to commercialisation
- New services for new world
- New solutions for new world

otherwise they have more chance of dying. So these targets are based on health. So we are working with the North West ambulance service, siemens, the transport systems catapult, future cities catapult, and imtech. The way we are going to get the ambulance to A&E faster is control the traffic lights and create a smoother path for the ambulance. So that is something that we very proud to work on. The plan is to pilot it in Liverpool and then Manchester and then look at commercialising it in other cities. And that is great that we are doing that. We have co-invested in it so we invest 40% of the money and we get 60% investment from Innovate UK. With all the partners it is a £600-700,000 project and I see that as a nice stamp of where we have come as a company and as a city over the last 4/5 years. We had been talking to the people in the traffic team about doing this since 2012. They told us we think this is possible, we did some early research and development and we could never quite get there but in this case we were successful with some funding and hopefully we will make a product. And we have been able to do that because we have a good relationship with the city, they trust us with this data, very sensitive data and we have a good relationship with the NHS who trust us with sensitive data because they can see our vision for trying to create something that has a social good. So all the work we take on has some sort of social good and social value and I guess that is because my background in the human rights sector for 11 years. And all the team here are very committed to doing some good with technology. So what I see in technology companies globally, and I can say that as I work in Silicon Valley to work with companies such as google, I see the smartest people there working as hard as they can to get people to click on an advert. And that is how big data and analytics is being driven. You have companies like amazon, facebook, google and their business model is to get you to click on something but these techniques and skills can be learnt by anybody and I see our opportunity here to use some of those cutting edge techniques to try and improve peoples lives. And like I said earlier we know what the challenges are of people in cities, I don't necessarily think a city like Liverpool needs to have a smart car parking system, I wouldn't say that is top of our priority. I would like to see some sort of use of innovation not necessarily the technology but to not have 90,000 children who are in poverty, not having thousands of children who are hungry because it is the summer holidays. I think that is what innovation companies should be trying to solve. The real challenge is tagging it to a business model because the technology can be created but that is our challenge now. I think if you can create value and part of your research and development is seriously thinking about how you are going to commercialise it then you can create new products and services that fit into this world. I think the

- Too much technology focus
- Technology push taken over
- Need outcome based on city
- How to fund projects on issue
- Cities not interested in current business model
- Need to create value in projects
- Who benefits from the project
- Adopt business model to social value
- Large companies facilitate development
- Think about business model after proving value
- Commercialisation of project
- Capture usage before business revenue
- Business model adaptation
- Return on investment a challenge
- Collaborative roles
- New environment requires new company
- Partnerships required for success
- Need P-P-A to succeed
- Partnerships in SC initiative to work
- Role of technology in formulation
- Private companies need to adapt
- Social value of projects
- Local solution to local problems

- How is data captured
- Joint partnership ventures

falling of the smart cities sector is that it has been too technology driven, you have got smart-ish people saying you need this bit of technology to make your city better. And the next question is who is going to pay for this? I don't think that is the smartest way of looking at it and I think cities are not buying that model. I think you have got to look at where is the value being created? And who is capturing that value? And that should help inform what the business model is. So the example of google is a good one. We all take google for granted now as the search engine, probably use it for email and for documents. When I first started using google when I was at university I got onto it because people said this is a better search engine than the other ones I was using and it was good. I don't think they quite knew what their business model was at that point, it was just let's get very good at search. And then they later found their business model which was to create a great search engine that was driven by ad revenue. So I think the smart city companies need to be creative with their business models and that is the challenge. And until we get smarter companies who do not just look at the old model we are not going to get smart cities. And I think there is a role for the public sector as well as the private sector and voluntary sector and academic sector to play in that I think they genuinely do have to work together and have different conversations. And I think we are seeing the start of some of that in Liverpool with some of the people you have interviewed. These are the people and the good thinkers and I think you are not going to get smart cities unless you have that triple helix approach. When I talked about that example of the open planning app, that was the local government, the university and the business and we all had a stake in it. And we created something that has helped us all and until you get those partnerships I don't think we will get to where we need to go. Yes so headlines are we make technology, we are private company who has got social values and we are very firmly planted in Liverpool.

R - That's all great. Many of the questions I had you've actually answered there so thank you. I'd like to pick up on the social aspect in a minute but before you do, I would just like to talk a little bit more about the first application you did in 2011 and how you had to collect the data manually.

E - So where did we get the data points from? We did a joint venture so we owned 50% of it and the other half was owned by a man who used to work at the council. A historian was possibly the best way to describe his role, but he was one of these people who was very very passionate about Liverpool. You get these people who know everything about Liverpool, for example he would say, we were the

7.

- Role of technology then not prominent

- Manually collect data
- Long process due to no technology

- Collected data via walking crowd
- Not efficient capture process

- Role of people taking leadership
- Open data ethics important
- SC initiative for open data
- Private led where city wouldn't
- Clustering of datasets
- Distribution of data for sharing
- Data was not valuable
- Data was of low quality
- Requirement to share more data
- Obstacles to gaining data

- Lack of data hindered SC development

- Manual process to collect data
- Long and inefficient gathering of data
- Lack of technology integration
- Lack of data sharing
- Frequency of data issue
- Resulted in a bad experience
- Hindered the progress of the SC

first city to have a wet dock. He was one of those guys and he was super informed about his city. In 2002 perhaps 10 years before we started he produced a CD - which shows as you can't even stick them in your computers now - but he created a guide to Liverpool and it would have data on such every statue in the city centre he knew what it was, he knew the significance of it, he knew the date because he was passionate about he went out there got on his bike and did it. So he had things like that but he literally spent weeks, when we would be working on designing and coding he would go out and take 200 photos of tourism destinations. He was almost pounding the streets and that was the way we were getting the data perhaps of hotels or restaurants.

R - I suppose at that time you had to really. I just want to see maybe now some of your insight of what has changed between now and then in terms of if you were to source data how and where would you do it?

E - So I think because of people like James Noakes at the council you have got someone who understands open data. So when we created Open Data Liverpool - and again we did that almost as a provocation to the city to say we are going to take our money, gather some data sets - stuff which was public anyway but not easy to find - put it on a site and create a twitter. And the sort of data that was there was nothing valuable it was more just like here is a start. I think the city needs to open it up, by the city I don't just mean the public sector but private and academic as well. So back then you could collate stuff in a portal which was already out there but are you going to get something that innovative? Probably not. When I think we got the innovation, or should I say probably in the middle from getting the tourism guide to what we are doing now with the ambulances, this is a good example. So when we wanted to open up the transport data we couldn't even get the data of where is the 96 train stations in Liverpool and where are they? Where do you put them on a map? So we had to go to google for that information and we did some manual searches and started finding the longitude and latitude of google and we would do things like draw train tracks between the stations which might not be perfect but you could make an assumption and work out where the train is going. So just to produce something as simple as a map with all the trains in real-time going between the stations was an incredible amount of work. You had to find all the data yourself of where the train stations are sort of work out where the train should be based on the open data we did have which was signal boxes and sort of link it all together. And it was doable but it took us a few months. That data is somewhere but we

- Lack of access to data
- Needed data to power product
- More access to data
- Stronger partnership approach
 - Improved situation
 - Better facilitation of SC development
- Opening up of data
- Lack of strategy in council
- Hindered SC development
- No sharing of data hindered progress
- Technology allowed new capture of data
- Prolonged process due to lack of sharing
- Development of education re open data
- Altered attitudes in gov.
- Political issue of open data
- Hinders progress of SC development
 - Data ecosystem complicated
 - Access to data resulted in SC initiative
 - Data improves understanding
- Enables vision realisation
- Data integral to project success

didn't have access to it. So that was a bit better because network rail opened up some of their data nationwide. So we just took a little corner of their data to try and power what we were doing. So we mashed up their bit of open data and our found and created data including algorithms. And then you have got a product. The next one was the open planning app so this time it was different. We went to the city as part of a larger consortium that was funded by academia, we came late to that as they already had collaboration agreements in place, already had the buy in from the councils so everyone was bought into it and that was a lot easier. So we said OK we need this bit of data, make it happen and they were open. The actual reality of getting that open data was very very difficult so it wasn't like it was stored on a server somewhere for us to pull down, it wasn't as though it was on a disk or a spreadsheet, it sort of didn't exist in a place anyone in the council could get access to. So lets just say this planning application data, the really valuable stuff a third party supplier had it, who had no interest in speaking to us really because their business model was they wanted to see out the contracts with the council because of the services that they are meant to deliver. So we were fobbed off but as you have probably seen from our approach we did not let that deter us so we had to create a work around, a bit of technology that grabs the data, almost going in through the backdoor to get it. It is not doing anything wrong it is just using techniques such as scraping and we had to do it the long way but again we got the work around and because we had that work around it led us to the energy app. So we are going from nobody understands what open data is to us being in a position where we are educating the local government that if you open this data up you can provide a better service for your citizens to them saying yes we want to do this but actually we can't. So maybe you also have the political will. You have got the will of officer level but it is a little bit like you are asking them to influence a supplier which the officers you are working with have no control over the contract. So it is big issues. So we still made the products that added value and where we are now, where we are given huge data sets for the whole North West of England around where all the ambulances are for the last year and some sensitive stuff and also the traffic management data - were we know where all the congestion is - we've got an understanding of what controls the traffic lights, this is being getting opened up and we are in a privileged position now. We are pulling all that together so it is our vision which is saying we need this, no? OK we haven't got this yet can you get it? Somebody put some pressure on somebody to get it. And that has taken, so that would have been Liverpool tourism guide I think in August 2011, the life project started November 2015. So you are talking four and a half years to

9.

- Open data movement
- Value of data to citizens
- Value of data to economic growth
- Collaborative approach
- Develop external partnerships
- Public sector need to take leadership role

- Private sector more open to innovation
- Public sector not adapted to environment
- Political issues resist change

- Provision of new services to improve lives
- Products to improve lives
- Private sector facilitated better

- Progression in use of data
- More opening up of data
- Liverpool falling behind
- London + America best practice

go from nobody understands what open data is and what the value is to both citizens but also about it driving economic growth to some people in the city get it and we can work together. And that is because we are working with some smart people in academia, we are working with some smart people in the public sector, people like Kevin Toye who you have mentioned - visionary guy gets it. Unfortunately you sort of want people like him to be in the public sector. We met him when he was in Liverpool council and there are other great people like that who worked in the council or public sector driving innovation around health and social care. I think what happens to those entrepreneurs who have got the ability to help create that value they move on quite quickly because they are disrupting a big Goliath from the inside and people don't like that. I guess the public sector bodies have got empires and vested interests and when somebody comes around and rocks the boat they will do it for a few years and they will probably get frustrated and it is to the stage where if they are like us and want improve people's lives and create new products and services then they are probably better doing it outside those organisations.

R - That is a good point you make. I myself worked for a year in the planning department and the difference between what I'm doing now and the world I can see developing compared to what it is like in the public sector is massive. So to pick up on something you mentioned with regards to data and the access to data. It is really interesting you provide a unique insight from where you was in 2011 compared to now and I just know myself from looking for this data that we are going to use were we had to look to London to access that data from their data store. It was the most easily accessible data and although it would have been great to have done something on Liverpool we couldn't.

E - What was the data?

R - It is a health data set - probability of loneliness in over 65, and transport data - access to public transport. And the reason we chose those two was because they are placed in a standardised mode which means they can easily be compared and analysed. The aims is to investigate and see how each data set affects the other and what services could come out of that.

E - Yes. We were the same as the first but of data we used was the network rail data and it just so happened to crawl into Liverpool. But if we were based in London, San Francisco or New York, we would probably be telling you a completely different story as we would

- Roadmap ahead

- Open data is valuable to SC development

- Value of open data realized

- Data for transparency
- Data provides better services

- Gov. needs to take a leadership role

- Political resistance aspect to open data

- New environment in UK

- Reluctance of public sector to adapt

- Political aspect of open data

- Lack of partnership development

- Competitive aspect to SC development

- Sharing data increases SC development

- Data can improve services

- Social outcomes to projects

- Develop cross-sector partnerships

have loads of interesting apps for those cities. But we are starting much more behind here.

R - So in your view do you think open data has a positive effect on the development of the smart city?

E - Yes so I think open data as a concept I guess has been around for 10 years. And it was New York and San Francisco who drove it. But really it didn't become a thing in the UK until I guess 2011 or something like that. And it was originally one of those things that the last (coalition) government had some iffy policy shall we say but take my hat off to them there they said we are going to open up this civil service data really and push for it. And the reason they opened it up was to improve transparency and you will get better services, I think that still stands true today. I think in typical British style the civil service didn't want that and I know the guy who put it through and he said he had to get a letter off David Cameron the prime minister to be sent to the senior civil servants to go you will do this. Because I think what Whitehall does is the 'yes prime minister' sort of cliché - they are not going to be transparent with anything, that establishment is the opposite of transparency it is about keeping things under hat, its the status quo. And I think we have seen that with disruptive agendas like the government digital services I think that is a really positive thing for the UK to be involved in. But I think it has not had the effect it should have probably because of that Whitehall agenda to not change. Shall we say senior civil servants in Whitehall do not want open data, they do not want more transparency of services being on websites. Ultimately because it means parts of civil service budgets coming out of that traditional ministry or department and going to some IT type company. And I think that scares them and I think until we get our head around that as a country that we have got competing interests within our country we are not going to get the true smart cities. But I think yes if you open up data you get smart services without doubt. We see bad services all the time and a lot of it is because of bad data.

R - So just to move on then, this is quite good for the services aspect of smart cities and I know you have spoken about your social value in the projects you do but what role do you see data or big data playing in that and what opportunities or obstacles are there?

E - Yes so to talk about some of the more socially minded projects we are doing, we are working on a project at the moment that is co-funded by the European Union and we are working with a food poverty charity in Liverpool called Can Cook. We are also working

11.

- Development of partnerships
- International scope
- Targetted outcomes at specific users
- Need to adapt business model
- Use of data in SC development
- Need analytics in place to understand data
- Increased interconnectivity
- Use technology for social solution outcome
- Adoption of new business models
- Technology allows new opportunities
- Targetted outcomes of projects
- New technology new opportunities
- New insights through big data
- New business models emerge
- Localized solutions
- Targetted outcomes in projects
- Access to skills in start-ups
- Lack of funding opportunities
- Flexible approach to solutions

with the Frown Profit Institute, Soneye the biggest retailer in Portugal and some partners in Holland. The problem we are trying to solve is older people get malnutrition because they are not eating the right stuff at a certain part of their life. And when they are not eating the right stuff or drinking enough they are more likely to fall or more likely to go into hospital. This is a problem, we know it is a problem. So we are using our skills in design, so we are doing co-creation sessions with end users both from affluent communities but also poor communities because we cannot just be social for the sake of it we also need to try to figure out a business model. We are doing that in Liverpool, Lisbon and Holland so we will create a product at the end of it which uses some sort of big data algorithm to crunch a lot of data around what people eat and the nutritional value of that data. So we should have some sort of mobile app that connects to people who make or sell food and there will be some sort of service that connects the people who make or grow or cook food with the older people who need the food and a bit of technology needs to sit in the middle. It needs to be a cheap business model because we are looking at people who will be in food poverty situations but I think if perhaps we can work out ways for some sort of business model where people can get together and buy fresh food in bulk which is maybe grown locally, then get packaged in a way that goes through this app and gets delivered. Then perhaps we can solve some of the problems around nutrition and bad diets. So that is a classic sort of red Ninja project really where we are using our skills in design, we are using our engineering experience in mobile technology but also our understanding of big data and the insight that you can provide from that data. So I think the technology bit just sort of disrupts the traditional model of services such as meals on wheels or if you live in a poor area the places you can probably eat are going to be cheap fried chicken, chips, burgers, kebabs and it is all nice stuff but it is bad for you. And I think some places are in poverty areas where they don't have the options to buy some of the food that might be cheaper but there is no fresh vegetables for them to buy at the right time and at the right price. Another one where we are trying to tackle activeness in older people is the problem we have identified is you have got companies like us, not just technology companies but SME's or start ups, we struggle to grow in our early years because we don't have enough access to relevant skills and resources. A good example with me is very creative, I can knock together an app or design something but I am not very good at accounts so you have got companies like us who are growing and need help or it could be a one person band or anything, and then you have got older people who have retired who are skilled. An example could be a retired accountant and you have reached an age in your life at retirement

- Targeted outcomes for social good
- Social value impact
- Internal partnerships
- Improving connectivity of people
- Role of technology in improving lives
- Increased connectivity allows for new opportunities
- Solutions to societal problems
- Targeted solutions at specific problems
- Local solutions to local challenges
- Social value of projects
- Risk element involved
- Innovative approach to problems
- Implementation of VC initiatives
- Private sector leading implementation
- Local solutions to local problems

where society has said you cannot add value to the economy anymore. And that is wrong because you don't just get to 65 and not be good at accounts and I would love to connect to that person. So the product which we have collaborated on is called time to share and essentially it just takes those two groups of people and matches them up. We are in the early stages of the pilot at the moment and we have worked with companies in Cyprus, Spain, Holland, Romania and the end-user group who work in Stockport so that is interesting. The ageing population we are very interested in we have put free WiFi in a residential or assisted living place this year. We have put it in for free because we wanted to have a trial to prove to the housing association that if you give people the internet they will have a better life and when I met them they said they want to do a launch to try and show them the benefits of the internet. I get the analytics so I know they are all on the internet using mobile phones or tablets and 40% of the time they are going on youtube so they are doing what me or you would do, this is not a thing you need to sell you just need to connect them and they will have a better life. And OK they're life may not be better off just by watching youtube videos, although I would argue it would be, but the next stage is for that housing association to say OK how can we supply the appropriate tools for these people. Maybe it is those connecting to apps that we spoke about but I think as we try to tackle every problem, such as the ageing population, you can make great apps but if they haven't got the connectivity they cannot afford to do it. And there is a whole stack that we have got to change. And I guess what our social values do is it allows us to take more risks, we are not a company who specialise in putting WiFi in places we will just call BT or Sky and say put WiFi in here. But we used our innovative type approach and worked out how to do it, you just have to connect to the fibre outside, put some routers in, and you have got a whole stack of people you have to pay. I guess if we didn't believe in the stuff we were doing we would not have taken that risk. It might not work but we see it as an investment that if we can prove there is something there then hopefully we will get to work with these people. So I guess there is a lot of stuff like that which we do. We have 10 projects on at the moment that all have social aspects and are around improving the health of children with anxiety or mental health problems. Improving the lives of the ageing population, improving the lives of mothers who have sick babies, trying to reduce falls in older people. So it is all social and I guess maybe that is a representation of where we live. Perhaps if we live in Canary Wharf we may be making Fintech but I guess we are a product of our environment.

13.

- Data plays role in increased decision capacity
- Data better informs decisions
- Cross-sector SC projects
- Network partnerships
- Private facilitating public
- Using data to inform evidence base
- Data value in informing future decision making
- Using data to inform policy
- Integration of tech to environment
- Increased data gathering
- Role of data in informing future decisions
- Improved data gathering
- Improve decisions based on increased evidence base

R - Just to conclude the interview I have one question that is really open-ended. Does more data necessarily mean smarter decisions, or is there more to it than just that?

E - That is a good question. I would say yes. I think in any decision you have to make whether it is your boring domestic decisions based on how you run your house or life, taking out to running a company, to a department or a city, from a personal point of view the more data I have got on things the better decisions I can make. The more informed it is. Otherwise you are guessing, one of the first transport smart city projects we did in Liverpool was for Merseytravel so we raised all the money and Merseytravel were like a customer who got the product for free and they were interested in the area we are sitting in now - the Baltic Triangle - there is no bus stop or train station but you go outside you will see lots of people. There are 650 people in this building, a school next door so thousands of people are here. The only public transport stuff is bike racks which is great and I use them everyday but what Merseytravel wasn't sure was is there a business case to put bus stops or open up the derelict train station over the road. And their policy and planning team did not know that data apart from using surveys so we put a couple of sensors around just to see how many people are going from A to B and there was a lot of people and that data is different to the data they have got now which is anecdotal. They could maybe send somebody with a flip board to ask some questions and you might make the right decision or you might not but hardcore data when you can see a trend from A to B should make it easier to make the right decision. I think the decisions the city have made around the last few years with transport are interesting, I know the bus lanes got scrapped. Now to me that was wrong because I believe a bus should get priority because it has more people on it. I don't drive a car, I want to live in a city where public transport is good and I am encouraged to walk, cycle, get bus's, get trains like Amsterdam is and I think you are going to make it harder to use public transport then you are encouraging more people to drive cars which is unsustainable. Now I don't know what data that decision was made on but I think in the modern world there has got to be a better way of doing it than that.

1.

Focused coding

Red Ninja (private) Interview Transcript

06/09/2016

Researcher – (R)

Participant – (E)

R - Thank you for meeting with us today. I just thought it would be good to start with a background as to what it is you do here at Red Ninja with regards to the smart cities sector.

Private sector technology company

Cross collaboration skills

Producing technological solutions with outcomes aimed at citizens

Using city to test out projects

Digitising new services

Manual collating of data long process

Improving quality of data creates better solution

Citizen involvement in product design

E - No problem. So my name is Lee Omar the CEO of Red Ninja. Red Ninja are a design-led technology company based in Liverpool. We have been operating for five years, formed in May 2011. We are a multi-disciplined team made up of designers, software engineers, electrical engineers, data scientists and industrial designers. So we can make physical hardware products such as sensors that use data for smart cities and we can make software products as well such as apps and websites. So we got interested in smart cities around 2012, early 2012 because we were interested in making mobile applications to improve peoples lives in cities and our city which we live and work in is Liverpool. So we thought we want to start using Liverpool as a test-bed or lab to test new innovations, new ideas and new technology. So our thinking was if we can make stuff work in Liverpool we can scale it to other cities both in the UK and abroad. So our first ever app that we made was in spring 2011 and that was the Liverpool tourism guide app. It was a mobile app for iPhones and androids and the idea was it was going to give tourists a better experience of Liverpool. It was going to link them with services in the city, everything they needed really. And for us to do that we had to do it the hard way. We had to collect tens of thousands of data points manually, for example going on google, walking around the city to find out what was there, speaking to people and getting data that way. And it was a very long way to do things but at least we had made a product using data which we had created ourselves. That was relatively successful, it had over 22,000 downloads and it was £2.00 each so we had very quickly turned into a company who made products and sold them to the general public and that was our business model. We realised to make better smart city applications we needed better data and our next iteration on the Liverpool tourism guide was the 'It's Liverpool' smart city app. So we had lots of interest from people who lived in Liverpool saying they want a mobile app to help them. So they like the shopping aspect of the tourism app but the feedback in the co-creation and market research

Using technology to
create new services
in existing sectors

Promoting holistic
approach to SC
solutions

Expanding SC agenda
to wider areas

Providing local contextual
analysis in pre-design
phases

Targetting solutions
to local problems

Creating a strategic
vision to aim
towards

Approaching many sectors
for collaborative approach

sessions that we had was why is there no an app there to link us with transport networks? Why is there not an app there to link us with health services? So that got us thinking and then early 2012 we started doing more research in the areas of smart cities so for our first year we didn't know what the term smart cities meant. It was an abstract term to us but we looked into the growing sector and we realised as we got our head around it that this was trying to do some of the things that we were trying to do in Liverpool. We felt at the time our agenda was wider so things like health were not included in traditional smart city communities. So if you went for a conference in 2012, which I did, nobody spoke about health. It was five areas really of transport, ICT, waste, energy and water - that was it. And it was a technology company driven agenda so at this time when we got a feel for what the smart city sector was about we took the knowledge of smart cities globally, looked at what other cities were doing, and we looked at how we saw technology changing but more importantly we looked at the challenges and opportunities that the Liverpool city region faced. So Jordy, my colleague, worked very hard with me to create a 140 page document. Now half of that document was: here is the challenges of Liverpool city region - it was things like health inequalities, child poverty, limited growth compared to the rest of the country, less business start ups, less limited companies, high unemployment - in a nutshell. People dying of heart disease earlier and that sort of stuff. So we took all the data that was available to academics, thinkers and strategic people and planners in the city. So we read all the transport plans, the local economy plans, we read everything, all the health plans, so we were as up to date as anybody. But rather than just outline the problems in one document we spent the second half of the document looking at areas such as big data, internet of things, mobile technology, augmented reality - the sort of stuff now which is relatively common - but this was published in 2012. And we set out a start of a vision for what Liverpool could become by 2017. So it was called 'Creating a Smart City' and it stimulated the start of a twelve month co-creation or consultation period were we had this document, done the research and we presented it to key stakeholders in the city in each sector. We presented it to vice-chancellor at Liverpool University, director of the local enterprise partnerships, smart city leads in the council, health people - all the areas we wanted to work we presented it to and asked for their inputs on how do we get to this vision of being a smart city by 2017. And what did that actually do now we are in 2016? From a business point of view we were bold enough to stick our neck out to say we need to do something in the city and that polarised some people towards us and we got a reputation of being forward thinking but what we had to do was actually turn those

3.

Implementing ideas into
action a
challenge

Private sector providing
solutions to public
sector

Providing platform for
sharing of data

Designing products with
improvements in frequency
of data

Gathering data a
problem in the past

Introducing technology
allows for better data
frequency

Offering new services
through IC
solutions

Creating cross-sector
partnerships

Prototyping to demonstrate
impact before scaling

Creating partnerships across
multi-sector

Collaborating on projects

ideas and fledgling seeds of a smart city into action and that was whole different ball game. So I guess Liverpool is a poor city, the public sector is facing major cuts, there is probably structural problems as to the way it is run anyway and I think there is a lot of inefficiencies in the public sector so when someone is coming along and saying be bold and innovate, a lot of people don't want that. I think the vested interests in some of the large public sector bodies are set up to resist change so nobody was going to say lets do this, here are some budgets you can work with or open up the data. So we did everything on our own and created open data Liverpool in 2012 or 2013 and found some data sets ourselves and published them on the internet. We approached Merseytravel and said why don't you open up your real-time transport data? And they ignored us for a year. So what we did as a reaction for not getting any traction with the transport sector as we were getting with other sectors was to take some open data from Network Rail because it was our vision to create a real-time bus app. This was 2012/2013, the transport authority were not going to give us the data but we got a lot of the train data from Network Rail. It wasn't really in much of a usable format it was things like location and status of signal boxes and if we knew where the signal boxes were we could overlay that on some maps and work out where the trains are. So we did some clever maths and created an algorithm and created a real-time train app for the Merseyrail network which was part of Merseytravel. So we had gone out there and it was a prototype but it worked. We presented it at some high profile innovation events in the UK and it got a lot of plaudits but the reason why we did that was because we wanted to visualise what was possible with the use of open data and how new products or services could be developed. Through the council we got a meeting with the chair of Merseytravel and presented it to him, he was obviously very impressed and that helped us have more of a relationship with them. That is just one example of a product we made, didn't get any money from people in the city, didn't get any research grants from anyone we just used our own time and worked late to create some prototypes which could be used as a sort of demonstrator for further investment. Or to grow our profile and capability. So this was the context of where we were maybe three or four years ago. Because we started doing stuff like that and we created some internet of things products with ARM we were getting very good at this sort of stuff. We started to work with other cities around the UK so we worked with Milton Keynes, some work with some of the London boroughs, Lancaster and a lot of our partnerships came through academic relationships that we have had and the first collaborative project we worked with a council in Liverpool, the university and us. It was a project called 'Open

Using technology to increase public participation

Designing projects that use data

Sharing data produced via open data platforms

Making use of new technologies to provide services

Prototyping before commercialising products

Building international profile through partnerships

Providing technical solutions to public sector

Introducing technology on partnership projects

Cross-discipline projects fuelling outcomes

Creating links with political governance

Planning' so in a nutshell the hypothesis was how can we use mobile technology, data, to try and democratise the planning application process? We created a prototype that took planning data, visualised it on a mobile app in a nice way, and enabled anybody to get involved in either objecting or supporting planning applications in areas which they were interested in. So it wasn't reliant on you knowing about a development because you had seen a sign outside of the development. The data finds you. That was the start of us working in a good way with Liverpool Council. That led to another open data product which we commercialised, because we were going to use planning application data, we were able to create an application that advised one of the big six energy companies how they can save money through distributing energy. So having the correct electric network and we used some machine learning and open data to do that. That was 2014 so we are starting to go from prototyping stuff just to prove we can get value to co-invest in some research projects to creating a prototype to actually commercialising our knowledge with a big company. That journey took two years so we are very interested in data. In smart cities now, and I include healthcare in smart cities, we are working with the NHS and they are probably our biggest customer. So we use internet of things technologies and mobile technology to create health apps. We work a lot in the transport sector so we have developed a product that can help transport planners in cities and we won the smart city expo innovation prize in Barcelona for that in November. The prize was to work with 'Ferrovial' who are a big Spanish infrastructure company and they own companies like AMEY. So our first customer for that product in Spain is the Madrid council who we are selling the sensors and the service to. We have created sensor for hospitals to prevent falls, we have created sensors that can connect patients across two hospital sites using secure networks which also uses mobile technology. So we have got to the stage now where we have grown pretty fast, there is 15 of us now, and we are based in Liverpool but we have got staff in Cambridge and London, we work on several European projects and Innovate UK projects. We have probably created about between 12-15 products for clients and we have co-created five of our own bits of intellectual property for ourselves, normally with partners. An example of projects we are doing at the moment is in the smart city/health/transport space and it is driven by open data in a transport sense but also in a health sense. So this wouldn't be possible if we didn't have such good relationships with people like James Noakes from Liverpool City Council and the hypothesis is that we can reduce the amount of time that it takes for an ambulance to get to A&E for people who have had a heart attack or stroke. So currently they need to get there within 5 to 8 minutes

5.

Collaborative approach
to providing solutions

Testing projects before
scaling up

Funding essential to
delivering projects

Building trust with
PS partners

Social outcomes of
projects

Using data to improve
people's lives

Designing projects
for local challenges

Providing a return on
investment is a
challenge

otherwise they have more chance of dying. So these targets are based on health. So we are working with the North West ambulance service, siemens, the transport systems catapult, future cities catapult, and imtech. The way we are going to get the ambulance to A&E faster is control the traffic lights and create a smoother path for the ambulance. So that is something that we very proud to work on. The plan is to pilot it in Liverpool and then Manchester and then look at commercialising it in other cities. And that is great that we are doing that. We have co-invested in it so we invest 40% of the money and we get 60% investment from Innovate UK. With all the partners it is a £600-700,000 project and I see that as a nice stamp of where we have come as a company and as a city over the last 4/5 years. We had been talking to the people in the traffic team about doing this since 2012. They told us we think this is possible, we did some early research and development and we could never quite get there but in this case we were successful with some funding and hopefully we will make a product. And we have been able to dot hat because we have a good relationship with the city, they trust us with this data, very sensitive data and we have a good relationship with the NHS who trust us with sensitive data because they can see our vision for trying to create something that has a social good. So all the work we take on has some sort of social good and social value and I guess that is because my background in the human rights sector for 11 years. And all the team here are very committed to doing some good with technology. So what I see in technology companies globally, and I can say that as I work in Silicon Valley to work with companies such as google, I see the smartest people there working as hard as they can to get people to click on an advert. An that is how big data and analytics is being driven. You have companies like amazon, facebook, google and their business model is to get you to click on something but these techniques and skills can be learnt by anybody and I see our opportunity here to use some of those cutting edge techniques to try and improve peoples lives. And like I said earlier we know what the challenges are of people in cities, I don't necessarily think a city like Liverpool needs to have a smart car parking system, I wouldn't say that is top of our priority. I would like to see some sort of use of innovation not necessarily the technology but to not have 90,000 children who are in poverty, not having thousands of children who are hungry because it is the summer holidays. I think that is what innovation companies should be trying to solve. The real challenge is tagging it to a business model because the technology can be created bu that is our challenge now. I think if you can create value and part of your research and development is seriously thinking about how you are going to commercialise it then you can create new products and services that fit into this world. I think the

Smart cities too technology focused in past

Creating value in projects essential to business model

Flexible approach to SC solutions required

Adopting business model to data-environment

Roles to be played for all sectors in collaboration

Partnerships between sectors creating solutions

Gathering data to inform projects

failing of the smart cities sector is that it has been too technology driven, you have got smart-ish people saying you need this bit of technology to make your city better. And the next question is who is going to pay for this? I don't think that is the smartest way of looking at it and I think cities are not buying that model. I think you have got to look at where is the value being created? And who is capturing that value? And that should help inform what the business model is. So the example of google is a good one. We all take google for granted now as the search engine, probably use it for email and for documents. When I first started using google when I was at university I got onto it because people said this is a better search engine than the other ones I was using and it was good. I don't think they quite knew what their business model was at that point, it was just let's get very good at search. And then they later found their business model which was to create a great search engine that was driven by ad revenue. So I think the smart city companies need to be creative with their business models and that is the challenge. And until we get smarter companies who do not just look at the old model we are not going to get smart cities. And I think there is a role for the public sector as well as the private sector and voluntary sector and academic sector to play in that I think they genuinely do have to work together and have different conversations. And I think we are seeing the start of some of that in Liverpool with some of the people you have interviewed. These are the people and the good thinkers and I think you are not going to get smart cities unless you have that triple helix approach. When I talked about that example of the open planning app, that was the local government, the university and the business and we all had a stake in it. And we created something that has helped us all and until you get those partnerships I don't think we will get to where we need to go. Yes so headlines are we make technology, we are private company who has got social values and we are very firmly planted in Liverpool.

R - That's all great. Many of the questions I had you've actually answered there so thank you. I'd like to pick up on the social aspect in a minute but before you do, I would just like to talk a little bit more about the first application you did in 2011 and how you had to collect the data manually.

E - So where did we get the data points from? We did a joint venture so we owned 50% of it and the other half was owned by a man who used to work at the council. A historian was possibly the best way to describe his role, but he was one of these people who was very very passionate about Liverpool. You get these people who know everything about Liverpool, for example he would say, we were the

7.

New technologies allow for better capture of data

Manually capturing data a long ineffective process

Leadership figures within governance

Sharing data brings greater benefits

Promoting an open data culture and ethos

Accessing data previously has been a problem

Obstacles to accessing data reduce development

Improving frequency of data creates better products

first city to have a wet dock. He was one of those guys and he was super informed about his city. In 2002 perhaps 10 years before we started he produced a CD - which shows as you can't even stick them in your computers now - but he created a guide to Liverpool and it would have data on such every statue in the city centre he knew what it was, he knew the significance of it, he knew the date because he was passionate about he went out there got on his bike and did it. So he had things like that but he literally spent weeks, when we would be working on designing and coding he would go out and take 200 photos of tourism destinations. He was almost pounding the streets and that was the way we were getting the data perhaps of hotels or restaurants.

R - I suppose at that time you had to really. I just want to see maybe now some of your insight of what has changed between now and then in terms of if you were to source data how and where would you do it?

E - So I think because of people like James Noakes at the council you have got someone who understands open data. So when we created Open Data Liverpool - and again we did that almost as a provocation to the city to say we are going to take our money, gather some data sets - stuff which was public anyway but not easy to find - put it on a site and create a twitter. And the sort of data that was there was nothing valuable it was more just like here is a start. I think the city needs to open it up, by the city I don't just mean the public sector but private and academic as well. So back then you could collate stuff in a portal which was already out there but are you going to get something that innovative? Probably not. When I think we got the innovation, or should I say probably in the middle from getting the tourism guide to what we are doing now with the ambulances, this is a good example. So when we wanted to open up the transport data we couldn't even get the data of where is the 96 train stations in Liverpool and where are they? Where do you put them on a map? So we had to go to google for that information and we did some manual searches and started finding the longitude and latitude of google and we would do things like draw train tracks between the stations which might not be perfect but you could make an assumption and work out where the train is going. So just to produce something as simple as a map with all the trains in real-time going between the stations was an incredible amount of work. You had to find all the data yourself of where the train stations are sort of work out where the train should be based on the open data we did have which was signal boxes and sort of link it all together. And it was doable but it took us a few months. That data is somewhere but we

Opening up of data
increases SC solution
development

Approaching consumers in
larger partnerships resulted
in more project
success

Issues surrounding
access to and handling
of data

Existing public sector
contracts not negotiated
in digital age

Lossing value of data
through old contracts

Extracting value of open
data

Evaluating sectors in benefits
of open data

Previous success increases
trust of data sharing
with public sector

Creating a strategic vision
to work towards

didn't have access to it. So that was a bit better because network rail opened up some of their data nationwide. So we just took a little corner of their data to try and power what we were doing. So we mashed up their bit of open data and our found and created data including algorithms. And then you have got a product. The next one was the open planning app so this time it was different. We went to the city as part of a larger consortium that was funded by academia, we came late to that as they already had collaboration agreements in place, already had the buy in from the councils so everyone was bought into it and that was a lot easier. So we said OK we need this bit of data, make it happen and they were open. The actual reality of getting that open data was very very difficult so it wasn't like it was stored on a server somewhere for us to pull down, it wasn't as though it was on a disk or a spreadsheet, it sort of didn't exist in a place anyone in the council could get access to it. So lets just say this planning application data, the really valuable stuff a third party supplier had it, who had no interest in speaking to us really because their business model was they wanted to see out the contracts with the council because of the services that they are meant to deliver. So we were fobbed off but as you have probably seen from our approach we did not let that deter us so we had to create a work around, a bit of technology that grabs the data, almost going in through the backdoor to get it. It is not doing anything wrong it is just using techniques such as scraping and we had to do it the long way but again we got the work around and because we had that work around it led us to the energy app. So we are going from nobody understands what open data is to us being in a position where we are educating the local government that if you open this data up you can provide a better service for your citizens to them saying yes we want to do this but actually we can't. So maybe you also have the political will. You have got the will of officer level but it is a little bit like you are asking them to influence a supplier which the officers you are working with have no control over the contract. So it is big issues. So we still made the products that added value and where we are now, where we are given huge data sets for the whole North West of England around where all the ambulances are for the last year and some sensitive stuff and also the traffic management data - were we know where all the congestion is - we've got an understanding of what controls the traffic lights, this is being getting opened up and we are in a privileged position now. We are pulling all that together so it is our vision which is saying we need this, no? OK we haven't got this yet can you get it? Somebody put some pressure on somebody to get it. And that has taken, so that would have been Liverpool tourism guide I think in August 2011, the life project started November 2015. So you are talking four and a half years to

9.

Understanding benefits of open data

Building partnerships to develop SC's

Educated people in leadership positions

Public sector hard to adapt to new environment due to size

Private sector adapts at a quicker rate

go from nobody understands what open data is and what the value is to both citizens but also about it driving economic growth to some people in the city get it and we can work together. And that is because we are working with some smart people in academia, we are working with some smart people in the public sector, people like Kevin Toye who you have mentioned - visionary guy gets it. Unfortunately you sort of want people like him to be in the public sector. We met him when he was in Liverpool council and there are other great people like that who worked in the council or public sector driving innovation around health and social care. I think what happens to those entrepreneurs who have got the ability to help create that value they move on quite quickly because they are disrupting a big Goliath from the inside and people don't like that. I guess the public sector bodies have got empires and vested interests and when somebody comes around and rocks the boat they will do it for a few years and they will probably get frustrated and it is to the stage where if they are like us and want improve people's lives and create new products and services then they are probably better doing it outside those organisations.

R - That is a good point you make. I myself worked for a year in the planning department and the difference between what I'm doing now and the world I can see developing compared to what it is like in the public sector is massive. So to pick up on something you mentioned with regards to data and the access to data. It is really interesting you provide a unique insight from where you was in 2011 compared to now and I just know myself from looking for this data that we are going to use were we had to look to London to access that data from their data store. It was the most easily accessible data and although it would have been great to have done something on Liverpool we couldn't.

E - What was the data?

R - It is a health data set - probability of loneliness in over 65, and transport data - access to public transport. And the reason we chose those two was because they are placed in a standardised mode which means they can easily be compared and analysed. The aims is to investigate and see how each data set affects the other and what services could come out of that.

E - Yes. We were the same as the first but of data we used was the network rail data and it just so happened to crawl into Liverpool. But if we were based in London, San Francisco or New York, we would probably be telling you a completely different story as we would

Gathering data to inform projects can be an obstacle

Competing with other cities who are ahead

have loads of interesting apps for those cities. But we are starting much more behind here.

R - So in your view do you think open data has a positive effect on the development of the smart city?

"Guinea Pig" approach

Opening up of gov. data sets a leadership position

Opening data creates transparency

"House of Cards" with regards to data

Digitisation era disrupts existing services

"House of Cards" obstacle to adapting to environment

Opening data results in better solutions

Designing projects with social outcomes

E - Yes so I think open data as a concept I guess has been around for 10 years. And it was New York and San Francisco who drove it. But really it didn't become a thing in the UK until I guess 2011 or something like that. And it was originally one of those things that the last (coalition) government had some iffy policy shall we say but take my hat off to them there they said we are going to open up this civil service data really and push for it. And the reason they opened it up was to improve transparency and you will get better services, I think that still stands true today. I think in typical British style the civil service didn't want that and I know the guy who put it through and he said he had to get a letter off David Cameron the prime minister to be sent to the senior civil servants to go you will do this. Because I think what Whitehall does is the 'yes prime minister' sort of cliché - they are not going to be transparent with anything, that establishment is the opposite of transparency it is about keeping things under hat, its the status quo. And I think we have seen that with disruptive agendas like the government digital services I think that is a really positive thing for the UK to be involved in. But I think it has not had the effect it should have probably because of that Whitehall agenda to not change. Shall we say senior civil servants in Whitehall do not want open data, they do not want more transparency of services being on websites. Ultimately because it means parts of civil service budgets coming out of that traditional ministry or department and going to some IT type company. And I think that scares them and I think until we get our head around that as a country that we have got competing interests within our country we are not going to get the true smart cities. But I think yes if you open up data you get smart services without doubt. We see bad services all the time and a lot of it is because of bad data.

R - So just to move on then, this is quite good for the services aspect of smart cities and I know you have spoken about your social value in the projects you do but what role do you see data or big data playing in that and what opportunities or obstacles are there?

E - Yes so to talk about some of the more socially minded projects we are doing, we are working on a project at the moment that is co-funded by the European Union and we are working with a food poverty charity in Liverpool called Can Cook. We are also working

11.

Partnership approach to project solution

Tailor making solutions to specific challenges

Designing projects to local context

International projects with partner cities

Analyzing data to extract value

Implementing the sharing economy

Using big data to provide insight

Introducing new technologies provides new services

Creating solutions that include all generations

Increasing accessibility

with the Frown Profit Institute, Soneye the biggest retailer in Portugal and some partners in Holland. The problem we are trying to solve is older people get malnutrition because they are not eating the right stuff at a certain part of their life. And when they are not eating the right stuff or drinking enough they are more likely to fall or more likely to go into hospital. This is a problem, we know it is a problem. So we are using our skills in design, so we are doing co-creation sessions with end users both from affluent communities but also poor communities because we cannot just be social for the sake of it if we also need to try to figure out a business model. We are doing that in Liverpool, Lisbon and Holland so we will create a product at the end of it which uses some sort of big data algorithm to crunch a lot of data around what people eat and the nutritional value of that data. So we should have some sort of mobile app that connects to people who make or sell food and there will be some sort of service that connects the people who make or grow or cook food with the older people who need the food and a bit of technology needs to sit in the middle. It needs to be a cheap business model because we are looking at people who will be in food poverty situations but I think if perhaps we can work out ways for some sort of business model where people can get together and buy fresh food in bulk which is maybe grown locally, then get packaged in a way that goes through this app and gets delivered. Then perhaps we can solve some of the problems around nutrition and bad diets. So that is a classic sort of red Ninja project really where we are using our skills in design, we are using our engineering experience in mobile technology but also our understanding of big data and the insight that you can provide from that data. So I think the technology bit just sort of disrupts the traditional model of services such as meals on wheels or if you live in a poor area the places you can probably eat are going to be cheap fried chicken, chips, burgers, kebabs and it is all nice stuff but it is bad for you. And I think some places are in poverty areas where they don't have the options to buy some of the food that might be cheaper but there is no fresh vegetables for them to buy at the right time and at the right price. Another one where we are trying to tackle activeness in older people is the problem we have identified is you have got companies like us, not just technology companies but SME's or start ups, we struggle to grow in our early years because we don't have enough access to relevant skills and resources. A good example with me is very creative, I can knock together an app or design something but I am not very good at accounts so you have got companies like us who are growing and need help or it could be a one person band or anything, and then you have got older people who have retired who are skilled. An example could be a retired accountant and you have reached an age in your life at retirement

Partnering with cities internationally
to provide solutions

Delivering projects to
target inclusive tech
for all ages

Data provides insight
to success of projects

Offering digitised
solutions reflects
new environment

Taking risks due to
social outcome
strategy

Designing projects to
improve peoples
lives

Local solutions to local
problems

where society has said you cannot add value to the economy anymore. And that is wrong because you don't just get to 65 and not be good at accounts and I would love to connect to that person. So the product which we have collaborated on is called time to share and essentially it just takes those two groups of people and matches them up. We are in the early stages of the pilot at the moment and we have worked with companies in Cyprus, Spain, Holland, Romania and the end-user group who work in Stockport so that is interesting. The ageing population we are very interested in we have put free WiFi in a residential or assisted living place this year. We have put it in for free because we wanted to have a trial to prove to the housing association that if you give people the internet they will have a better life and when I met them they said they want to do a launch to try and show them the benefits of the internet. I get the analytics so I know they are all on the internet using mobile phones or tablets and 40% of the time they are going on youtube so they are doing what me or you would do, this is not a thing you need to sell you just need to connect them and they will have a better life. And OK they're life may not be better off just by watching youtube videos, although I would argue it would be, but the next stage is for that housing association to say OK how can we supply the appropriate tools for these people. Maybe it is those connecting to apps that we spoke about but I think as we try to tackle every problem, such as the ageing population, you can make great apps but if they haven't got the connectivity they cannot afford to do it. And there is a whole stack that we have got to change. And I guess what our social values do is it allows us to take more risks, we are not a company who specialise in putting WiFi in places we will just call BT or Sky and say put WiFi in here. But we used our innovative type approach and worked out how to do it, you just have to connect to the fibre outside, put some routers in, and you have got a whole stack of people you have to pay. I guess if we didn't believe in the stuff we were doing we would not have taken that risk. It might not work but we see it as an investment that if we can prove there is something there then hopefully we will get to work with these people. So I guess there is a lot of stuff like that which we do. We have 10 projects on at the moment that all have social aspects and are around improving the health of children with anxiety or mental health problems. Improving the lives of the ageing population, improving the lives of mothers who have sick babies, trying to reduce falls in older people. So it is all social and I guess maybe that is a representation of where we live. Perhaps if we live in Canary Wharf we may be making Fintech but I guess we are a product of our environment.

13.

Increasing data use
provides more
insight

Value of data in
future decisions

Partnering to provide
solutions

Using technology to
gather new data

Introducing technology
to improve quality of
data

Using technology to
shape behaviour
for outcomes

Using data in ways to
improve decision

R - Just to conclude the interview I have one question that is really open-ended. Does more data necessarily mean smarter decisions, or is there more to it than just that?

E - That is a good question. I would say yes. I think in any decision you have to make whether it is your boring domestic decisions based on how you run your house or life, taking out to running a company, to a department or a city, from a personal point of view the more data I have got on things the better decisions I can make. The more informed it is. Otherwise you are guessing, one of the first transport smart city projects we did in Liverpool was for Merseytravel so we raised all the money and Merseytravel were like a customer who got the product for free and they were interested in the area we are sitting in now - the Baltic Triangle - there is no bus stop or train station but you go outside you will see lots of people. There are 650 people in this building, a school next door so thousands of people are here. The only public transport stuff is bike racks which is great and I use them everyday but what Mersytravel wasn't sure was is there a business case to put bus stops or open up the derelict train station over the road. And their policy and planning team did not know that data apart from using surveys so we put a couple of sensors around just to see how many people are going from A to B and there was a lot of people and that data is different to the data they have got now which is anecdotal. They could maybe send somebody with a flip board to ask some questions and you might make the right decision or you might not but hardcore data when you can see a trend from A to B should make it easier to make the right decision. I think the decisions the city have made around the last few years with transport are interesting, I know the bus lanes got scrapped. Now to me that was wrong because I believe a bus should get priority because it has more people on it. I don't drive a car, I want to live in a city where public transport is good and I am encouraged to walk, cycle, get bus's, get trains like Amsterdam is and I think you are going to make it harder to use public transport then you are encouraging more people to drive cars which is unsustainable. Now I don't know what data that decision was made on but I think in the modern world there has got to be a better way of doing it than that.

X.ii.vi Interview (F) Initial and Focused coding

1.

Initial Coding

Researcher – (R)

Participant – (F)

- Specific team for innovation
- Public Sector background
- Partnership development
- Funding required for development
- Team sits within new department
- Department not public sector character
- Commercial mentality to work
- Sits outside city council gives new role
- outcome based for social value
- Medium term planning using
- Collaborative ethos to work
- cross-sector approach to development
- partnerships with other cities
- Inclusion of communities & citizens
- create a strategic vision for citizens
- organisation set up for new environment
- Quite newly formed department
- Feedback for projects successful

- Digital skills form part of team
- Holistic approach to SC
- Diverse range of skill sets in team
- Streamline of process through central authority

R - If we could start with an introduction to your role and the department that you work in within Bristol City Council.

F - So I am city innovation team manager in Bristol City Council (BCC) and my function within the team is focused around partnership development and bid development so that entails funding bids, how they are structured etc. so we sit as the city innovation team within a pretty unusual department within Bristol City Council called Bristol Futures. And Bristol Futures is unusual because it is outward facing, we don't serve a function of the city council, we are about building up the city holistically and what the city will develop into. Things like how we can use ICT to become a more sustainable, more prosperous, more inclusive city as well as more liveable city within the next ten to twenty years. So it is big vision stuff, it is smart cities, big data, ICT and it requires us to work collaboratively with other public sector organisations, private sector organisations as direct suppliers to us but also as partners within the city. But also vitally for us to work with communities and community organisations to capture their vision for how they see their city operating within the next ten to twenty years. So it is within an unusual setting for a city council but I think it has been demonstrated to be quite successful within the last five to six years that we have been operating.

R - So it is quite a new department in terms of its set up?

F - Yes it was proposed in 2010. At the time I was managing the digital innovation function at BCC and there was colleagues who was focusing their attention on the city as a whole, its sustainability. Other colleagues were working on the economic development and regeneration and what happened was that all of our functions were brought together and we formed this division called Bristol Futures.

R - Its interesting that you mention the 2010 date almost as the forming of the department, because a lot of the other participants we have spoken to have told of the trend whereby they make new departments to function in this smart cities area. So do you believe that it has been a benefit to Bristol in terms of achieving its aims for the future?

- Organisation's adaptation good for development
- Responsibility for bids + funding
- Risk profile of city internationally
- Department crucial to success
- Competitive nature of cities
- Measurement of SC performance
- Medium sized city offers SC growth
- City over performing for size
- Strong in delivery of projects
- Partnerships crucial to org. success
- Built relationships of trust for future
 - network of trusted providers ecosystem
- Oversight + strategic direction via directorates
- Innovative approach to development + bids
- European funding plays vital role
- Successful in obtaining funding in competitive environment
- Partnered with other cities to secure funding
- New impacts through SC development
- Pilot stage to development
- Prove concept before scaling up
- Driving implementation through districts

- Partnership development key to role
- Need a point of contact in SC environment
- Outlooking approach key for business
- Communication outlet provided for all sectors + citizens
- Important both ways as creates ideas
- Provide opportunity to private sector

- Good to have doorway for citizens
- Business value the open ethos
- International partnership development
- Technology companies providing solutions

F - Definitely and I can give you some solid concrete examples of what we have achieved. So it was Bristol Futures the division which worked on Bristol bid to become European Green Capital in 2015 which was successful – it was huge, a massive thing for the city and we would not have achieved it if it wasn't for the formation of Bristol Futures. Similarly Bristol has gone from being a medium sized city in the middle of the pack to a recognised city within the smart cities index as only two cities (London and Bristol) who are recognised as leaders in the smart city index. For a city of our moderate size that demonstrates that we have made huge strides forward. Alongside all of that there has been so many practical developments here around us being able to deliver extremely ambitious projects in partnerships with organisations who are highly credible and for the organisations to have those types of relationships of trust is unusual and powerful. Because of the directorate and especially within the Bristol Futures team we have the space and the opportunity to be thinking about what's coming next and be developing bids which are genuinely innovative. We have been hugely successful particularly in European funding bids. Last year we secured one of the showcase lighthouse programme bids under the Horizon 2020 smart cities call to replicate and that is massive for us. I think it was 27-million-euro programme of which Bristol will benefit 7 million euro. Hopefully this is where we are going to see step changes in the impacts of smart cities. In the past we have piloted or ran proof of concept projects but now we are doing district level, integrated, significant intervention.

R - And with that gradual progression from the pilots, to the proof of concept, to where you are now have you formed new networks within BCC itself as well as externally with private industry?

F - Certainly and that is such a huge part of my job itself. I in many ways become the front door to the city council for anybody interested in technology. I view it as my job to say yes to talking to people like you, to say yes to talking to big businesses, say yes to talking to small businesses, say yes to talking to communities groups about technology because often it is such a struggle for people to be able to talk to the right person about their idea or innovation. So I consider it is my job to create opportunity.

R - I think you are right there because from my own experience talking to councils across the UK I have to say it was really good to hear back from you so quickly and get this set up so quickly. And I can imagine it is the same for citizens and companies.

F - Exactly and I think the companies really value having somebody there that they can contact. For example we have NEC yesterday who are a major Japanese based global supplier of technology who

3.

- Interacted focus to research + solutions
- Use of technology to solve (realised) challenges
- Collaborative approaches to work + solutions
- Talk to private to create value for both
- High-end technological solutions
- Two way relationship tech private solutions
- Look for opportunities to develop partnerships
- Keep an open mind to develop networks
- May not require solving now but think far into future
- Looking ahead to what the infrastructure need for new outcomes

contacted me to talk about their incredible research lab in Germany and we want to come and talk to your team about what we are doing to sense check with you as to whether our technologies are going to solve any of the problems that you see in your city. So they brought over their top research professors from Germany, I gathered my project managers together just to have that debate. We can get so much incredible value from that because we can talk to people who are on the cutting edge of technology solutions and they can talk to people who are on the edge of implementing and sorting out the problem. So yes that is a large part of what my role can add and I am constantly looking for opportunities to form new partnerships with new partners. Not necessarily having an eye on the specific outcome but I think you need to be entrepreneurial and talk to people to understand what they are trying to achieve and eventually they will come back round again and say 'oh I know that guy who is interested in autonomous vehicles, we want to talk to him' and eventually you get an outcome which is positive.

R - That's all really good information for us. And I actually agree with a lot of what you are saying. SO maybe if I could move onto one of the key questions which is about your strategy. Is there a strategy in place within the organisation or how you use data? Is there an onus for example on producing open data? And making the data from your projects available to a wider audience?

- Not so much a strategy in place
- A mentality towards how people operate
- Strategy provides too much pros, need more to develop ideas
- Technology used to increase accessibility
- Accessibility to technology for all people in the city
- Inclusive outlook to solutions
- Specific skillset brought to role
- Projects have accessibility focus
- Work gradually to reach what aims
- Role of technology in future city
- Role of data in making decisions
- Create a fair city for all
- Need on understanding extent to work towards
- Open data effort to work
- Work on tech/digital in council for a while
- Role of data + power/influence from data
- Political role in organisation amplification
- Requirement to understand data
- Role of data in public sector
- Data enabling new services

F - I think to say that there is a strategy is wrong. A strategy would be a very formal way of looking at it. There are a set of ideas and principles that guide a lot of the work that we do. The technology that we do that guides our IT programme came from a set of enterprises around accessibility. That was making sure that technology that was being introduced to the city could be used by everybody and that is my academic background - accessible technology, so I brought a bit of that to the city council and that has fed through many of the projects that has brought us closer and closer to the idea that a future city managed by technology and driven by data, within that but which is accessible to everybody and equitable and fair. So that is one of the principles, strands, threads that creates an understanding. We have quote which is as close to a vision statement for our open data programme that we have. I was at an event a few years ago and it was 30/06/2010 and at the time we in the big technology and digital innovation of the council were starting to understand the power of big data. But we were fortunate enough to have a councillor who was an IT professional so he was another level and fundamentally understood big data and how it was going to transform the way the council operates. The more the council can release its data and facilitate the delivery of services by

- Data allowing dissemination of projects
- Data that can be shared
- No data that cannot be shared
- Vision statement required
- People in positions who understand data
- Political role in IT development
- Leadership provides development
- Create environment that fosters sharing data
- Obtains via people mentality

others, rather than having to deliver everything themselves. The quote was: "There are only two types of data in BCC, confidential data which we can't share and open data which will be made available". The councillor was called Mark Wright and in 2010 for that boldness of vision to be expressed publicly was huge. Now that was driven by a particular politician's understanding of it but it did start us down that line, it gave us the impetus to start doing creative things and start to challenge people who maybe were not as comfortable to release their data.

R - That is a really good point you make because the politician to be making that statement gave the officers in the council the confidence to pursue this. So I notice you mentioned the power of data and the ability of it to transform the way in which councils operate. Perhaps you could give us your views on how you see the role of data in the development of smart cities and perhaps specifically in Bristol's case also.

- Data been in mind for significant time
- Large amount of data in council
- Maintenance of data an issue
- Make data secure
- Handle data in certain way
- Security of data v. impenetrable
- Less access to data previously
- Cultural shift in regards to data
- Data should be shared with people
- Data science been at council for long time
- Challenges posed re. big data
- Using data to make decisions
- Use platform to distribute data
- Quality of data can be improved
- Standardisation of data = progress
- Specific role of data
- Publish data to increase value
- Monetisation of data
- Data sets can be valuable
- People produce the data
- Companies profit off that data

F - Ok we have thought a lot about data over the years so I will not be able to boil it down too much but what I would say is that the key things about data is that it is actually something as a city council we have in an abundance. As an organisation in the past we were organised around maintaining that data but also securing that data. So keeping it in a filing cabinet, making sure it was up to date but keeping it secure from people. And there wasn't really a consequence whereby the public should have access to that data even though they paid for it. So it is a massive cultural shift to speak to people who work in the public sector environment to say we should give this data to people. Now I have been doing this for a long time, I have worked in the city council with data since before 2010 and since 2010 with a big focus on data. And the size of challenges that have been presented to me with regards to big data have been a lot. Now if we were to say to somebody I want to take that data that you have created through your project and put it on this platform I would expect a number of reactions. The first would be we can't do that because it's not very good, it's not accurate or people would not understand it because we do not code it in an understandable form - basically saying we understand the data but other people wouldn't. So my argument against that is that if we publish it other people can improve by error checking it. The secondary response has been occasionally we can't publish this because we actually sell it and these data sets are usually something that people would find highly valuable, for example accidents statistics. Now this stuff should be made available to the people who create that data but insurance companies will pay a lot of money for that. And the third element which is probably a function of the fact

5.

- Public sector conditions uncomfortable to people
- Data can be harmful to some people
- Use data to understand performance
- Data improving transparency
- Future of data role in public sector
- Change in attitude required in PS
- Organisation needs to adapt to new environment
- Generational shift in attitudes
- Privacy of data a major issue
- Some data cannot be shared
- Open data brings advantages
- Use data to increase awareness
- Accessible data allows highlight of issues
- Run campaigns based on data

- Generational shift required
- LA needs to adapt to environment
- Resource issues in public sector
- Bad to fail in public sector
- Failure accepts needs to be there
- Innovation requires failure
- Bristol future role in development
- Characteristics to way to fail
- allows aspect of failure with low costs + transparency

that often in the public sector you can feel that the public are very critical of what you do, people will say why should we give the public hammers to hit us with. If we public this data we will find issues, errors and will see that there are things we are underperforming in. And clearly that is about transparency and holding people to account. Now to some people that looks like over exposure to public scrutiny. SO I think data within a public sector organisation within a local authority is really powerful and contentious. And I think there is a cohort effect that needs to happen in that there are people who have worked in the sector and along time and operated with data in a certain way and they want to maintain but protect it and there needs to be that shift which perhaps comes generationally and this is about protecting the private data which we must never allow to be shared or exposed. But preparing and having the open data in an appropriate way so that other people can take advantage from it, people can gain value from it, and it might be that people want to run campaigns about it and say I'm looking at the traffic accident spots and there are black spots here and we want a crossing and that is a perfectly legitimate thing to do.

R - They are all really good points and to give you a bit of background to myself and my research, I worked in Liverpool City Council in the planning department, and leaving university so soon I was aware on the smart cities movement yet the officers were not so much and the organisation was not prepared - so there was a gap. The generational shift is how I view it and I think until that happens we will not see the true value of data.

F - I think your absolutely right and there is a real risk aversion within local authorities that increases as more pressure is put on budgets. Nobody wants to stick their head out, nobody wants to try something new because failure is career inhibiting. Not the essence of innovation is that you need to be able to fail otherwise you are not innovating. And I think that is another reason why having the directorate called Bristol Futures which was about trying new stuff that encapsulates the permission to fail. Fail fast - and I think that should be part of it, to fail quickly and inexpensively, but be permitted to fail and demonstrate that something doesn't work.

R - That's a really good point that you make and it will help us move onto the next key question which is what are some of the major challenges your organisation faces in attempting to adapt the increasingly data driven environment? Now when I look at Bristol I actually think you are possibly ahead of other cities in terms of mitigating those challenges with the formulation of the Future

- Role of IT department in SC development
- Innovation team sits within department
- The role of data + its value
- Skills set data enviro.
- Need more education across org.
- Train people in handling data
- A lot of datasets available
- Obstacles to publish those datasets
 - Regular release of data only shows
 - Open data benefits
 - Role of data in city performance
 - Platform used to distribute data
- Requirement to understand data
- Understanding brings out value of data
- Need to train managers in org
- Data can bring benefit to city
- FOI requests to get data anyway
- Platform helps to distribute (data)

- Role of data platform in SC development
- Platform acts as catalyst
- Digital world requires new approach
- Need more implementation of projects
- New technologies introduced to city
- Use people to spread success
- Increase usage
- Data platform elevates SC
- Provides opportunity for new services
- Build profile of city
- Award partnerships
- Open data ethos
- Functional level of visibility

Bristol department that gives you the freedom to innovate. But maybe if you could speak about any other barriers that you see?

F - Yes I agree that having the Bristol Futures department there and particularly having my team that sits within that which is the city innovation team provides a team that all fully understand the power of data. We are all data literate and we understand what the community, and technical community want from data but the rest of the organisation perhaps don't know in the same way. And that is a challenge because data literacy is not evenly spread throughout the organisation so there are a number of people who are the custodians of massive data sets that I would love to publish but they are too nervous to do so. They don't see the value of regular releases of open data, we are all under pressure in the public sector and when I go to somebody who doesn't understand how data will revolutionise the performance of the city and I say to them will you put the data into this spreadsheet and upload this data to the platform so that other people can use it they don't need that headache. And if they don't understand data then they are not going to go out and use it, so there is that education piece which has to be rolled out in terms of training to managers to say it is going to be worth your while doing this because there will be a tangible benefit for the city. But also to yourself because you will not have to answer the freedom of information requests that you currently do because you point people to the open data platform.

R - So just to pick up on a point you made there about the open data platform, do you think the influence of the platform has been positive in terms of achieving the aims of your department and the wider smart city aims of Bristol?

F - Undoubtedly. It is a real catalyst to have something tangible in the digital world. I had a mantra that I say to my team which is show them something. Because when we are working in the tangible, digital world which everyone talks a really good smart city but I am always surprised when people show me something. So I say to the team if you want to talk to somebody show them something whether it is a sensor, a router box, a video of something that is working because that is what people respond and react to and that is the stories that they tell people. If all you doing is blowing a lot of hot air at what you are going to do then that is not useful. So having that data platform is a tangible catalyst for the open data movement in Bristol and that has happened. We have applied to be recognised with the Open Data Institute as a global node and I made the application myself. We were interviewed and successful so then we became part of the ODI node networks. It is a global network of

7.

- Technical aspect to city
- Partnership development in Bristol scale
- Increase participation through hacks
- Gain ideas from citizens
- Platform acts as visibility also
- Create network of people
- Credibility from other urban partnerships
- Challenge events increase democratic process
- Implementation of ideas crucial

cities across the world, Seoul is one, Paris, Chicago, Queensland so we are part of a very elite group of cities because we have been able to develop a community of practitioners and we regularly hold challenge events or 'hacks' to get people with ideas to come along and we have sold every challenge event out. So having the platform allowed us to create a buzz, we developed a network of people and there are 700 members of our meet up group, and also allowed us to get the credibility of being an ODI global node and from there everything is coming together. The challenge events are really high profile and get sold out to then making apps from this that go on the app store. So you start with one tangible real thing and you build on it. If all you are doing is talking and you have no real stuff to show people, then it is all built on sand.

R - Thank you for that insight because that is something we have reflected on which is the effect of having a data platform to allow for better meeting of aims. The contrast between cities who do and don't have the platform and the effect this has on their development is a big issue. So just moving onto the projects that BCC is currently pursuing that you would like to tell us a bit about.

- City has many SC initiatives directly in place
- Projects create data
- Data creates potential
- Name projects to increase visibility
- Greater data through new projects
- Transit of data on issues
- Communication of data between nodes
- Integration of data to infrastructure
- Success of SC initiatives in Bristol
- Local contextual analysis of city
- Local solutions to local problems
- Making solutions to local challenges
- Technology used to reduce energy
- Greater use of data through projects
- Frequency of data collection
- Regular collection of data
- Big data needs time to develop

F - Sure. Some of the projects that are in operation at the moment in the city is that we have two autonomous vehicle projects for driverless cars which have huge data requirements and data potential as well. One of those is called 'Venturer' and the other is called 'Flourish'. Now without going into too much detail the data that is derived from those projects will be enormous but it is not just about the data itself but about the transit of data and how you send the data between those nodes of infrastructure such as traffic signals. Now all these things are fascinating and all of those things need to be resolved and we are pleased that they are happening in this region. We also have an enormous catalogue of energy projects that we have been running, we have been running these projects for a long time as Bristol is still a social landlord, we still own and energise a large amount of council housing stock - we have about 28-29,000 homes and being a sustainable green city, and having the status of being a green capital in 2015, we have really focused on doing what we could to reduce the energy use in those households but also to make sure that people don't fall into fuel poverty. So I have done six energy saving projects, six smart grid projects just over the last few years so again there is enormous data archives from all those things. We measured lots of things and did energy monitoring whereby we were capturing data at five second intervals over a year so we had millions and millions of data points. Now one of the things that we took from that is to have that level of data, which I would say is approaching what people would refer to big data, the

- Big data allows for more intelligent
- Powerful use of data
- Data can be used to predict
- Data can increase understanding to large levels
- Gathering data through technology introduction
- Ethical concept of data for good or bad

intelligence that you can derive from people, in terms of their practice and what they do is valuable but scary. We could know what time people had gotten up, we could also predict which is another matter once we had gathered data from a few months what they would do the next morning. We knew when people were on holiday, we knew you worked night shifts and we could know so much about people's lives just through their energy use and the energy use data. So that really woke us up to the potential of data both for good and for ill.

R - So there is a responsibility aspect on behalf of the council with regards to how you use that data.

- Governance has responsibility of data
- Current model for data use needs to improve
- Somebody benefits from data
- Value attached from data
- Private industry capitalize from data
- Ownership issue of data
- Government take leadership position
- Open up public data
- Generate data from many areas
- People produce other through actions
- Governance does not own data
- Issues regarding handling of data
- People need to take ownership of data
- Use data for good causes
- Access data for certain organisations
- Privacy issue of data
- Use benefits of data in ways
- Data ownership an issue

F - Undoubtedly, and as I mentioned earlier I have been thinking about data a lot over the years and the current model for how data is managed is that data either sits in the public sector, in the governments hands or it sits in the private sector in corporate hands, for example with Apple, Google, Sainsbury's etc. so whoever owns that data derives the value from it. Now government is moving a little bit towards the way of publishing data so people can derive value from it but that is not the same thing as genuinely giving people ownership of their data and investment in the value of that data. You see because you and I generate so much data based on who we are such as what we do, what we have bought, who we have met, what our experiences have been like, has the bus been late? The value of all that data is enormous but we own none of it and we don't have the power or control to share it with who we want to share it with, nor do we have power over who or why we share it, even whether we want to share it. And also derive value back from that so as people become more sophisticated about their data there has to be a space as to where they can move into. Where it might be for instance that I am perfectly happy to share data about my health with the British Heart Foundation because they are an organisation that I care about and I would like to allow them access to my data free of charge whenever they may need it. I might also not want other organisations to have any access to my data, or if I do I want them to pay me for it in a particular way either to me or whether it is through investment to a community that I care about. So I have been thinking about much more sophisticated ways to think about data ownership and I haven't solved it yet but something has to change or be different.

R - So just to bring the interview to a close, when you go about comparing innovation now and previously in the organisations history do you believe projects attempt to incorporate the capture

9.

- Political aspect of data
- Vision statement plays key role
- Understand power of data to Capitalize
- Positions of leadership important
- Understand data in high positions
- Ownership for benefits of data
- Try to implement new strategies for data
- Personality plays key role in org. set-up.
- Hard stance from government for breakdown development
- Principles enforced over development
- Data skill in very early stages
- LA has role to play in adopting organisation
- Medium-term aims + goals
- Understand value of data
- Educate people with data
- Data can be powerful
- Gradual process of people to adopt use of technology
- More proficient use of technology means more data

- Make the journey accessible to everybody
- Open data principles need to be in place
- Data can bring new services

of data through their design with the intention that that data can be used in the future for a large benefit through the use of that data?

F - That is a really interesting question. I think it is probably linked to personality and politics. I bring you back to the vision statement earlier as that was driven by an individual who fully understood the power of data, now he got up and he gave that statement because he was a councillor he was well positioned to drive that forward. Now a few years later we have a city director who also understood the value of data and what she didn't want to do was give away control of data when it has been procured through the system. Now she mandated that in every system that we procured going forward we had to have agreements in there that we owned the data. Now in owning the data that gives us the ability to deliver that data for free in any way we find useful but again that was driven by an individual who mandated a particular approach and enforced it. And in at least one occasion that I know about it resulted in the break down of a procurement because there couldn't be an agreement about the system and the issue of data ownership. So because we are in very early days of the role of data in ethics and in local authorities it does take these individual pioneers to stand up and say this is the way that we are doing it within the local authority while also playing catch up throughout the rest of the organisation. There are people like me who can inform educational session to help people see the value we are talking about and in ten years time those stand out individuals would have to stand out and say this is how we do stuff because there will be a general understanding that data is valuable, data is powerful and people will be educated enough with that data. It is like all technologies, people will probably start off feeling afraid of it unless they are early adopters. Then the rank will file and people will begin to be more educated and adopt it. Then there is a moment of danger where people feel comfortable enough with it to explore and find themselves in difficulties but eventually it just becomes the way that things are done. It is a process and an evolution.

R - So there is a process and we are very much at the early stages of that.

F - Definitely at the early stages and it is about attempting to bring everybody along with us so this doesn't become a siloed thing where open data sits as a separate pursuit within the organisation. It is important that everyone sees the benefits and everyone sees the benefits that can be had as sharing their data as a service.

1.

Focused cooling

Bristol City Council Interview Transcript

28/10/2016

Researcher – (R)

Participant – (F)

R - If we could start with an introduction to your role and the department that you work in within Bristol City Council.

organising LA for new environment
Building partnerships

Bristol futures facing outward

holistically developing city

collaborating with other sectors

organisation set-up proving a success

F - So I am city innovation team manager in Bristol City Council (BCC) and my function within the team is focused around partnership development and bid development so that entails funding bids, how they are structured etc. so we sit as the city innovation team within a pretty unusual department within Bristol City Council called Bristol Futures. And Bristol Futures is unusual because it is outward facing, we don't serve a function of the city council, we are about building up the city holistically and what the city will develop into. Things like how we can use ICT to become a more sustainable, more prosperous, more inclusive city as well as more liveable city within the next ten to twenty years. So it is big vision stuff, it is smart cities, big data, ICT and it requires us to work collaboratively with other public sector organisations, private sector organisations as direct suppliers to us but also as partners within the city. But also vitally for us to work with communities and community organisations to capture their vision for how they see their city operating within the next ten to twenty years. So it is within an unusual setting for a city council but I think it has been demonstrated to be quite successful within the last five to six years that we have been operating.

R - So it is quite a new department in terms of its set up?

Newly formed department

Bringing departments together for streamlined process

F - Yes it was proposed in 2010. At the time I was managing the digital innovation function at BCC and there was colleagues who was focusing their attention on the city as a whole, its sustainability. Other colleagues were working on the economic development and regeneration and what happened was that all of our functions were brought together and we formed this division called Bristol Futures.

R - Its interesting that you mention the 2010 date almost as the forming of the department, because a lot of the other participants we have spoken to have told of the trend whereby they make new departments to function in this smart cities area. So do you believe that it has been a benefit to Bristol in terms of achieving its aims for the future?

Delivering projects through
new department

Developing visibility of city

Competing with other cities

Measuring SC success

Partnering to provide projects

Building relationships of trust

European funding plays
crucial role

Partnering with cities for
funding

Phasing in projects

Building partnerships

Offering communication for
business

Opening up to talk to citizens

Offering doorway to council

Building international relationships

F - Definitely and I can give you some solid concrete examples of what we have achieved. So it was Bristol Futures the division which worked on Bristol bid to become European Green Capital in 2015 which was successful – it was huge, a massive thing for the city and we would not have achieved it if it wasn't for the formation of Bristol Futures. Similarly Bristol has gone from being a medium sized city in the middle of the pack to a recognised city within the smart cities index as only two cities (London and Bristol) who are recognised as leaders in the smart city index. For a city of our moderate size that demonstrates that we have made huge strides forward. Alongside all of that there has been so many practical developments here around us being able to deliver extremely ambitious projects in partnerships with organisations who are highly credible and for the organisations to have those types of relationships of trust is unusual and powerful. Because of the directorate and especially within the Bristol Futures team we have the space and the opportunity to be thinking about what's coming next and be developing bids which are genuinely innovative. We have been hugely successful particularly in European funding bids. Last year we secured one of the showcase lighthouse programme bids under the Horizon 2020 smart cities call to replicate and that is massive for us. I think it was 27-million-euro programme of which Bristol will benefit 7 million euro. Hopefully this is where we are going to see step changes in the impacts of smart cities. In the past we have piloted or ran proof of concept projects but now we are doing district level, integrated, significant intervention.

R - And with that gradual progression from the pilots, to the proof of concept, to where you are now have you formed new networks within BCC itself as well as externally with private industry?

F - Certainly and that is such a huge part of my job itself. I in many ways become the front door to the city council for anybody interested in technology. I view it as my job to say yes to talking to people like you, to say yes to talking to big businesses, say yes to talking to small businesses, say yes to talking to communities groups about technology because often it is such a struggle for people to be able to talk to the right person about their idea or innovation. So I consider it is my job to create opportunity.

R - I think you are right there because from my own experience talking to councils across the UK I have to say it was really good to hear back from you so quickly and get this set up so quickly. And I can imagine it is the same for citizens and companies.

F - Exactly and I think the companies really value having somebody there that they can contact. For example we have NEC yesterday who are a major Japanese based global supplier of technology who

3.

Private sector supplying
technology

Collaborating with private
sector

Mutually beneficial relationship

Forming new partnerships

Entrepreneurial approach

contacted me to talk about their incredible research lab in Germany and we want to come and talk to your team about what we are doing to sense check with you as to whether our technologies are going to solve any of the problems that you see in your city. So they brought over their top research professors from Germany, I gathered my project managers together just to have that debate. We can get so much incredible value from that because we can talk to people who are on the cutting edge of technology solutions and they can talk to people who are on the edge of implementing and sorting out the problem. So yes that is a large part of what my role can add and I am constantly looking for opportunities to form new partnerships with new partners. Not necessarily having an eye on the specific outcome but I think you need to be entrepreneurial and talk to people to understand what they are trying to achieve and eventually they will come back round again and say 'oh I know that guy who is interested in autonomous vehicles, we want to talk to him' and eventually you get an outcome which is positive.

R - That's all really good information for us. And I actually agree with a lot of what you are saying. SO maybe if I could move onto one of the key questions which is about your strategy. Is there a strategy in place within the organisation or how you use data? Is there an onus for example on producing open data? And making the data from your projects available to a wider audience?

Principles underpinning data
operations

Increasing accessibility
via technology

Using technology for future
of city

Data playing a role in
future city

Understanding of 'big data'

Leadership positions taking
leading role

F - I think to say that there is a strategy is wrong. A strategy would be a very formal way of looking at it. There are a set of ideas and principles that guide a lot of the work that we do. The technology that we do that guides our IT programme came from a set of enterprises around accessibility. That was making sure that technology that was being introduced to the city could be used by everybody and that is my academic background - accessible technology, so I brought a bit of that to the city council and that has fed through many of the projects that has brought us closer and closer to the idea that a future city managed by technology and driven by data, within that but which is accessible to everybody and equitable and fair. So that is one of the principles, strands, threads that creates an understanding. We have quote which is as close to a vision statement for our open data programme that we have. I was at an event a few years ago and it was 30/06/2010 and at the time we in the big technology and digital innovation of the council were starting to understand the power of big data. But we were fortunate enough to have a councillor who was an IT professional so he was another level and fundamentally understood big data and how it was going to transform the way the council operates. The more the council can release its data and facilitate the delivery of services by

Partners delivering partners

Opening up of data

Politicians understanding of data

Challenging people who don't open up data

Thinking about data a lot in job role

City holds a lot of data

Accessibility to data

Governance adapting to new environment

Handling of data presenting challenges

Opening up of data brings issues/obstacles

Sharing data to improve the data

Commercialising data

Private companies profiting from data

others, rather than having to deliver everything themselves. The quote was: "There are only two types of data in BCC, confidential data which we can't share and open data which will be made available". The councillor was called Mark Wright and in 2010 for that boldness of vision to be expressed publicly was huge. Now that was driven by a particular politician's understanding of it but it did start us down that line, it gave us the impetus to start doing creative things and start to challenge people who maybe were not as comfortable to release their data.

R - That is a really good point you make because the politician to be making that statement gave the officers in the council the confidence to pursue this. So I notice you mentioned the power of data and the ability of it to transform the way in which councils operate. Perhaps you could give us your views on how you see the role of data in the development of smart cities and perhaps specifically in Bristol's case also.

F - Ok we I have thought a lot about data over the years so I will not be able to boil it down too much but what I would say is that the key things about data is that it is actually something as a city council we have in an abundance. As an organisation in the past we were organised around maintaining that data but also securing that data. So keeping it in a filing cabinet, making sure it was up to date but keeping it secure from people. And there wasn't really a consequence whereby the public should have access to that data even though they paid for it. So it is a massive cultural shift to speak to people who work in the public sector environment to say we should give this data to people. Now I have been doing this for a long time, I have worked in the city council with data since before 2010 and since 2010 with a big focus on data. And the size of challenges that have been presented to me with regards to big data have been a lot. Now if we were to say to somebody I want to take that data that you have created through your project and put it on this platform I would expect a number of reactions. The first would be we can't do that because it's not very good, it's not accurate or people would not understand it because we do not code it in an understandable form - basically saying we understand the data but other people wouldn't. So my argument against that is that if we publish it other people can improve by error checking it. The secondary response has been occasionally we can't publish this because we actually sell it and these data sets are usually something that people would find highly valuable, for example accidents statistics. Now this stuff should be made available to the people who create that data but insurance companies will pay a lot of money for that. And the third element which is probably a function of the fact

5.

Using data for transparency

publishing data for performance

Data influencing actions

Generations adapting to new data environment

Accessing data provides democratic process

Extracting value from data

LA not extracting value of their data

Trying new approaches for data environment

Department allowing new approaches

Failing forms part of the process

that often in the public sector you can feel that the public are very critical of what you do, people will say why should we give the public hammers to hit us with. If we public this data we will find issues, errors and will see that there are things we are underperforming in. And clearly that is about transparency and holding people to account. Now to some people that looks like over exposure to public scrutiny. SO I think data within a public sector organisation within a local authority is really powerful and contentious. And I think there is a cohort effect that needs to happen in that there are people who have worked in the sector and along time and operated with data in a certain way and they want to maintain but protect it and there needs to be that shift which perhaps comes generationally and this is about protecting the private data which we must never allow to be shared or exposed. But preparing and having the open data in an appropriate way so that other people can take advantage from it, people can gain value from it, and it might be that people want to run campaigns about it and say I'm looking at the traffic accident spots and there are black spots here and we want a crossing and that is a perfectly legitimate thing to do.

R - They are all really good points and to give you a bit of background to myself and my research, I worked in Liverpool City Council in the planning department, and leaving university so soon I was aware on the smart cities movement yet the officers were not so much and the organisation was not prepared - so there was a gap. The generational shift is how I view it and I think until that happens we will not see the true value of data.

F - I think your absolutely right and there is a real risk aversion within local authorities that increases as more pressure is put on budgets. Nobody wants to stick their head out, nobody wants to try something new because failure is career inhibiting. Not the essence of innovation is that you need to be able to fail otherwise you are not innovating. And I think that is another reason why having the directorate called Bristol Futures which was about trying new stuff that encapsulates the permission to fail. Fail fast - and I think that should be part of it, to fail quickly and inexpensively, but be permitted to fail and demonstrate that something doesn't work.

R - That's a really good point that you make and it will help us move onto the next key question which is what are some of the major challenges your organisation faces in attempting to adapt the increasingly data driven environment? Now when I look at Bristol I actually think you are possibly ahead of other cities in terms of mitigating those challenges with the formulation of the Future

Structuring org. to provide
right skills + environment

People understanding role of
data

Data literacy not spread
throughout org.

Opening up of data

Using data to improve
performance

Educating people on
benefits of data

Training people to use
data

Sharing more data
freely

Positive effect of platform
on SC development

Developing projects

Introducing new technologies

Data platform role as
catalyst

Developing new partnerships

Increasing global visibility
of city

Bristol department that gives you the freedom to innovate. But maybe if you could speak about any other barriers that you see?

F - Yes I agree that having the Bristol Futures department there and particularly having my team that sits within that which is the city innovation team provides a team that all fully understand the power of data. We are all data literate and we understand what the community, and technical community want from data but the rest of the organisation perhaps don't know in the same way. And that is a challenge because data literacy is not evenly spread throughout the organisation so there are a number of people who are the custodians of massive data sets that I would love to publish but they are too nervous to do so. They don't see the value of regular releases of open data, we are all under pressure in the public sector and when I go to somebody who doesn't understand how data will revolutionise the performance of the city and I say to them will you put the data into this spreadsheet and upload this data to the platform so that other people can use it they don't need that headache. And if they don't understand data then they are not going to go out and use it, so there is that education piece which has to be rolled out in terms of training to managers to say it is going to be worth your while doing this because there will be a tangible benefit for the city. But also to yourself because you will not have to answer the freedom of information requests that you currently do because you point people to the open data platform.

R - So just to pick up on a point you made there about the open data platform, do you think the influence of the platform has been positive in terms of achieving the aims of your department and the wider smart city aims of Bristol?

F - Undoubtedly. It is a real catalyst to have something tangible in the digital world. I had a mantra that I say to my team which is show them something. Because when we are working in the tangible, digital world which everyone talks a really good smart city but I am always surprised when people show me something. So I say to the team if you want to talk to somebody show them something whether it is a sensor, a router box, a video of something that is working because that is what people respond and react to and that is the stories that they tell people. If all you doing is blowing a lot of hot air at what you are going to do then that is not useful. So having that data platform is a tangible catalyst for the open data movement in Bristol and that has happened. We have applied to be recognised with the Open Data Institute as a global node and I made the application myself. We were interviewed and successful so then we became part of the ODI node networks. It is a global network of

7.

Creating network of international cities

Creating challenges to increase participation

Credibility of partnerships

Improving democratic process through participation

Introducing new SC initiatives to city

Handling of data forms new needs

Naming of SC projects increases visibility

Transporting of data an issue

Localising solutions to local challenges

Gathering data through implementing solutions

Improving frequency of data to create streams

Producing big data

cities across the world, Seoul is one, Paris, Chicago, Queensland so we are part of a very elite group of cities because we have been able to develop a community of practitioners and we regularly hold challenge events or 'hacks' to get people with ideas to come along and we have sold every challenge event out. So having the platform allowed us to create a buzz, we developed a network of people and there are 700 members of our meet up group, and also allowed us to get the credibility of being an ODI global node and from there everything is coming together. The challenge events are really high profile and get sold out to then making apps from this that go on the app store. So you start with one tangible real thing and you build on it. If all you are doing is talking and you have no real stuff to show people, then it is all built on sand.

R - Thank you for that insight because that is something we have reflected on which is the effect of having a data platform to allow for better meeting of aims. The contrast between cities who do and don't have the platform and the effect this has on their development is a big issue. So just moving onto the projects that BCC is currently pursuing that you would like to tell us a bit about.

F - Sure. Some of the projects that are in operation at the moment in the city is that we have two autonomous vehicle projects for driverless cars which have huge data requirements and data potential as well. One of those is called 'Venturer' and the other is called 'Flourish'. Now without going into too much detail the data that is derived from those projects will be enormous but it is not just about the data itself but about the transit of data and how you send the data between those nodes of infrastructure such as traffic signals. Now all these things are fascinating and all of those things need to be resolved and we are pleased that they are happening in this region. We also have an enormous catalogue of energy projects that we have been running, we have been running these projects for a long time as Bristol is still a social landlord, we still own and energise a large amount of council housing stock - we have about 28-29,000 homes and being a sustainable green city, and having the status of being a green capital in 2015, we have really focused on doing what we could to reduce the energy use in those households but also to make sure that people don't fall into fuel poverty. So I have done six energy saving projects, six smart grid projects just over the last few years so again there is enormous data archives from all those things. We measured lots of things and did energy monitoring whereby we were capturing data at five second intervals over a year so we had millions and millions of data points. Now one of the things that we took from that is to have that level of data, which I would say is approaching what people would refer to big data, the

Using data to increase knowledge
Data allowing future prediction
Forecasting via data
Using data for a purpose

Responsibility of LA handling data

Somebody is benefiting from all that data

Government leading the way

People are producing the data via activities

Owning data issue to extracting value

Using data for specific purposes

Restricting access to certain data

Developing new ways to use data

intelligence that you can derive from people, in terms of their practice and what they do is valuable but scary. We could know what time people had gotten up, we could also predict which is another matter once we had gathered data from a few months what they would do the next morning. We knew when people were on holiday, we knew you worked night shifts and we could know so much about people's lives just through their energy use and the energy use data. So that really woke us up to the potential of data both for good and for ill.

R - So there is a responsibility aspect on behalf of the council with regards to how you use that data.

F - Undoubtedly, and as I mentioned earlier I have been thinking about data a lot over the years and the current model for how data is managed is that data either sits in the public sector, in the government's hands or it sits in the private sector in corporate hands, for example with Apple, Google, Sainsbury's etc. so whoever owns that data derives the value from it. Now government is moving a little bit towards the way of publishing data so people can derive value from it but that is not the same thing as genuinely giving people ownership of their data and investment in the value of that data. You see because you and I generate so much data based on who we are such as what we do, what we have bought, who we have met, what our experiences have been like, has the bus been late? The value of all that data is enormous but we own none of it and we don't have the power or control to share it with who we want to share it with, nor do we have power over who or why we share it, even whether we want to share it. And also derive value back from that so as people become more sophisticated about their data there has to be a space as to where they can move into. Where it might be for instance that I am perfectly happy to share data about my health with the British Heart Foundation because they are an organisation that I care about and I would like to allow them access to my data free of charge whenever they may need it. I might also not want other organisations to have any access to my data, or if I do I want them to pay me for it in a particular way either to me or whether it is through investment to a community that I care about. So I have been thinking about much more sophisticated ways to think about data ownership and I haven't solved it yet but something has to change or be different.

R - So just to bring the interview to a close, when you go about comparing innovation now and previously in the organisations history do you believe projects attempt to incorporate the capture

9.

"House of Cards"

Creating a vision to provide growth

Positioning people who understand data

Factoring data into contracts

Providing ways to own the data

Still understanding how data affects LA's

Educating people on data

Using data to extract its value

People beginning to adopt new technologies

Beginning to shape people's lives

Ensuring accessibility to all for new solutions

Sharing data provides new services

of data through their design with the intention that that data can be used in the future for a large benefit through the use of that data?

F - That is a really interesting question. I think it is probably linked to personality and politics. I bring you back to the vision statement earlier as that was driven by an individual who fully understood the power of data, now he got up and he gave that statement because he was a councillor he was well positioned to drive that forward. Now a few years later we have a city director who also understood the value of data and what she didn't want to do was give away control of data when it has been procured through the system. Now she mandated that in every system that we procured going forward we had to have agreements in there that we owned the data. Now in owning the data that gives us the ability to deliver that data for free in any way we find useful but again that was driven by an individual who mandated a particular approach and enforced it. And in at least one occasion that I know about it resulted in the break down of a procurement because there couldn't be an agreement about the system and the issue of data ownership. So because we are in very early days of the role of data in ethics and in local authorities it does take these individual pioneers to stand up and say this is the way that we are doing it within the local authority while also playing catch up throughout the rest of the organisation. There are people like me who can inform educational session to help people see the value we are talking about and in ten years time those stand out individuals would have to stand out and say this is how we do stuff because there will be a general understanding that data is valuable, data is powerful and people will be educated enough with that data. It is like all technologies, people will probably start off feeling afraid of it unless they are early adopters. Then the rank will file and people will begin to be more educated and adopt it. Then there is a moment of danger were people feel comfortable enough with it to explore and find themselves in difficulties but eventually it just becomes the way that things are done. It is a process and an evolution.

R - So there is a process and we are very much at the early stages of that.

F - Definitely at the early stages and it is about attempting to bring everybody along with us so this doesn't become a siloed thing were open data sits as a separate pursuit within the organisation. It is important that everyone sees the benefits and everyone sees the benefits that can be had as sharing their data as a service.

X.i.iii Interview memos

Memos act as informal analytic notes (Charmaz, 2006) prompting the analysis of codes and categories throughout the research process. The process of memo writing plays an important role in the abstraction of ideas as some codes begin to stand out to form theoretical categories. The insights that arise through the act of writing enhance the data-gathering process and help in the active engagement of materials to produce theory that is grounded in the data. Charmaz (2006) writes 'memos give you a space and place for making comparisons between data and data, data and codes, codes of data and other codes, codes and category, and category and concept and for articulating conjectures about these comparisons' (p. 72-73).

The memos explore the relationships between the units of analysis. One method by which this can be done is to highlight an emerging concept and analyse it via comparing with alternative concepts and its role in the formation of categories. Memos of each unit of analysis can then be used to compare the relationships existing between different variables. Connections between concepts, as well as the properties of the unit of analysis (for example, is the participant representing the public or private sector?) formed the basis for writing of memos to be included with the thesis. Charmaz (2006) notes that there are few methods for writing memos and suggests the best thing to do is 'what works best for you' (p. 80).

There are two structural paradigms to memos that complement each other. Early memos explore the qualitative codes and take place as data collection is taking place. This helps to direct the focus of the study in an exploratory nature. Advanced memos meanwhile trace the development of codes and categories throughout the units of analysis. The thesis, however, added in another stage termed 'preliminary' to coexist among and between the early and advanced codes. This was simply down to the preference of the researcher in phasing the analysis. A comparative stage is what results through an explanatory nature. The thesis took advantage of adopting a writer's strategy prior to writing up of the memos. Following on from the early memos firstly a clustering of ideas provided a flexible and visual technique (Rico, 1983) for organising the data in an understandable manner, a process otherwise known as 'diagramming' (Silva et al., 2015). A short free writing exercise then followed to

explain the clustering in greater detail. The combination of which formed the basis for writing advanced memos that aimed to bring together all codes, concepts and categories to aspects of a larger argument, or development of theory.

X.iii.i Comparative memos

Comparative Memo AB

23/06/2017

Merseytravel (A) Sector: Public | Transport

Liverpool City Council (B) Sector: Public | Political

While the Merseytravel interview focused heavily upon the internal process of the company in relation to its adaptation to the newly formed data-driven environment, the Liverpool council interview was broader in terms of the range of topics discussed. However, both held a common characteristic which was the location of operation throughout the Liverpool City Region and more specifically, Liverpool itself. Each highlighted the importance of the organisation in adapting to the newly formed environment and the importance of the role of data itself in operating in a competitive environment. Thinking of data as a resource then is beginning to form an integral part of organisations in their evolution. More specifically a focus is held on the value of data in improving knowledge and efficiencies throughout the enterprise, as well as the service aspect of the public sectors for each of the interviewees.

Comparative Memo ABC

23/06/2017

Merseytravel (A) Sector: Public | Transport

Liverpool City Council (B) Sector: Public | Political

Data Consultancy Performance (C) Sector: Private | Smart Cities

The introduction of Data Consultancy Performance to the research was representative of the focus upon data in the development of the smart city. Furthermore, the private enterprise formed an alternative dimension to the two previous public sector organisations. Once again, data as a resource formed an

influential topic throughout the interview meaning that a paradigm was beginning to emerge and a synergy between both private and public sectors as highlighting data as a valuable resource. One area within which the organisations differ, however, is through the fact that both Merseytravel and Liverpool City Council were having to adapt to the new environment whereas Data Consultancy Performance was a newly formed organisation with the aim of operating within the environment from the get-go. This allowed for a new category to emerge that focused on the business model of the company, whereas previously in both interview A & B the business model was a concept that formed part of the organisation adaptation category.

While the interview with Merseytravel did focus on new technologies' role in capturing more reliable and accurate data, both Data Consultancy Performance and Liverpool City Council introduced the notion of project design as a category. Within that category, the concept of social value was also apparent – this was perhaps to be expected from the public sector, however, it was surprising to see the concept form such a substantial part of the private sectors business model.

Comparative Memo ABCD

23/06/2017

Merseytravel (A) Sector: Public | Transport

Liverpool City Council (B) Sector: Public | Political

Data Consultancy Performance (C) Sector: Private | Smart Cities

Transport for Greater Manchester (D) Sector: Public | Transport

Another transport department participant from the public sector was introduced to the research, this time, however, from a different geographical location in the North-West namely, Manchester. A common ground upon which a dialogue was opened was through the formation of a category comprising that of data as a resource. This time, however, the category was not as fruitful in terms of concepts grouped together when compared to the previous interviews as 'purpose' and 'usability' were the only concepts consistently produced throughout the interview. The adaptation of the organisation to the newly formed environment, however, was again an integral category – a factor that reinforces the notion that data as a resource is important to the business operational side of organisations and there is indeed a very specific requirement for organisations to adapt in order to compete in the data-driven

environment. Competition is a very important factor for much of the organisation involved due to the fact that many operate throughout the public sector which means that applying for funding from central and regional institutions forms the basis of the business model. Transport for Greater Manchester, however, further introduced the creation of new business models related to the newly formed environment that focuses upon a partnership approach to development and newly formed services residing not only in the physical environment but also in the digital environment.

Comparative Memo ABCDE

23/06/2017

Merseytravel (A) Sector: Public | Transport

Liverpool City Council (B) Sector: Public | Political

Data Consultancy Performance (C) Sector: Private | Smart Cities

Transport for Greater Manchester (D) Sector: Public | Transport

Red Ninja (E) Sector: Private | Smart Cities

The inclusion of Red Ninja as a private sector smart cities company provided an opportunity to better understand the business model of private sector companies, while the substantial experience and expertise of the company in developing projects throughout the sector again provided the opportunity to further explore a previously introduced category. It therefore became apparent that proof of concept of projects prior to full investment in development was an important stage in the life-cycle of smart city initiatives. This was a previously introduced concept in the Liverpool City Council interview and could be a shared characteristic due to the close cooperation of the two organisations. The role of funding in the business model of the private enterprise also reinforced the notion that businesses operating throughout the smart cities industry rely heavily upon funding programmes and tenders to realise and develop smart city projects. A significant development was the notion that social outcomes and social values of projects are again an integral part of the development of the smart city with evidence suggesting it is important to both public and private organisations – the primary comparative characteristic then is the interest in smart cities suggesting that the business model relies upon social outcomes being at the forefront of the tender process whereby institutions provide funding in order to reduce costs in separate areas. The data cycle again came up which is a common

category throughout the interviews providing further evidence that there is a new environment forming that is data orientated.

Comparative Memo ABCDEF

23/06/2017

Merseytravel (A) Sector: Public | Transport

Liverpool City Council (B) Sector: Public | Political

Data Consultancy Performance (C) Sector: Private | Smart Cities

Transport for Greater Manchester (D) Sector: Public | Transport

Red Ninja (E) Sector: Private | Smart Cities

Bristol City Council (F) Sector: Public | Futures

The final interview was held with a department of a public sector organisation, from a separate geographic location, that has been specifically formed as a result of the new environment. This brought together many aspects of previous interviews as the research gained first hand the role of the future department of Bristol City Council. This in itself was evidence that organisations are making internal changes to the way they operate in order to adapt to the newly formed environment of which data is a primary resource and the data cycle is important to both the project design phase of smart cities as well as the business model adaptation. While open data was a concept mentioned throughout previous discussion together with Liverpool City Council, Data Consultancy Performance and Red Ninja, the notion and introduction of the concept of Big Data provided another layer to the category. Here the value of data as a resource is deemed to be much more prevalent should a larger amount of data that is categorised as 'big data' be produced. Project design it is therefore suggested should attempt to achieve this status, however, in order to do so there are also partnerships that should be developed in the design and implementation phase of projects. As has previously been stated in some interviews, namely that of Liverpool City Council and Transport for Greater Manchester, funding programmes now include specific requirements to tender with partnership of organisations from both separate backgrounds i.e. public/private as well as geographical on different levels of national and international cooperation (especially with that of European funding). It will be interesting to see then the effect that Brexit will have upon the funding of smart city programmes – a factor that is definitely at the forefront of all

organisations – the evidence of which can be found in the notes of field observations through the Urban Mobility Action Network meetings.

X.iii.ii Early memos

Early Memo

02/07/2016

Merseytravel (A) Sector: Public | Transport

Data was the predominant topic discussed throughout interview A with Merseytravel. Both its role in making decisions and the organisational response to the data-driven environment. This first interview was used to establish the prominence of data in organisations' thinking and day-to-day activities. The conclusion was such that data's relevance to the subject area of smart cities was conclusive and therefore highlighted as a key theme to take forward to the next interview. The primary revelation to emerge from the interview was that data plays a vital role in the performance of the organisation. In this sense then data provided value through increased insight that was to be used to inform future decisions regarding the operations on the organisation. In order to extract that value, however, there was a requirement (of which the organisation was still in the process of implementing) to adapt to the new working environment of which data has shaped. Upon reflection the interview was highly directed towards understanding the implications of data for organisations operating throughout the smart cities sector and no alternatively themed insights arose.

That is not to say this was a weakness of the interview. As the first planned interview, it was important to establish the prominence of data within the subject area. However, moving forward it is deemed that a broader conversation should take place in order to investigate fully the avenues for research that are important to the conceptualisation of the smart city.

Early Memo

03/08/2016

Liverpool City Council (B) Sector: Public | Political

A lengthy delay of just over a month between the opening interview (Merseytravel) and this (LCC) politically themed interview - an aspect of the interview procedure that can at times be frustrating. Having established the prominence of data within the subject area it was time to speak with decision makers who are actively responsible for the transformation of cities to 'smart' cities. It was reassuring to hear that even in Liverpool there are smart city initiatives being pursued and their development is in the minds of people who hold influential positions. An initial aim of the interview was to speak with somebody who speaks for the people, or citizens, as they are an important part of cities. While the practicalities of speaking to many citizens is not the best, it was hoped through speaking with a local councillor, who in theory speaks for the people who have elected said councillor, we should gain an insight into the driving forces of the citizens. And to an extent this was achieved. Although we did not hear thoughts of citizens themselves, we did gain an insight into how data is being used to improve the lives of citizens.

Upon reflection of the interview, while much was learnt about data and the effect digital innovation is having on governance, there was still little insight into smart cities themselves – such as the practical solutions that form the market.

Early Memo

05/08/2016

Data Consultancy Performance (C) Sector: Private | Smart Cities

A shorter period between the second (LCC) and third (DCP) interviews brought an insight into the world of a dedicated smart cities company. The background of the company, however, was technology of which it is applying expertise in the smart cities field – a move that was pushed by IBM – one of the biggest players in the smart cities sector with a lot to gain should the concept take flight as it is currently promising to do so. Finally, we began to listen to some of the practical solutions that form the market. Firstly, the private sector business model is gaged towards offering services to the public sector with the promise of reducing costs and bringing a better service to citizens themselves. In this particular case the solution is through the form

of a model that handles data for the public service attempting to create new insights and provide technology for personalised services. It was interesting to see the friction between that of the private industry and the political philosophies of the city. Reflecting this was the notion that solutions need to be primed towards the local needs of the area targeted – perhaps in order for the solution to be taken up by the local authority.

Again the prominence of data was for sure in the conversation. Many avenues were exhausted throughout the interview process, however, as much of the conversation was geared back towards the solutions on offer from the company. This is to be expected and understood, however, as the prime focus of the private enterprise is itself.

Early Memo

06/08/2016

Transport for Greater Manchester (D) Sector: Public | Transport

An insight into the private world of the smart cities market preceded this interview and it was refreshing to speak again with an operator of the public sector. That is not to say I see the future of smart cities in the public sector, however, the habit to draw the conversation back to what the enterprise is offering (in the private sector) can limit the broadness of conversation achieved through the interview experience. The main topic to emerge from this interview then was the role of the public sector in facilitating the market and opportunity for the private sector to enter. It is important, however, to note that the transport sector is often a lot more commercial in their approach and ethos when compared to other sectors of public sector governance. Nonetheless, the insight provided through this interview was in my opinion the most rewarding to date due to the attitude of the participant and also the role they play in smart city development. A key outcome of the interview was the realisation that a specific innovation department was created to bring forward the development of new services of mobility for the smart city.

This interview completed the cycle for units of analysis of firstly establishing the prominence of data in smart cities (A), then understanding the view from citizens and

politics (B), to entering the world of the private enterprise (C), to understanding the role of the public sector in facilitating private markets for smart city solutions.

Early Memo

07/09/2016

Red Ninja (E) Sector: Private | Smart Cities

The key insight to emerge from the previous interview (D) that the public sector plays a pivotal role in smart city development by creating the opportunity for private enterprise to enter the market made it appropriate that the next interview was with again with a private enterprise. While the last private participant was what could be deemed an SME in the field, this interview was with a company who started out as an SME and while there is the possibility that they could be classed as an SME are definitely at the forefront of solution providers for smart cities certainly in the region and also as we were to learn in the interview further afield – both in the UK and abroad. It was really good to speak with somebody who has been in the field from the start in the UK and who has a real passion for improving peoples lives through their work. While again a characteristic of the company is that they have a technology background. Funding issues and the challenge of developing a business model for a smart cities company arose during the conversation. However, despite that the company is progressing well and providing top end solutions to the public sector and health sector especially. A collaboration with a large technology company again reinforced the opinion that there is a lot to gain for providers of software who filter their solutions down to SMEs who implement them on the ground and in local contexts.

Early Memo

29/10/2016

Bristol City Council (F) Sector: Public | Futures

It was refreshing to have this interview in such a short space of time between contacting the participant and having the conversation. I was to learn that this is because of the mentality of the participant in always providing an ear and mouth to anybody interested in the field and more accurately in the field and Bristol. The fact

that the participant has this mentality is most definitely some part of the factor as to why Bristol is one of a handful of cities who are leading the way for smart cities in the UK. Indeed this interview provided a broad conversation in which many themes and topics arose. An insight into the way data can be gathered and used in smart cities, as well as the issues of privacy of data and trust are how I would summarise this interview. A good rapport was built with the participant that I can imagine companies working throughout the sector would also appreciate – definitely a good thing to have when looking for investment. A key outcome of the interview was the discovery of the Bristol Futures department in the council, of which a specific innovation team operates for smart cities. I would suggest that this is definitely one of the best models for governance for smart cities I have seen to date.

X.iii.iii Preliminary memos

Preliminary Memo

13/12/2016

Merseytravel (A) Sector: Public | Transport

The first interview to commence, there was a heavy focus on the internal procedures of the organisation in adapting to the new environment. This was used to firstly establish the prominence and effect data is having on organisations operating throughout the sector. The role of data in evaluating and reviewing performance was a primary indicator of the effect data is having on the organisation. A lot of work is happening to restructure the company in order to respond to the digital age. This work includes the development of a new department specifically targeting the use of data and its handling in the organisation. An onus is placed on how team members handle data, with newly formed roles being introduced called ‘data guardians’ who are responsible for the data once in their ownership. The role of data in determining the performance of the organisation is meeting their key performance indicators was a primary outcome of the interview therefore enhancing the idea that data is to be used as a resource and there has to be systems in place to exploit the value of the resource.

These systems include processes for the gathering of data, analysing of data and finally presenting of data. The introduction of new technologies was highlighted as a means by which the data gathering procedure can improve by creating regular streams of data at new frequencies. One example of this is through the application of real-time data providing new solutions and opportunities of services for the smart city. An onus was placed throughout the interview not only on the technological applications of data but also on the human processes behind which it is transported between data guardians. In terms of the presenting of data, the absence of a data platform was highlighted as a limiting factor and therefore had a negative effect on the development of the smart city.

The potential effect of the introduction of the metropolitan area for Liverpool City Region was deemed as positive for the organisation in terms of implementing projects for the provision of new services. At current there is an approach for developing new partnerships and providing the opportunity for attendance at network meetings aimed at obtaining funding to implement new smart city projects. However, the centralisation of funding to allow for better collaborations in cross-local-authority solutions was an opportunity relished by the participant.

With regards to the sharing of data, the organisation suggested they felt the requirement to firstly get the internal system and process in place, however, this seemed to be a side-stepping of the issue whereby the commercialisation of data is of strategic importance to the operating business model of the organisation, and the level of openness is nowhere near rivals such as Transport for Greater Manchester or Transport for London.

To conclude, the primary insights from the interview were to do with data as a resource – exploiting the value of the resource by optimising services and improving the performance of the organisation set against key performance indicators. Due to the technical background of the participant and specialised focused of using data for evaluation, key insights into the stages of the data cycle also formed the outcomes of the conversation.

(A)

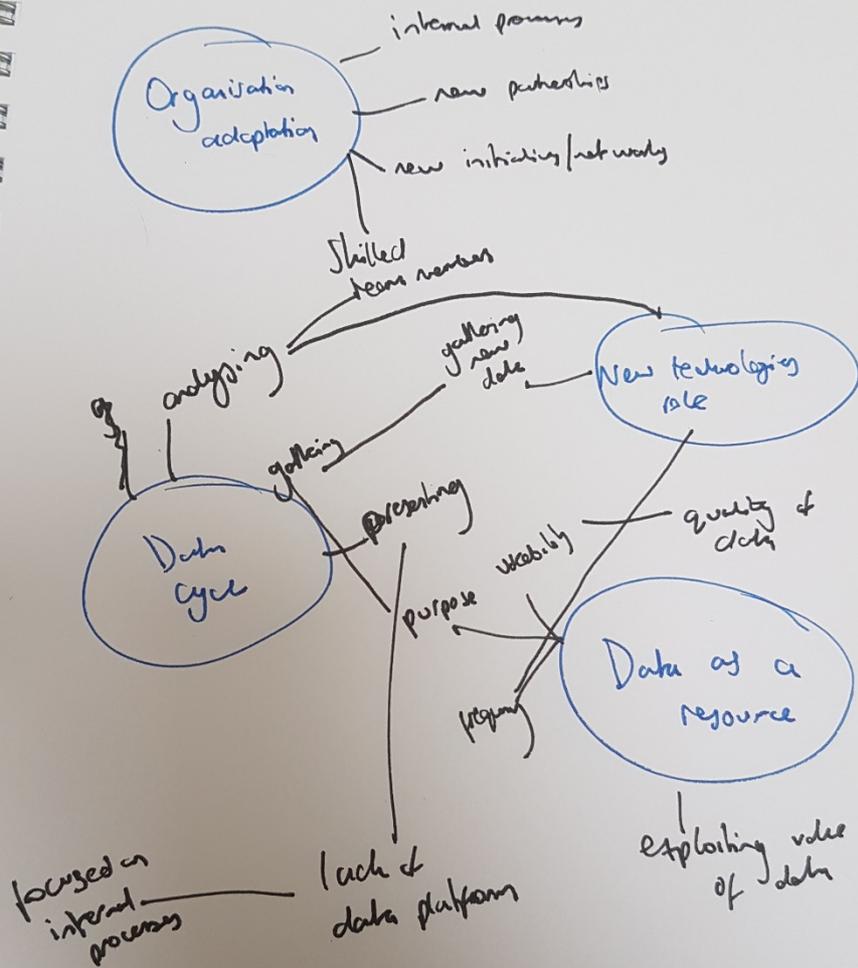


Figure 10. 2 Interview A diagramming

Liverpool City Council (B) Sector: Public | Political

The role of the participant as a local councillor, who holds the responsibility as Mayoral Lead for Smart Cities provided the opportunity to see into the world of the public sector in terms of its role in shaping policy and the strategic direction of the city in its development. The feedback presented then with regards to Liverpool reinforced the opinion that it is lagging other cities in its development journey towards the smart city. Initial problems found by the researcher in contacting the relevant department were confirmed that this was a result of the organisation not adapting to the new environment. There is no department that has its role aligned with that of the smart city, and there are no officers at the disposal of leaders (such as the participant) in order to carry out the work needed to really push the development of the smart city. In fact the role with the highest impact is that of the participant who is mainly responsible for pushing the agenda and attempting to increase the visual profile of the city on a national and international scale to attract investment in the sector.

As was stated by the participant the current policy is inept, there are no dedicated role nor department, and there is no data platform that acts as the catalyst for stimulating smart city growth through the sharing of data that can be used to ignite new projects. Nonetheless the conversation resulted in finding out about the smart city initiatives that have been pushed by the councillor. It is here we find out that the private sector is predominantly responsible for the development of the city in terms of smart city initiatives. It makes you think the opportunity is there should the local authority recognise and respond to the new digital environment it is now a victim, as oppose to benefactor, of – as it should be.

In designing projects targeted at smart city responses the participant advocates the role of citizen engagement throughout the process – this is to be expected of due to the political position of the participant, however, an onus on providing local solutions to local problems was also pushed. Here the notion that we should not introduce

technology for technologies sake was put forward. The role of citizens in producing data was highlighted as a significant factor to be accounted for when determining who benefits from such smart city projects. Using the city as a laboratory was highlighted as one aspect of an approach that is being developed in order to better improve the transformation into the smart city. A memorandum of understanding between the city governance and sensor city is proposed whereby sensors developed through the initiative can be tested in the environment of the city – if this proposal comes to fruition it could prove highly valuable when trying to attract investment – this type of proactive approach is exactly what is needed.

The role of data as a resource is highlighted throughout the conversation. Examples are provided highlighting the role of data in providing an evidence base to provide to decision makers in order to inform decisions. There should not be data for data's sake, however, and a clear purpose as to why the data is being collected should be provided. This links back to the earlier mention that as citizens produce the data, the outcomes should be targeted at improving the lives of citizens in the city.

A significant outcome of the interview was the role of the planning department in smart city development. The participant highlights the requirement for a new response to the issue whereby planning needs to adapt both in policy and in practice to the digital age of smart cities. This is a missed opportunity and could provide the leadership that would take the city forward in its transformation.

and implement projects using the software provided in the market. The implementation by SME's on a local scale is an aspect of providing local solutions to local challenges.

The company operates on a social value business model, whereby using data as a resource informs the decision-making process. Assessing the impact of the project takes a holistic approach, as the social value concept does not function on the traditional expenditure-revenue model. Thus, a holistic approach is taken towards the assessment whereby reduced cost in the health sector, for example, can be gained through introducing technology that provides increased efficiencies and reduced costs. An example of the types of provision of services provided includes personalisation of the product. This enhances the experience of the user (usually the citizen) and thereby allows, for example, specific dietary plans and physical exercise training targeted at the specific problem at hand thereby shaping the behaviour of the citizen towards the desired direction.

A model for data interoperability is also under construction. This aims to provide a means by which the council can internally standardise their data formats in order to improve data sharing thereby improving efficiencies. This product works towards the concept of using data as a resource in order to improve the decision-making process. The ability of technology to provide privacy to those who want it, while also allowing individuals to share data with organisations they wish to do so also highlights the attempts of the company to provide solutions to existing problems regarding data. The processing of data within the data cycle is also highlighted as important in order to create insight and exploit value of the data collected.

Moving onto the concept of open data the participant is highly supportive. Benefits are highlighted in improved transparency and accountability of governance in relation to the funds spent on providing services. A strong opinion is offered with regards to the obstacles in place for Liverpool specifically with the absence of a data platform, but also the industry itself with the 'house of cards' phenomenon appearing to highlight the political philosophies that at times can hinder the progress of the private sector, and smart city development itself.

To conclude the conversation also highlighted the inept abilities of the public sector in the digital age. A lack of a strategic vision and opening up of data are seen as issues throughout the sector. However, such issues do appear to breath life to the company as they primarily function on the ability to provide solutions to the public sector for such problems.

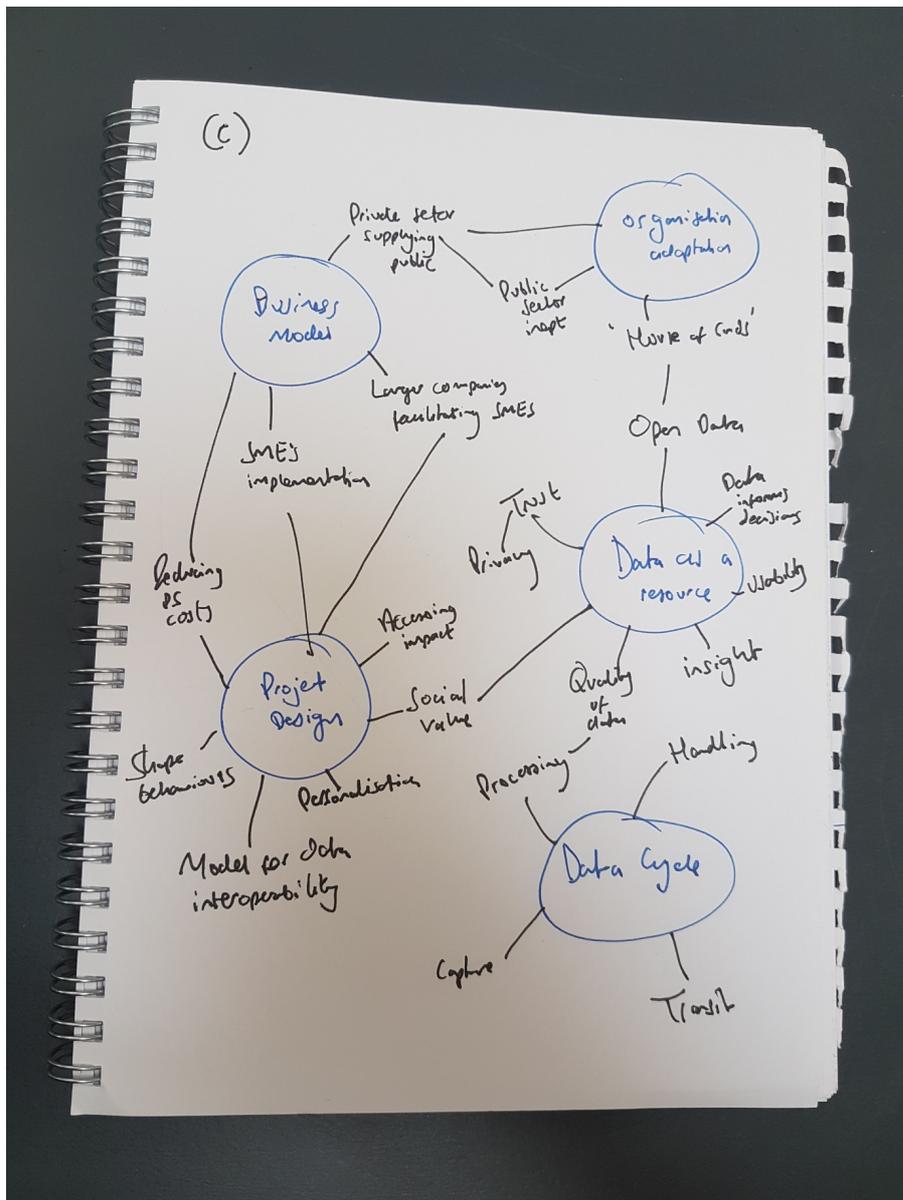


Figure 10. 4 Interview C diagramming

Transport for Greater Manchester (D) Sector: Public | Transport

The role of the public sector in facilitating smart city development was a prime outcome through the interview. The participant provided insight into the mindset of the transport authority for the metropolitan area in regards to the strategy for their development of the smart city. Providing the infrastructure for the provision of the private sector to offer enterprise solutions is one example. The primary example provided is the electrical vehicle charging network by the authority in order to attract investment from energy companies and also car companies. It is within this context that we can view the role of the public sector in providing the opportunity for private investment in the area. As a side-effect of this is the specific operating structure of the transport authority in the metropolitan area. In the view of the participant the metropolitan area has a positive impact upon the development of the smart city due to less obstructions to the provision of infrastructure that can provide the opportunity for private investment. As a side note it was discussed the impact the introduction of a metropolitan area to the Liverpool City Region could have on smart city development. Again the response was that it would be a positive move.

Bringing the discussion back to the case in hand which is Greater Manchester, the valuable insight into the adaptation of the business model with regards to transport was introduced. Here the participant highlighted the introduction of another layer to the city in the form of digitisation, therefore, forming both the physical layer of the city (whereby companies who provide bicycles for the cycle share scheme can advertise on the physical bikes themselves) and also the new digital layer of the city (an aspect of the digital age whereby new technologies, such as smart phones, allow for alternative revenue streams to be produced). The way within this would happen is through the use of an app that is provided as a service alongside the physical layer of the city services e.g. cycle share scheme.

This leads us onto one of the primary initiative of the participant in terms of their day-to-day role within the innovation team (a newly formed department specifically designed to bring forth the smart city for Greater Manchester) which is introducing

the new service of cycle sharing fleets for citizens to use. Here the introduction of new technology allows for suppliers (also citizens) to make available their bike for other citizens (on the demand side) to use when the bike is free. This is enabled through smart locks and access to an app – therefore demonstrating the role of the physical/digital equilibrium in smart city services. The design of the project also provides some insight into the rationale of smart city initiatives. Here, the participant provided the insight that through implementation of such schemes it is possible to shape the behaviour of citizens to provide targeted outcomes (such as increasing cycling rates in order to reduce the strain on the NHS throughout the area). The provision of new services also includes personalisation for citizens (again enabled through new technologies), as well as gamification and incentivisation (a means by which it is proposed the authority can persuade or encourage new behaviours and actions by citizens).

Underpinning all of this, however, is data whereby the important role it plays was highlighted by the participant. Without data none of the digital layers of the city would be available, however, it is important to note the role of the physical layer of the city in facilitating the opportunity for a digital layer – the two have to co-exist in order to survive. An onus throughout the interview was placed on the purpose of the data being collected, reflecting the targeted outcomes highlighted above through project design and implementation. The usability of data was a factor, while also the consistent streams of data being produced allowing for a more informed and therefore effective decision making process.

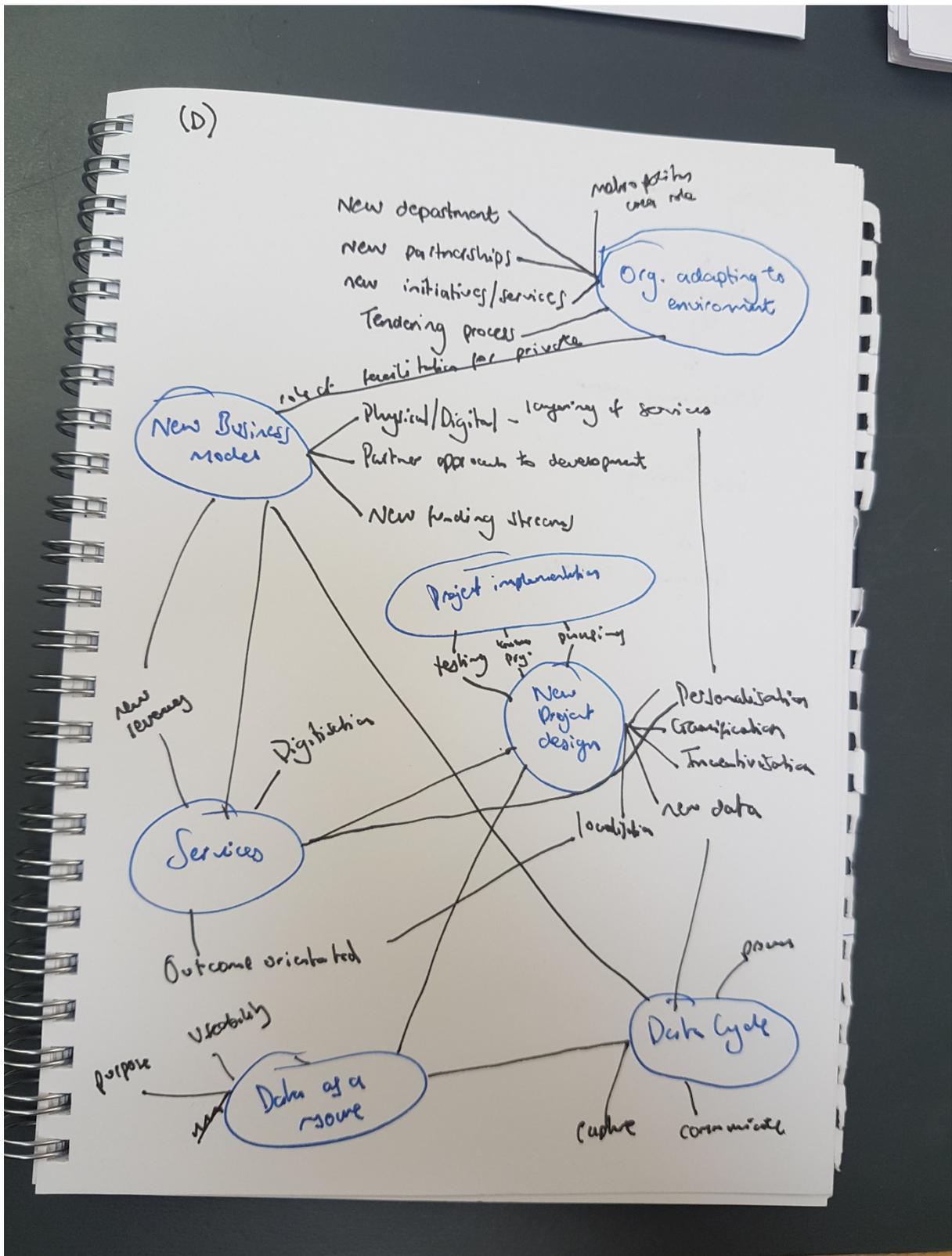


Figure 10. 5 Interview D diagramming

Red Ninja (E) Sector: Private | Smart Cities

It seems appropriate to begin this memo by mentioning the flagship project of the private SME in their collaboration with Siemens, the NHS, and Liverpool City Council which is designed to improve ambulance response times by controlling and adapting the traffic light system throughout the city. Access to the traffic controls (which had to be negotiated with the council and was facilitated by a local councillor) provides a large amount of data that can be used to cross-reference with the location of the ambulance with the aim to improve response times for serious cases in order to increase the chance of survival for the patient. This project is being tested in Liverpool with plans to expand to Manchester and hopefully further afield should the proof of concept and testing phase return positive results. The strategy above by which using the city as a laboratory, phasing in stages to the project development, and testing is a key insight of the interview whereby we gained first hand the process of taking project from concept to design and finally implementation.

This provides a good context as to where the company stands today, however, as we found out through the interview it has not always been plain sailing. The first project to commence in the smart cities sector was nowhere near as advanced. In fact the data that was used to design the project had to be collected manually due to the absence of the relevant data coupled with the non-existence of technology (at the time, 2010) in the city to collect the required data. This resulted in a long and tedious process whereby the team had to manually collect the data at certain points in the city. The quality of data, as well as the frequency (what can be known as the usability of data) therefore suffered. It goes to show the advancement of the field in this short space of time.

Moving on from this the next project (2012) that was pursued again resulted in data access problems. However, this time the data did exist it was a case that Network Rail did not want to share that data – something we will later find stifles development of smart city initiatives. Nonetheless the team eventually managed to collect the required data through manually collecting it (although this this time with technology)

however the time delay reduced the impact of the project. This led the conversation onto the role of open data in aiding the development of smart city initiatives. The participant was a strong advocate of opening up data for other people to use and campaigns consistently for such practice – especially from the public sector who they often regard as analogue in their approach to the digital age. The company advocates the sharing of data through open data initiatives and also offers educational sessions for its value. The overall role of open data in the development of smart city projects and advancement was a primary communication of the interview.

Rich data regarding project development was acquired during the conversation. Specifically the creation of a strategic vision, coupled with partnership programmes, citizen engagement and designing local solutions to local challenges characterises the approach towards the design of projects for the company in the field of smart cities. Underpinning all of this is a belief that accessibility to technology for all ages is a primary obstacle that smart city practice has to overcome in order to create an inclusive smart city for all.

To conclude, the approach towards finding a return on investment for the smart city projects was not as much of an issue for the company as has been stated by alternative literature. The social value focus and perspective for social outcomes of projects means that the business model is secondary. However, the requirement to survive in the private sector also means that alternative approaches have to be developed which includes IP of technological solutions and a partnership approach to funding projects.

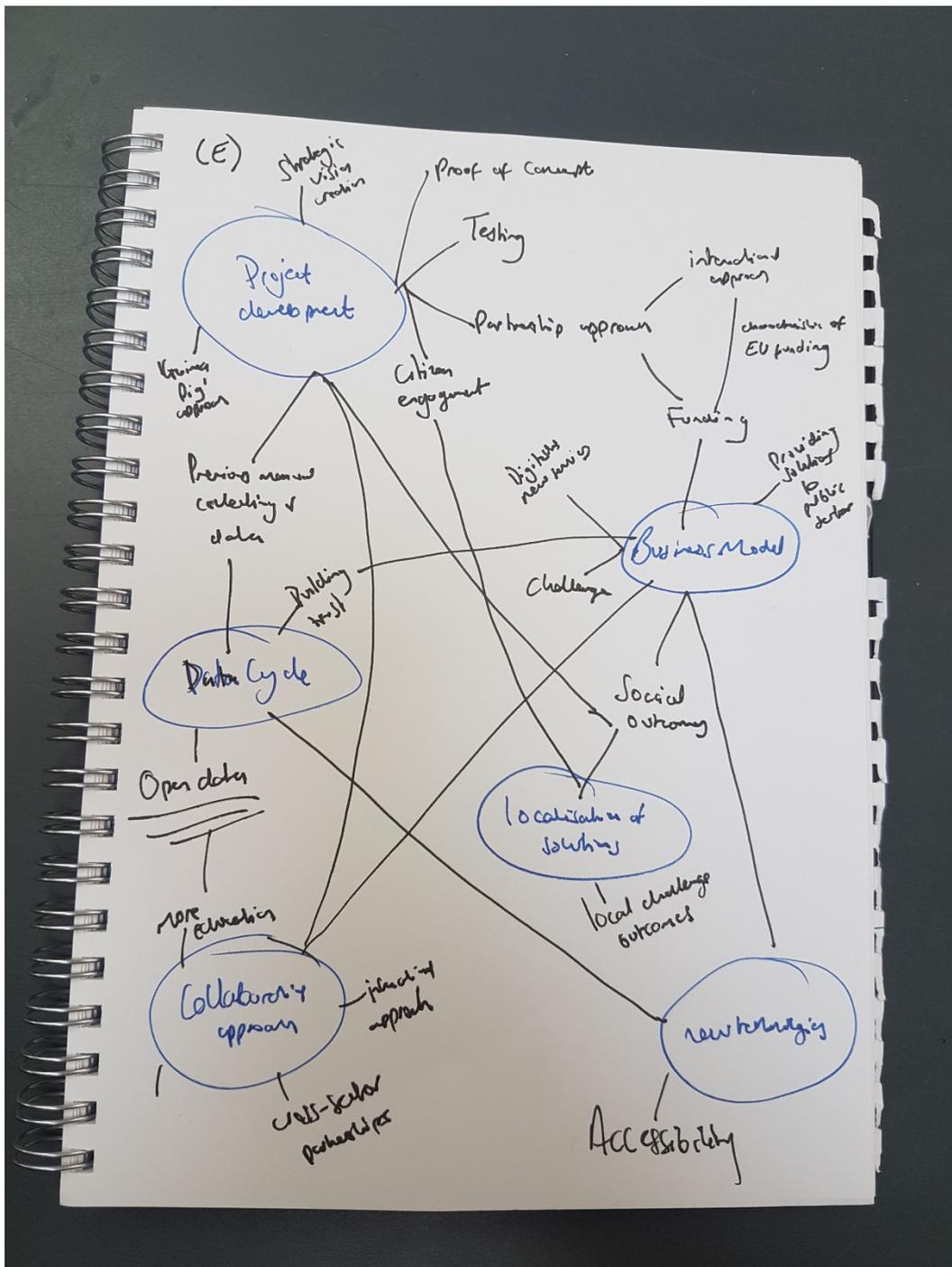


Figure 10. 6 Interview E diagramming

Bristol City Council (F) Sector: Public | Futures

An appropriate place to start is perhaps significant adaptation of Bristol City Council in terms of the development of a Bristol Futures organisation. The reason it is termed an organisation as oppose to department is due to the org sitting outside of the council yet still tied to it in achieving their aims and vision. The innovation team that sits within the Bristol Futures is responsible for much of the projects that have given Bristol a name as one of the leading smart cities in the country. The interview revealed, however, that this was an effect of the ethos that is applied throughout the whole of the Bristol Futures organisation whereby the sharing of data, coupled with the responsibility of the public sector in maintaining and securing private data to gain trust is fundamental to their operations.

The introduction of the issue of trust of the public sector in handling data came about as the participant described the accumulation of what they attributed the term 'big data' in a recent locally targeted solution to local challenges of the energy sector supplying the vast amount of social housing under the authorities responsibility. As the participant highlighted, the responsibility extended beyond simply supplying energy to the houses, and more towards ethical grounds for handling big data produced through the implementation of smart metering. Here a key insight was provided whereby the vast swathes of data being produced and transmitted to the local authority on a daily, hourly, minute basis allowed the opportunity for intrusion into peoples lives. In fact just from the data being produced and gathered, one could (should the necessary ethical and safeguarding procedures not be in place) use the data to understand when a person is at work, whether they are on holiday. But not only that the data could be used to forecast and predict what a persons routine (such as when they will wake up, when they will be out the house) is and therefore this highlighted the very real role and responsibility of the public sector in handling and gaining trust in handling peoples data.

The data that makes up this private data cannot and will not be shared by the local authority., However, as was highlighted by the participant the organisations strives to

make available all other types of data through their open access data platform. This principle was provided by a local councillor previously in the authorities history and highlights the requirement for a leader to emerge that helps the organisation adapt to the new environment. The production of the data platform is viewed as a highly positive influence of the development of the smart city. Therefore reinforcing previous interview data and also highlighting the absence of such as platform in Liverpool and the effect of such in their development towards the smart city.

The design of projects aimed towards accumulating new data streams was at new rates of frequency was also a factor in the conversation. The usability of this issue was highlighted as was the purpose or reason or collecting such data. This came back to providing outcomes targeted at local challenges and using the data to create a more informed approach towards decision making.

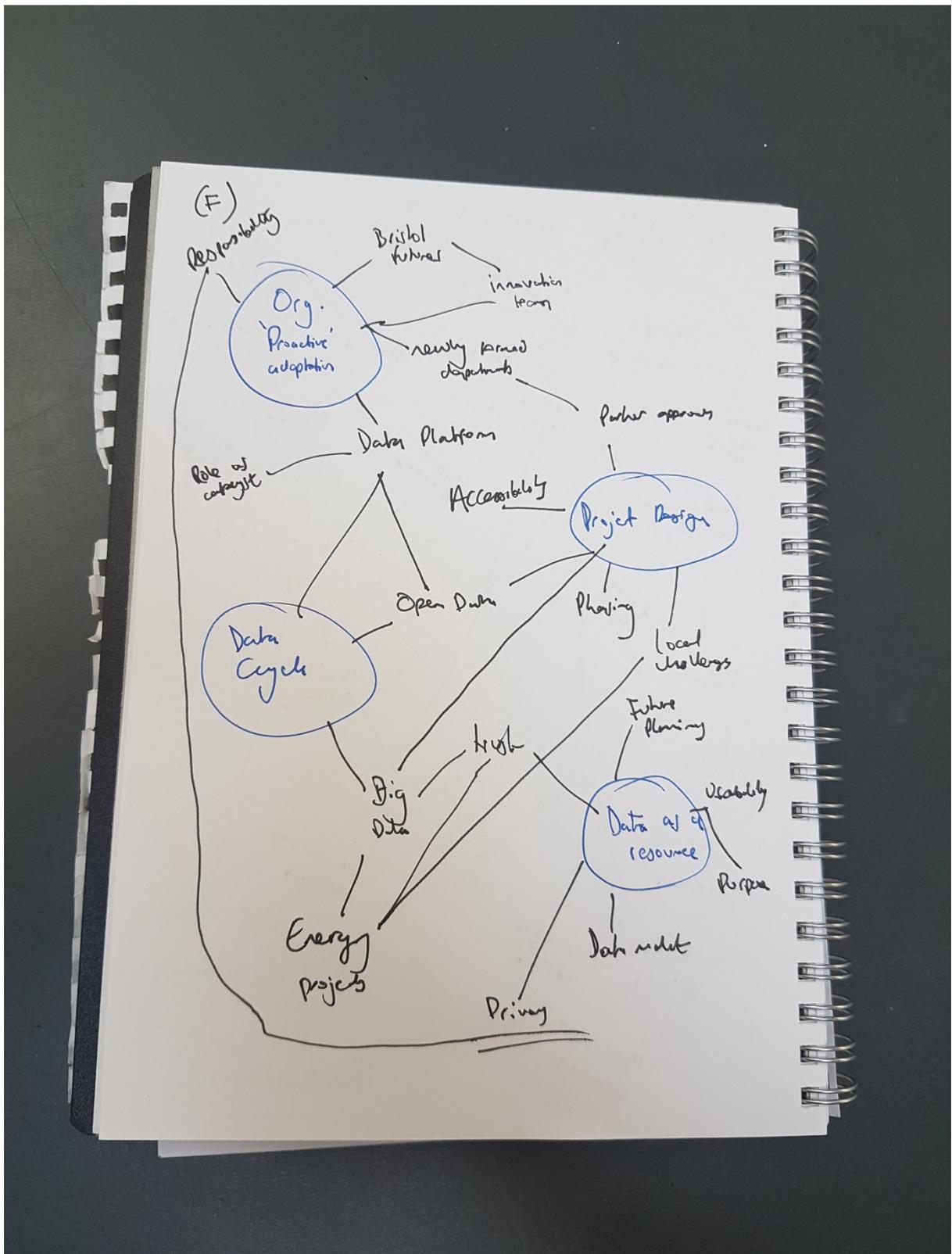


Figure 10. 7 Interview F diagramming

X.ii Phase two

X.ii.i Probing the relationship between smart city planning applications and evaluation of planning policy

Correlation coefficient is a technique used in statistics to measure the strength of a relationship between two variables.

Pearson correlation coefficient was used to measure the relationship between the variables.

Tested hypothesis with Spearman's rank correlation coefficient – rank correlation is a measure of the relationship between the rankings of two variables or two rankings of the same variable – we did the rankings of two variables (testing each hypothesis).

Correlation coefficient

The Pearson correlation coefficient is a measurement of linear correlation between two variables, which in the case of this research is the evaluation of planning policy and indicator of smart city development. A value of +1 would represent a positive linear correlation, while a value of 0 represents no linear correlation and a value of -1 represents a negative linear correlation. A positive linear correlation is one whereby as X gets bigger so too does Y; while a negative linear correlation is one whereby an increase in X variable coincides with a decrease in Y. A neutral linear correlation meanwhile represents no relationship between the two variables.

Hypothesis testing

The relationship between evaluation of planning policy and smart city development was investigated through the testing of hypothesis that aimed to formulate a strategy for the management of development of smart city planning applications that could be integrated into the decision-making framework for planning smart cities.

Analysis of planning policy & smart city development

Table 10. 1 Smart city planning matrix

Smart city planning application matrix			
Variable	Data	Sensor	Technology
Solution	124	82	51
Facility	112	0	331
Support	74	0	71

Correlation coefficient took place to measure the number of planning applications with the evaluation of planning policy in relation to the smart city framework.

Null hypothesis

- Null hypothesis (a) There is no significant relationship between evaluation of planning policy and number of planning applications for each development type.
- Null hypothesis (b) There is no significant relationship between evaluation of planning policy and number of planning applications for each development role.
- Null hypothesis (c) There is not significant relationship between evaluation of panning policy and number of planning applications.

Smart city characteristics tested hypothesis

- a1. The higher the evaluation of smart city characteristics, the higher the number of data planning applications.
R value: 0.1190476
Neutral

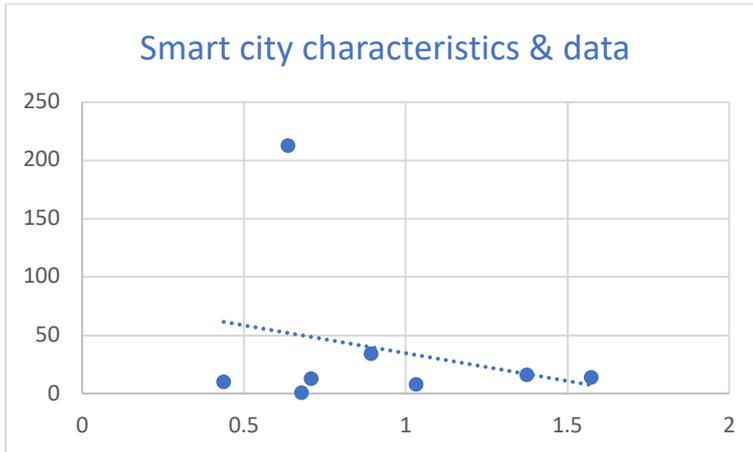


Figure 10. 8 Smart city characteristics & data planning application matrix

a2. The higher the evaluation of smart city characteristics, the higher the number of sensor planning applications.

R value: -0.160714

Neutral

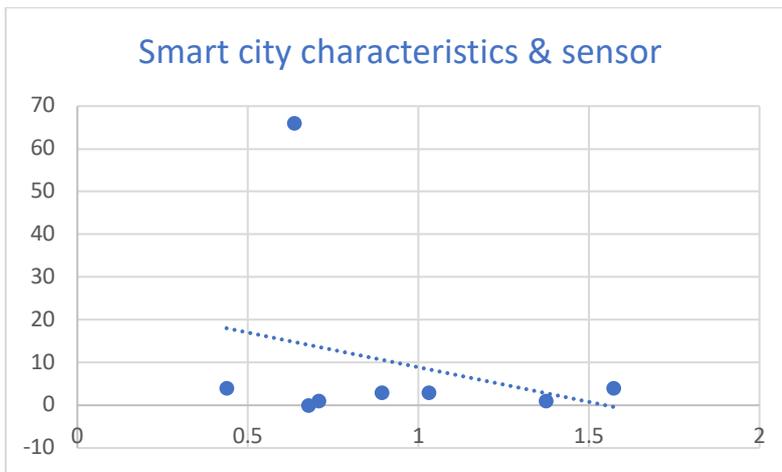


Figure 10. 9 Smart city characteristics & sensor planning application matrix

a3. The higher the evaluation of smart city characteristics, the higher the number of technology planning applications.

R value: 0.1666667

Neutral

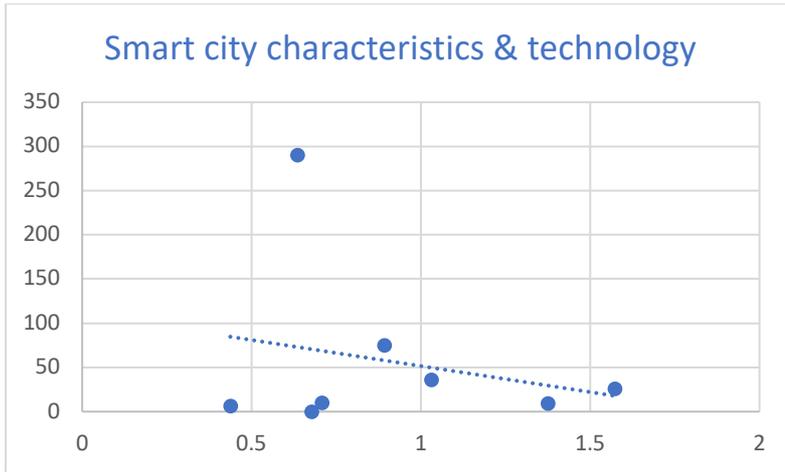


Figure 10. 10 Smart city characteristics & technology planning application matrix

b1. The higher the evaluation of smart city characteristics, the higher the number of solution planning applications.

R value: 0.2797619

Neutral



Figure 10. 11 Smart city characteristics & solution planning application matrix

b2. The higher the evaluation of smart city characteristics, the higher the number of facility planning applications.

R value: 0.16666667

Neutral

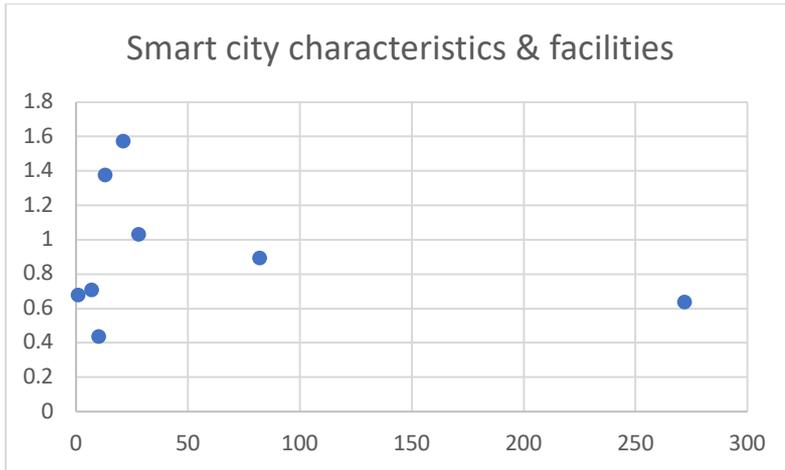


Figure 10. 12 Smart city characteristics & facility planning application matrix

b3. The higher the evaluation of smart city characteristics, the higher the number of supportive planning applications.

R value: -0.190476

Neutral

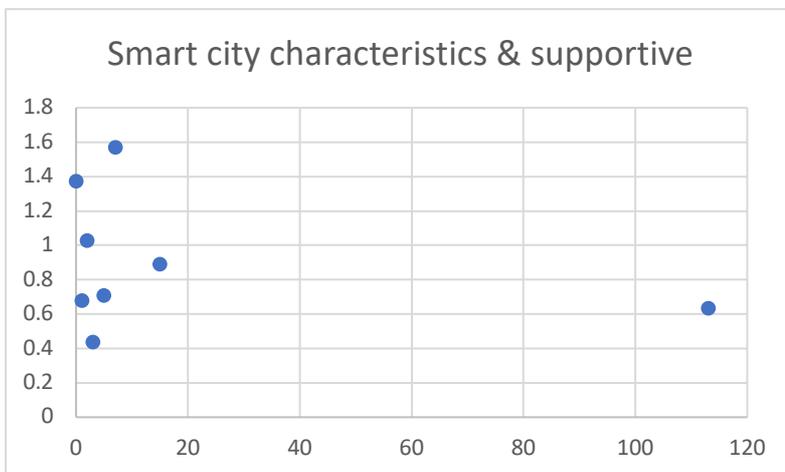


Figure 10. 13 Smart city characteristics & supportive planning application matrix

c1. The higher the evaluation of smart city characteristics, the higher the number of planning applications.

R value: 0.23809524

Neutral

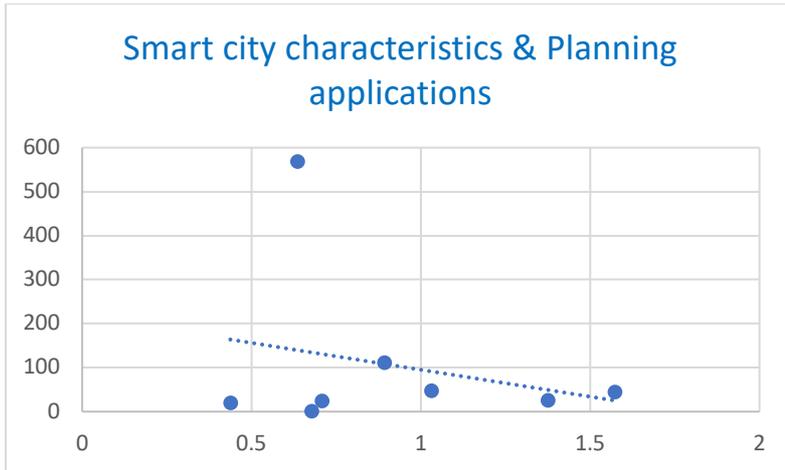


Figure 10. 14 Smart city characteristics & smart city planning application matrix

Summary: In each instance the tested hypothesis were rejected and null hypothesis is accepted therefore summarising that there is no significant relationship between evaluation of planning policy and smart city development.

Using data as a resource tested hypothesis

a1. The higher the evaluation of using data as a resource, the higher the number of data planning applications.

R value: 0.125

Neutral

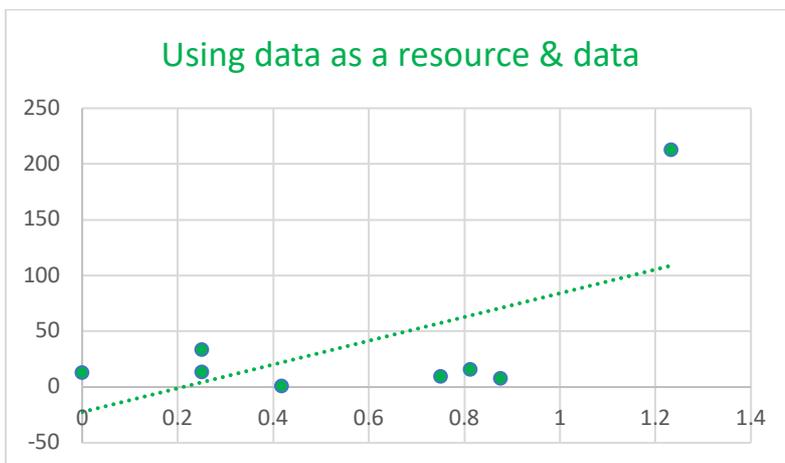


Figure 10. 15 Using data as a resource & data planning application matrix

- a2. The higher the evaluation of using data as a resource, the higher the number of sensor planning applications.

R value: 0.380952381

Neutral

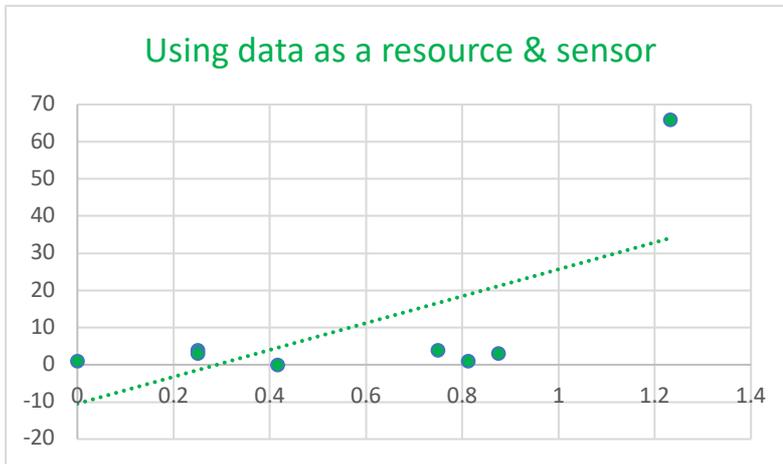


Figure 10. 16 Using data as a resource & sensor planning application matrix

- a3. The higher the evaluation of using data as a resource, the higher the number of technology planning applications.

R value: 0.24404762

Neutral

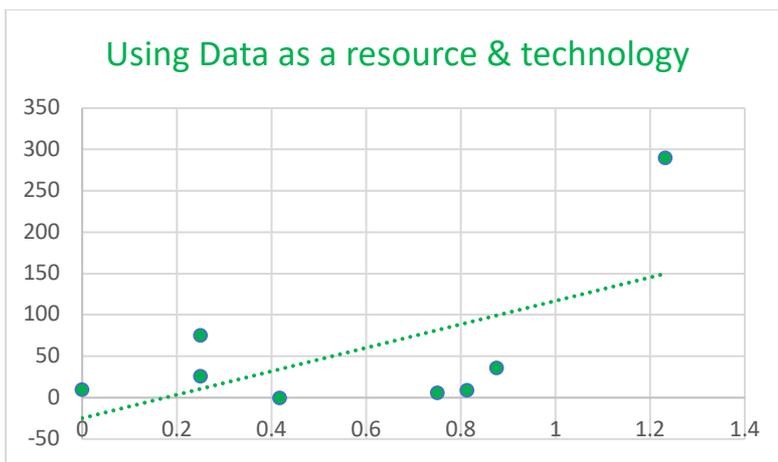


Figure 10. 17 Using data as a resource & technology planning application matrix

- b1. The higher the evaluation of using data as a resource, the higher the number of solution planning applications.

R value: 0.0714286

Neutral

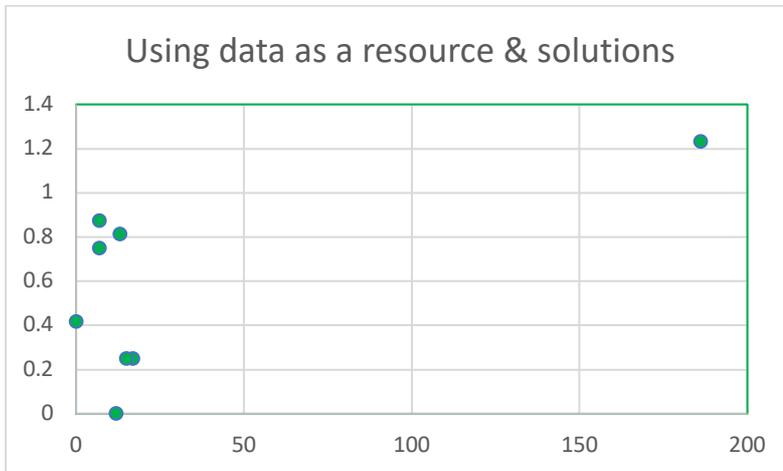


Figure 10. 18 Using data as a resource & solution planning application matrix

b2. The higher the evaluation of using data as a resource, the higher the number of facility planning applications.

R value: 0.4583333

Neutral

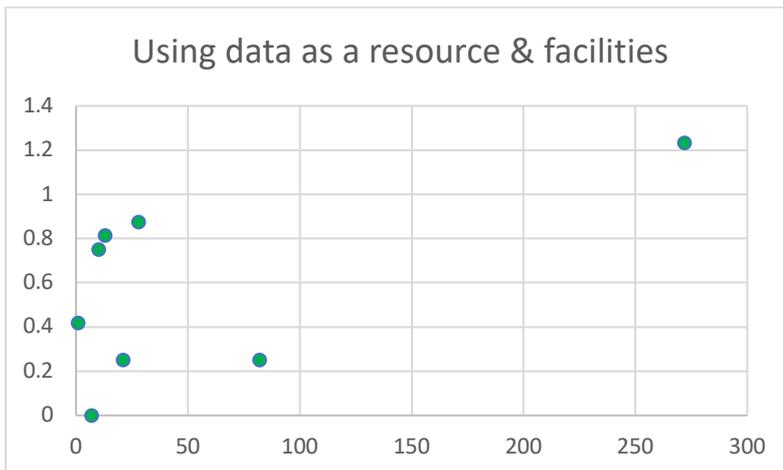


Figure 10. 19 Using data as a resource & facility planning application matrix

b3. The higher the evaluation of using data as a resource, the higher the number of supportive planning applications.

R value: -0.125

Neutral

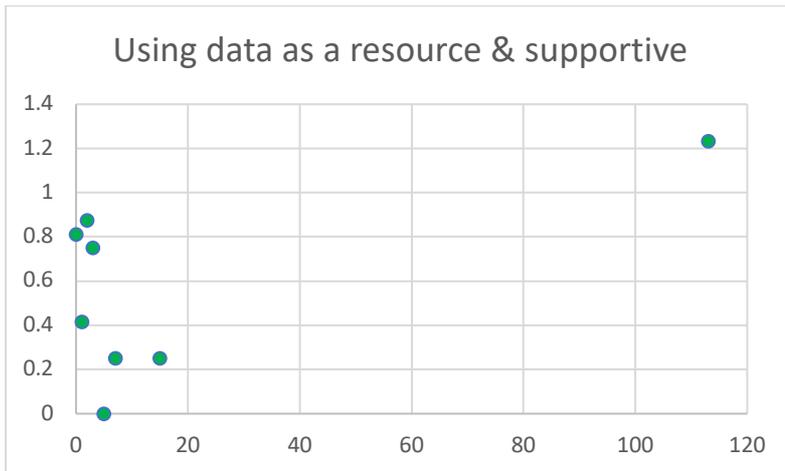


Figure 10. 20 Using data as a resource & supportive planning application matrix

c1. The higher the evaluation of using data as a resource, the higher the number of planning applications.

R value: 0.36309524

Neutral

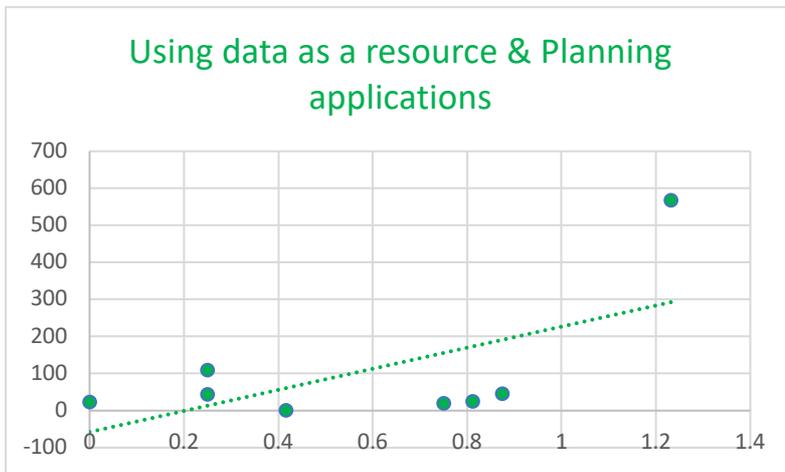


Figure 10. 21 Using data as a resource & smart city planning application matrix

Summary: In each instance the tested hypothesis were rejected and null hypothesis is accepted therefore summarising that there is no significant relationship between evaluation of planning policy and smart city development.

Project phases tested hypothesis

a1. The higher the evaluation of project phases, the higher the number of data planning applications.

R value: 0.02380952

Neutral

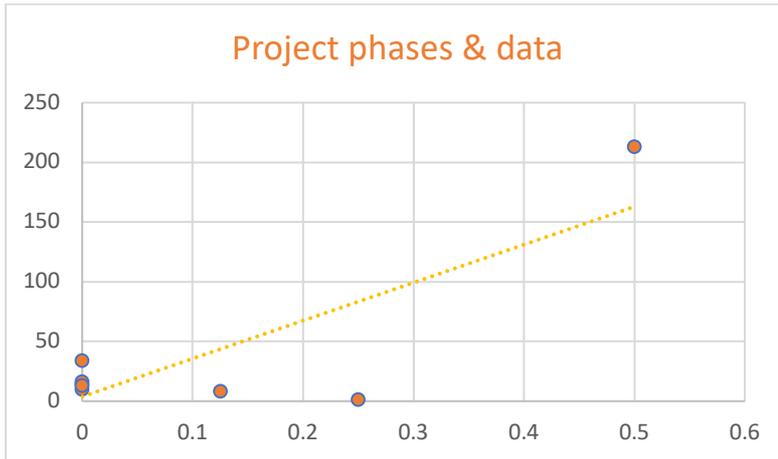


Figure 10. 22 Project phases & data planning application matrix

a2. The higher the evaluation of project phases, the higher the number of sensor planning applications.

R value: 0.2202381

Neutral

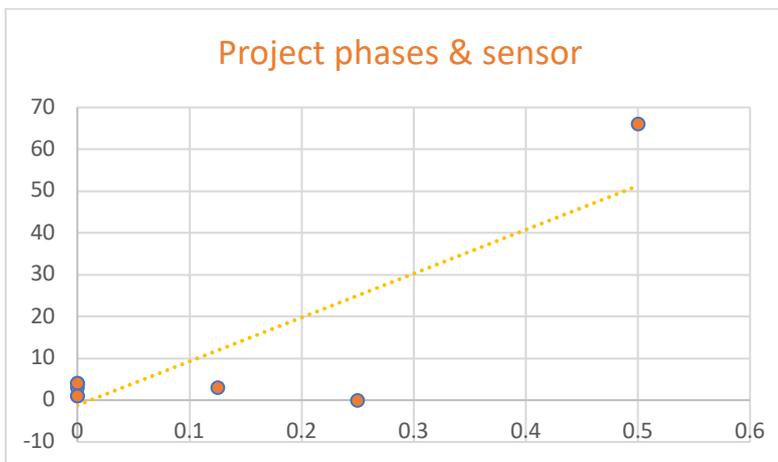


Figure 10. 23 Project phases & sensor planning application matrix

- a3. The higher the evaluation of project phases, the higher the number of technology planning applications.

R value: 0.30952381

Neutral

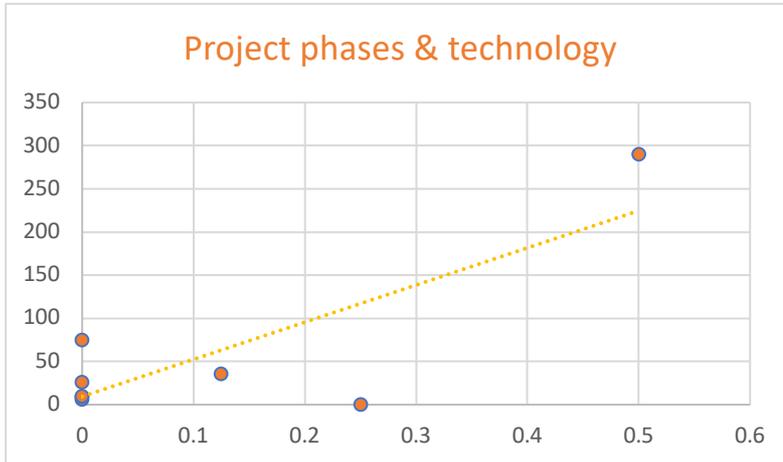


Figure 10. 24 Project phases & technology planning application matrix

- b1. The higher the evaluation of project phases, the higher the number of solution planning applications.

R value: 0.0654762

Neutral

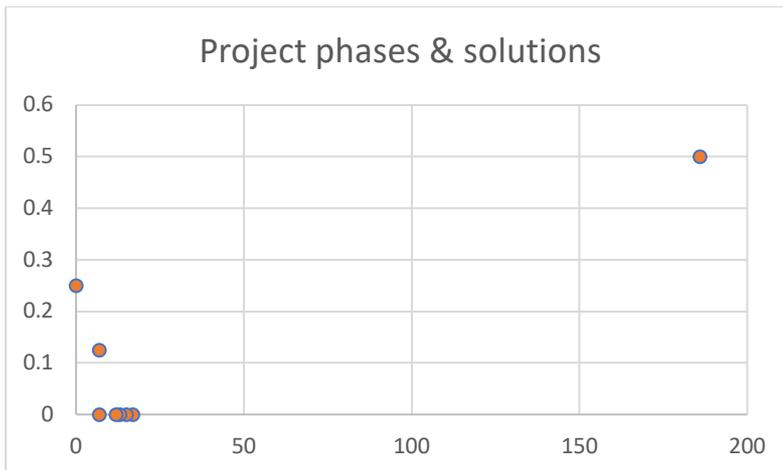


Figure 10. 25 Project phases & solution planning application matrix

b2. The higher the evaluation of project phases, the higher the number of facility planning applications.

R value: 0.3095238

Neutral

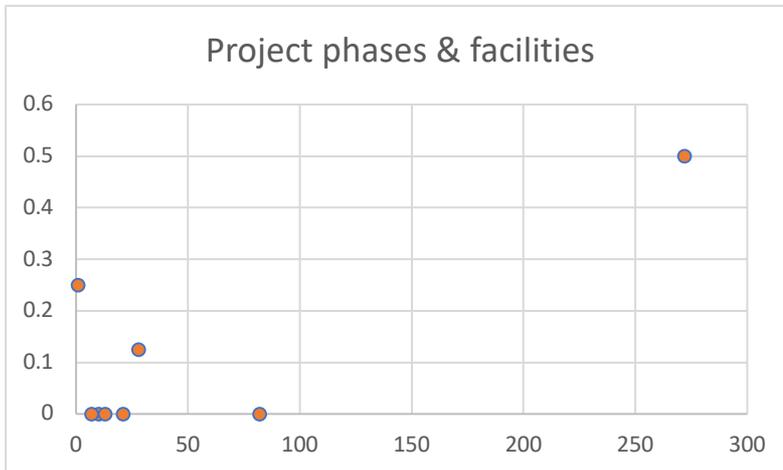


Figure 10. 26 Project phases & facility planning application matrix

b3. The higher the evaluation of project phases, the higher the number of supportive planning applications.

R value: 0.1904762

Neutral

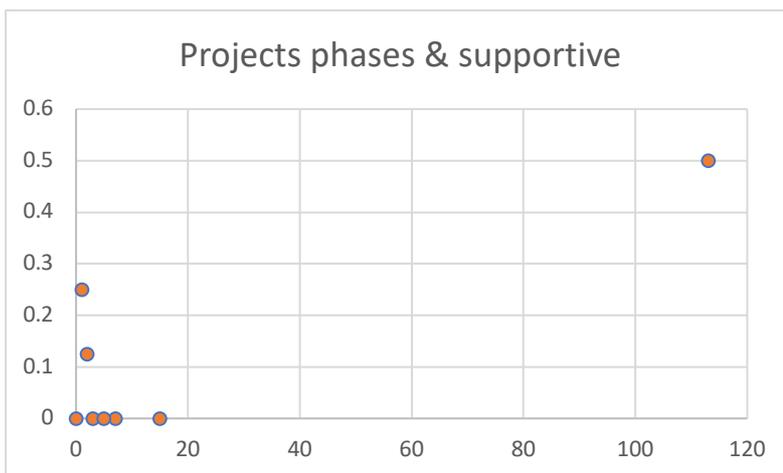


Figure 10. 27 Project phases & supportive planning application matrix

c1. The higher the evaluation of project phases, the higher the number of planning applications.

R value: 0.30952381

Neutral

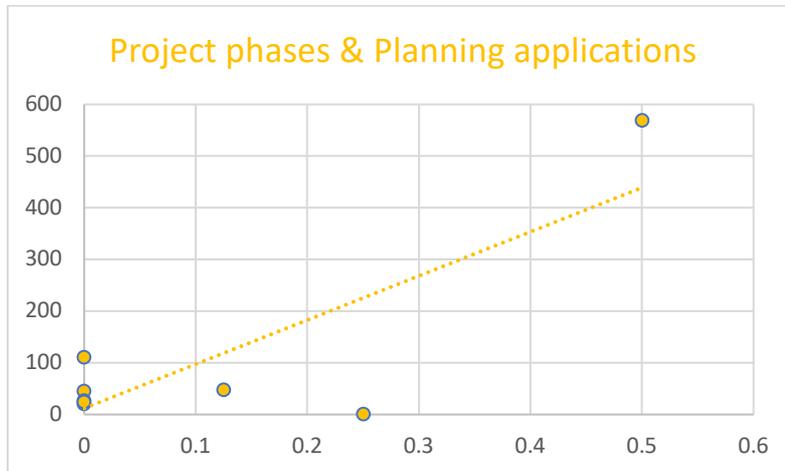


Figure 10. 28 Project phases & smart city planning application matrix

Summary: In each instance the tested hypothesis were rejected and null hypothesis is accepted therefore summarising that there is no significant relationship between evaluation of planning policy and smart city development.

Overview

According to the research result, there does not appear to be a significant relationship between planning policy and smart city development and as such a decision-making framework for smart cities should therefore aim to build upon the strengths of an established development system, work towards improving the weakness of smart city characteristics; so that the threat of the new environment is mitigated and opportunity of utilising data as a resource is realised.

X.iii Phase three

X.iii.i Questionnaire results

Strategic planning for smart cities

Showing 26 of 26 responses

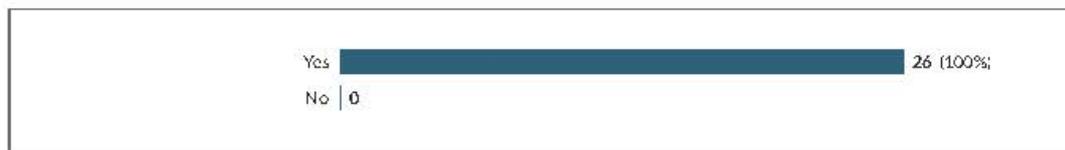
Showing **all** responses

Showing **all** questions

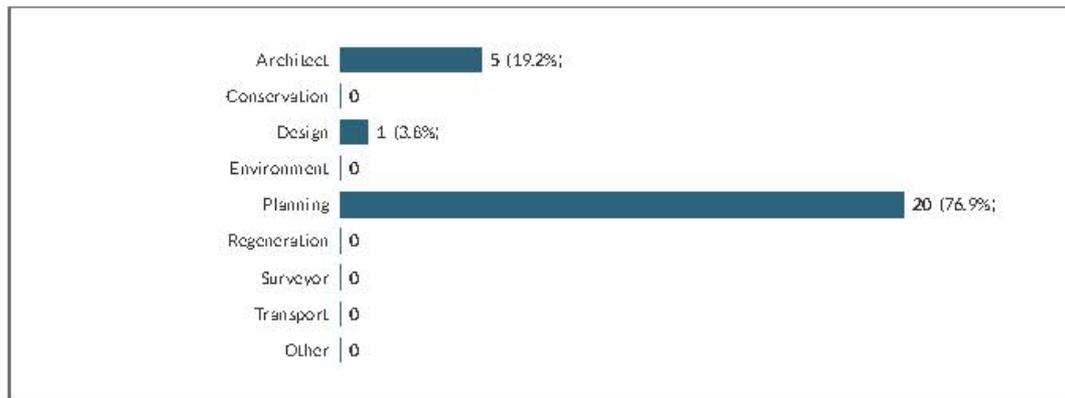
Response rate: 17%

Professional background

1 Do you work in the built environment?



1.a Within the built environment, which of the following sectors would you use to describe your profession?

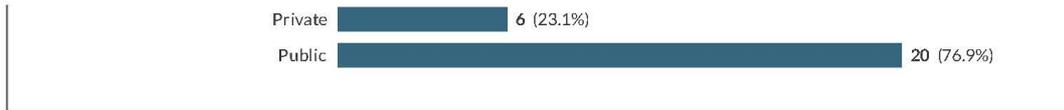


1.a.i If you selected Other, please specify:

No responses

1.b Do you work in the public or private sector?



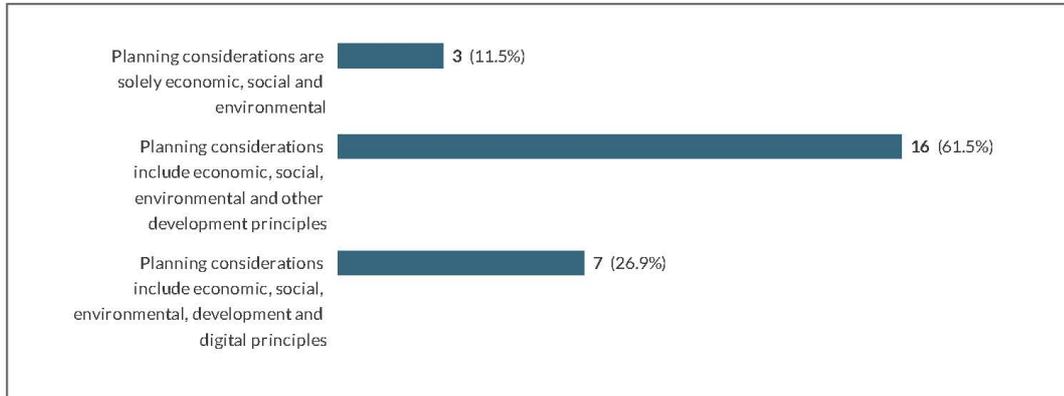


1.b.i Please provide an overview of your department and role.

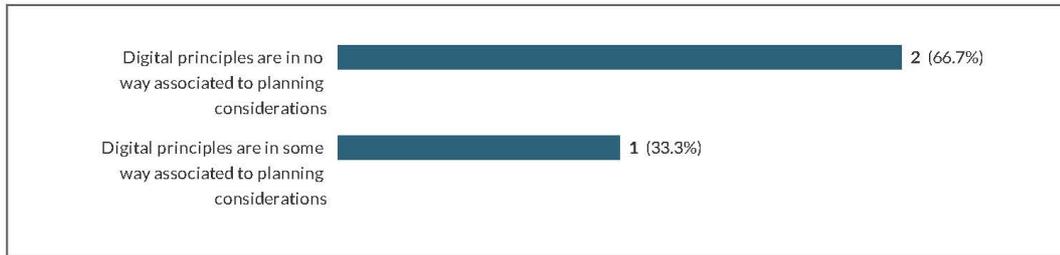
Showing 5 of 26 responses	
Development management officer at Liverpool City Council	333130-333122-30002522
Planning officer in development management at Liverpool City Council I deal with applications both minor and major including household and advertisements	333130-333122-30003973
Development management	333130-333122-30004562
Planning Officer - Development Management. Assessing planning applications and making recommendations to senior officers and committee, giving pre-application advice to developers.	333130-333122-30014386
Section deals with and assesses all planning applications submitted for determination under the Town and Pountry Planning Act 1990. I am currently involved within the Enforcement arm of the planning section. But my role recently changed and will soon be dealing with a range of planning applications for various development proposals across the city (Liverpool). applications can range from minor developments such as householder developments to major infrastructure developments. The role also entails giving pre-application advise to prospective applicants and also engaging with members of the public as well as elected members.	333130-333122-30012290

Planning consideration to digital principles

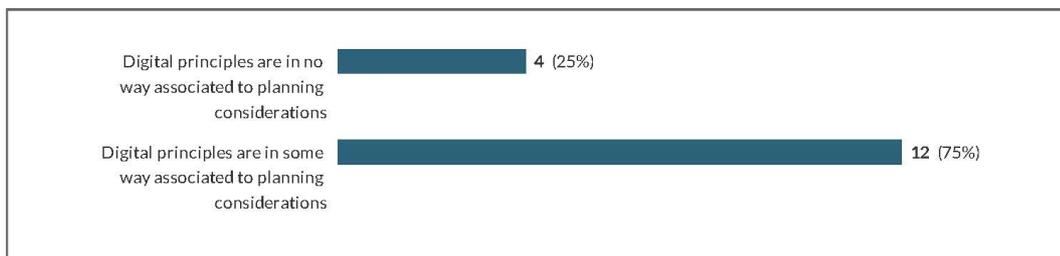
2 Which of the following statements do you most agree with regarding planning considerations?



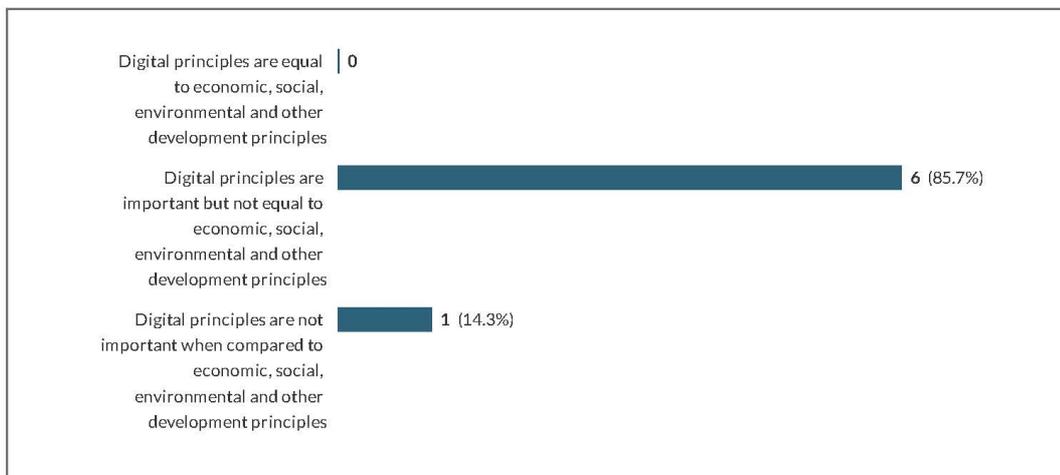
2.a Level of digital consideration in relation to planning:



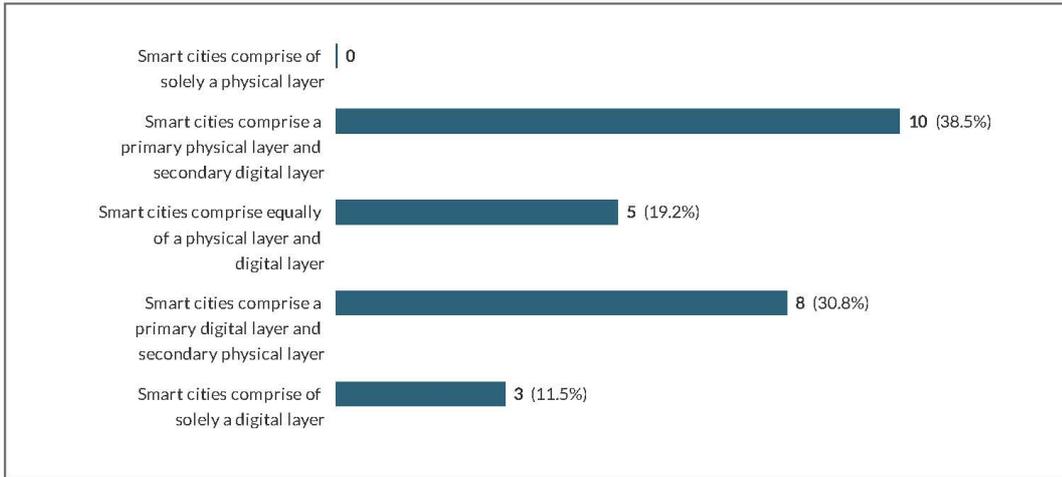
2.b Level of digital consideration in relation to planning:



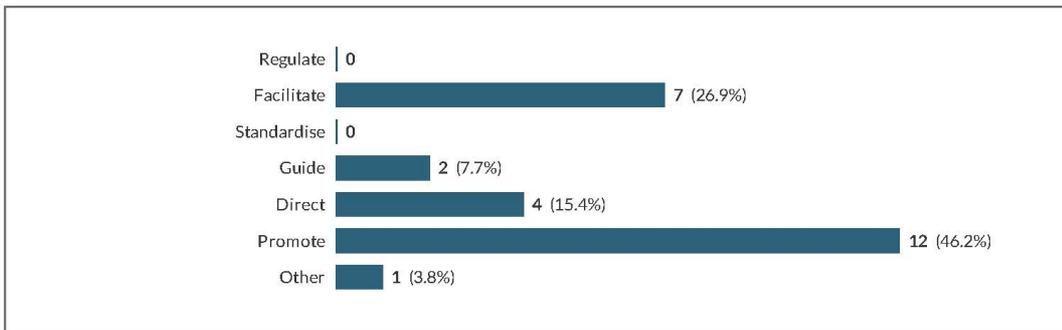
2.c Level of digital principles in relation to other planning principles:



3 Which of the following scenarios do you most agree with regarding development of smart cities?



3.a What role should planning have in contributing to a wider strategy for the accumulation of data in cities?



3.a.i If you selected Other, please specify:

Showing 1 response	
No role. I think it should be regulated under other legislation/	333130-333122-31543989

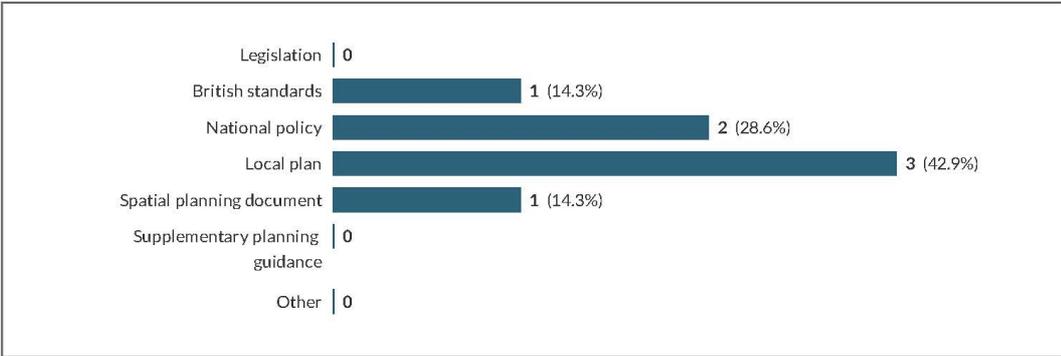
3.a.ii Where can planning policy regulate development when contributing to a wider strategy for the accumulation of data in cities?

Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

3.a.ii.a If you selected Other, please specify:

No responses

3.a.iii Where can planning policy facilitate development when contributing to a wider strategy for the accumulation of data in cities?



3.a.iii.a If you selected Other, please specify:

No responses

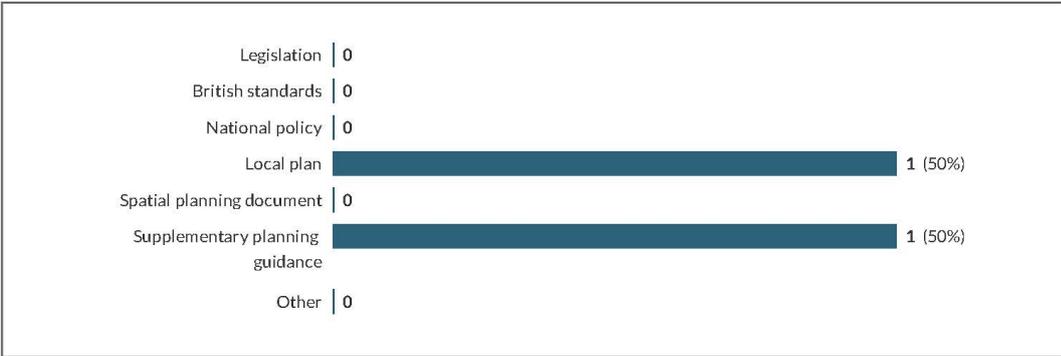
3.a.iv Where can planning policy standardise development when contributing to a wider strategy for the accumulation of data in cities?



3.a.iv.a If you selected Other, please specify:

No responses

3.a.v Where can planning policy guide development when contributing to a wider strategy for the accumulation of data in cities?



3.a.v.a If you selected Other, please specify:

No responses

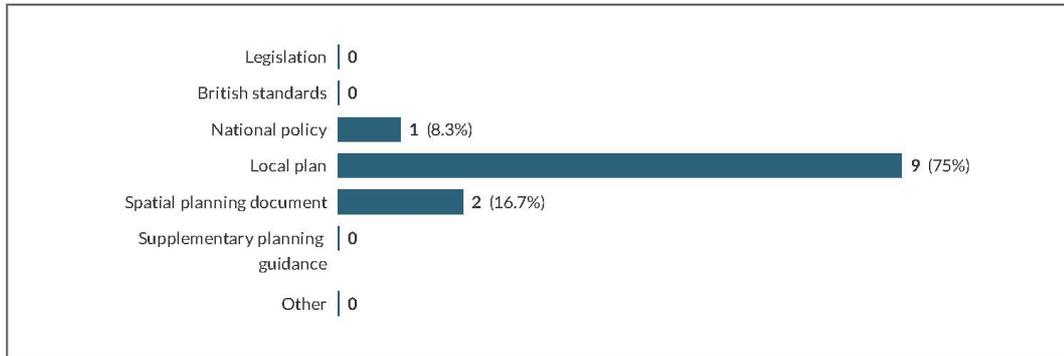
3.a.vi Where can planning policy direct development when contributing to a wider strategy for the accumulation of data in cities?



3.a.vi.a If you selected Other, please specify:

No responses

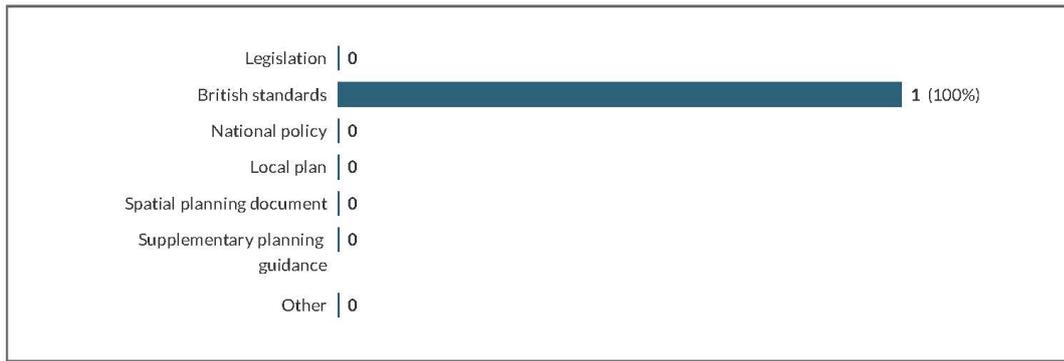
3.a.vii Where can planning policy promote development when contributing to a wider strategy for the accumulation of data in cities?



3.a.vii.a If you selected Other, please specify:

No responses

3.a.viii If you selected other, where can planning policy incorporate this level of oversight for development when contributing to a wider strategy for the accumulation of data in cities?

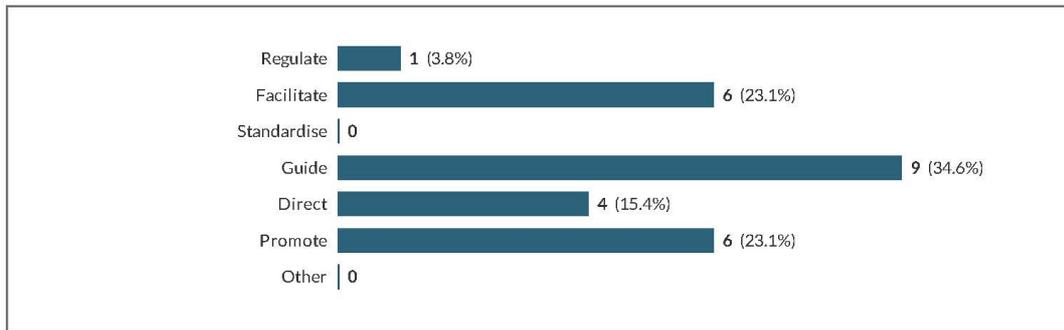


3.a.viii.a If you selected Other, please specify:

No responses

Integration of technology

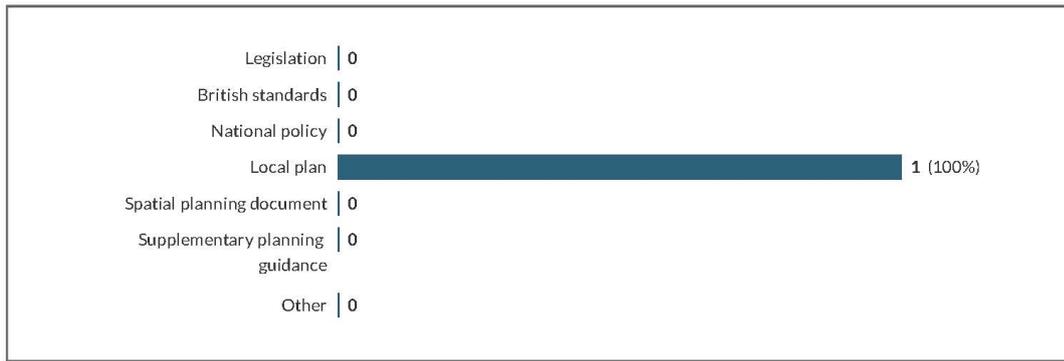
4 For integration of technology into the city; planning should: * development.



4.a If you selected Other, please specify:

No responses

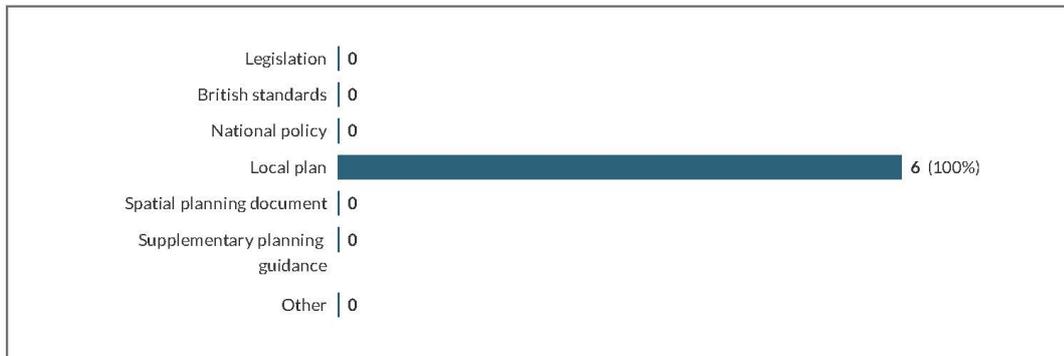
4.b Where can planning policy regulate development that integrates technology to the built environment?



4.b.i If you selected Other, please specify:

No responses

4.c Where can planning policy facilitate development that integrates technology to the built environment?



4.c.i If you selected Other, please specify:

No responses

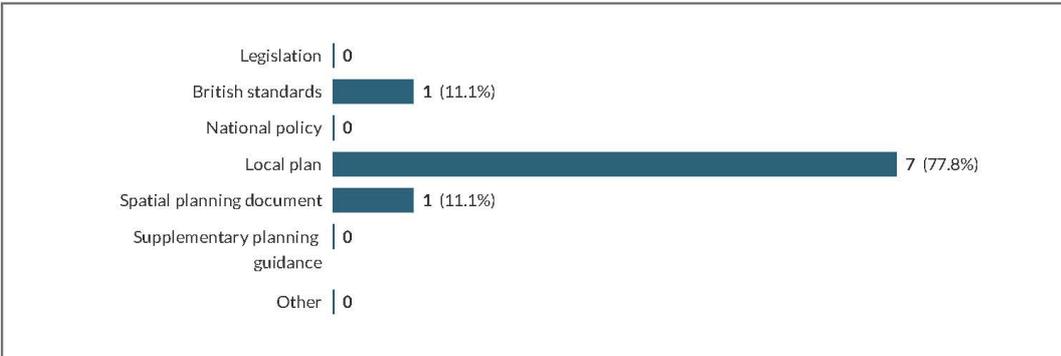
4.d Where can planning policy standardise development that integrates technology to the built environment?



4.d.i If you selected Other, please specify:

No responses

4.e Where can planning policy guide development that integrates technology to the built environment?



4.e.i If you selected Other, please specify:

No responses

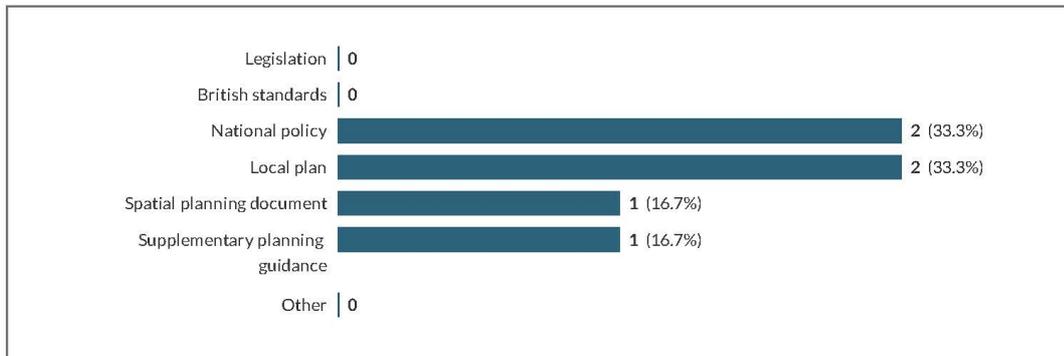
4.f Where can planning policy direct development that integrates technology to the built environment?



4.f.i If you selected Other, please specify:

No responses

4.g Where can planning policy promote development that integrates technology to the built environment?



4.g.i If you selected Other, please specify:

No responses

4.h If you selected other, where can planning policy incorporate this level of oversight for development that integrates technology to the built environment?

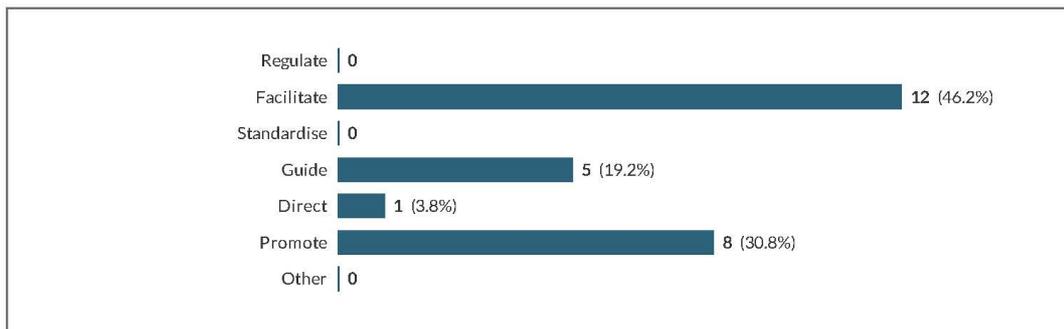
Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

4.h.i If you selected Other, please specify:

No responses

Interaction with technology

5 For interaction of technology with citizens; planning should: * development.



5.a If you selected Other, please specify:

No responses

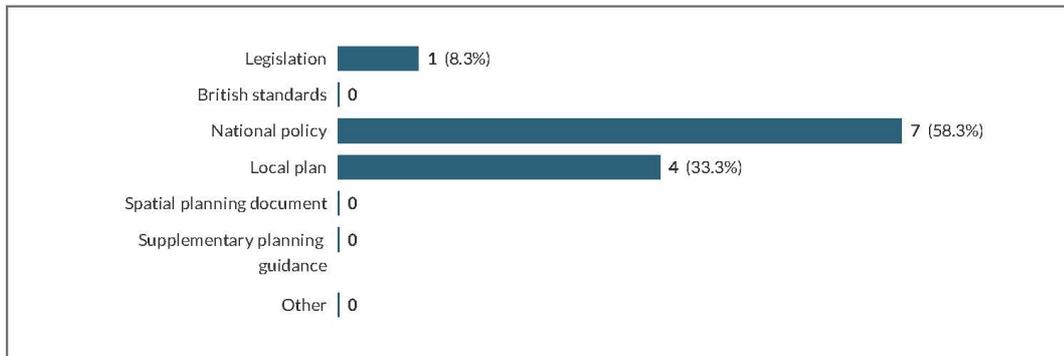
5.b Where can planning policy regulate development that interacts technology with citizens?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

5.b.i If you selected Other, please specify:

No responses

5.c Where can planning policy facilitate development that interacts technology with citizens?



5.c.i If you selected Other, please specify:

No responses

5.d Where can planning policy standardise development that interacts technology with citizens?



5.d.i If you selected Other, please specify:

No responses

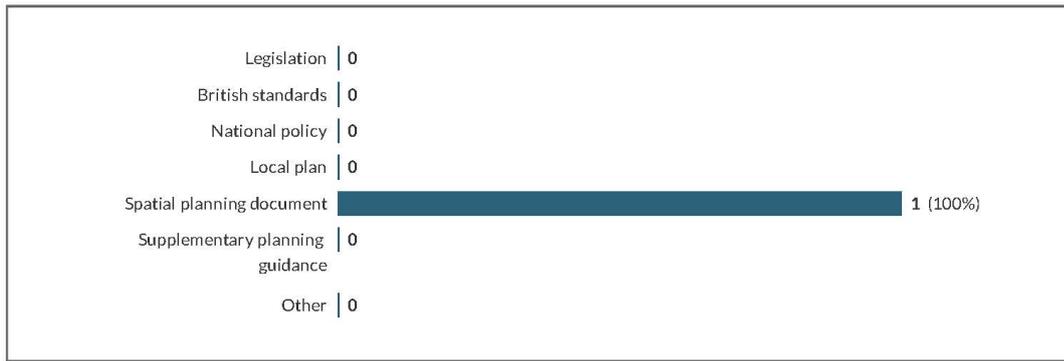
5.e Where can planning policy guide development that interacts technology with citizens?



5.e.i If you selected Other, please specify:

No responses

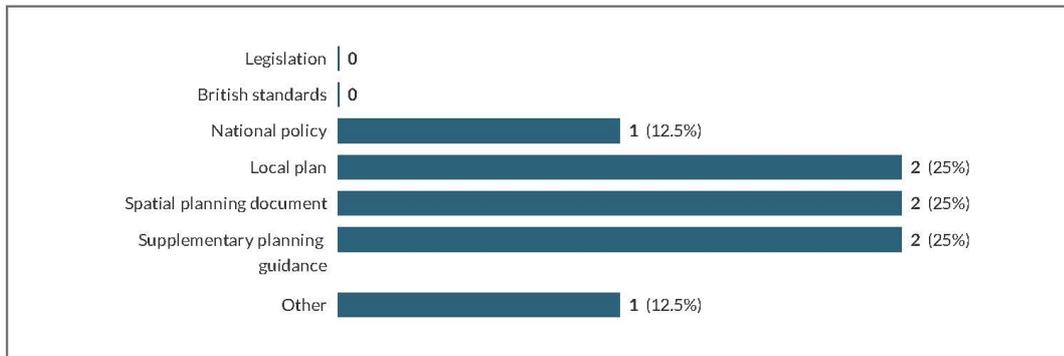
5.f Where can planning policy direct development that interacts technology with citizens?



5.f.i If you selected Other, please specify:

No responses

5.g Where can planning policy promote development that interacts technology with citizens?



5.g.i If you selected Other, please specify:

Showing 1 response	
As smart cities have potential to be used by everyone and planning do not have interaction with all citizens of a city. There needs to be an alternative way of promoting the benefits of a smart city outside the options above. - Possibly through news outlets, television and social media.	333130-333122-31083010

5.h If you selected other, where can planning policy incorporate this level of oversight for development that interacts technology with citizens?

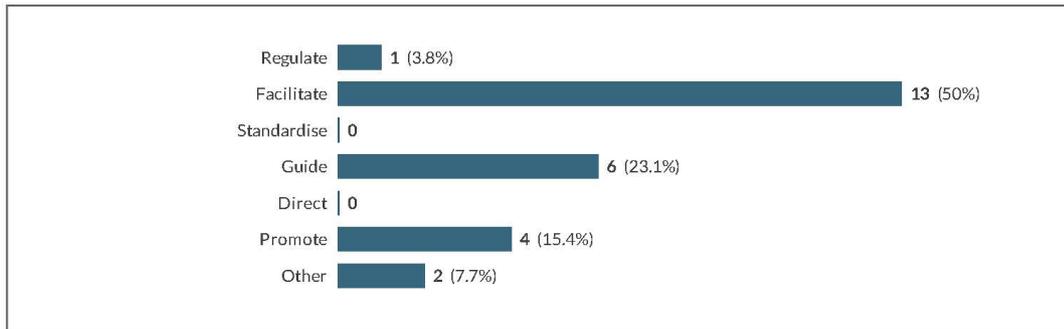
Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

5.h.i If you selected Other, please specify:

No responses

Influence of technology

6 For influence of technology in citizens lives; planning should: * development.



6.a If you selected Other, please specify:

Showing all 2 responses	
This should not be a consideration for planning	333130-333122-31079998
Planning should not influence how, when or where people use technology.	333130-333122-31543989

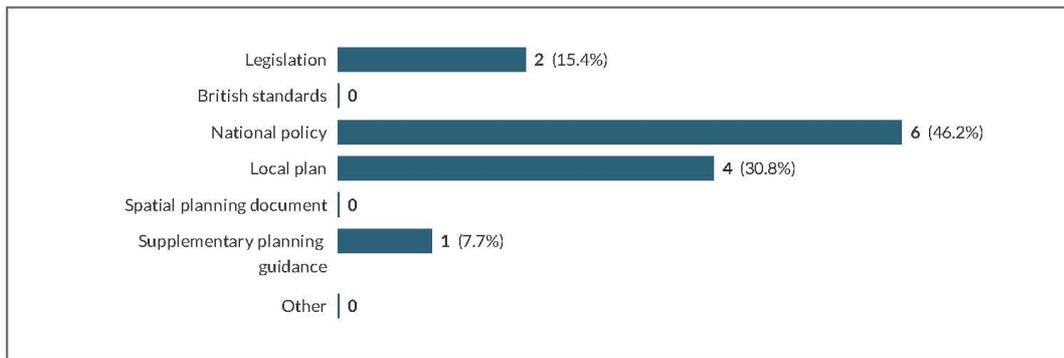
6.b Where can planning policy regulate development that influences the lives of citizens with technology?



6.b.i If you selected Other, please specify:

No responses

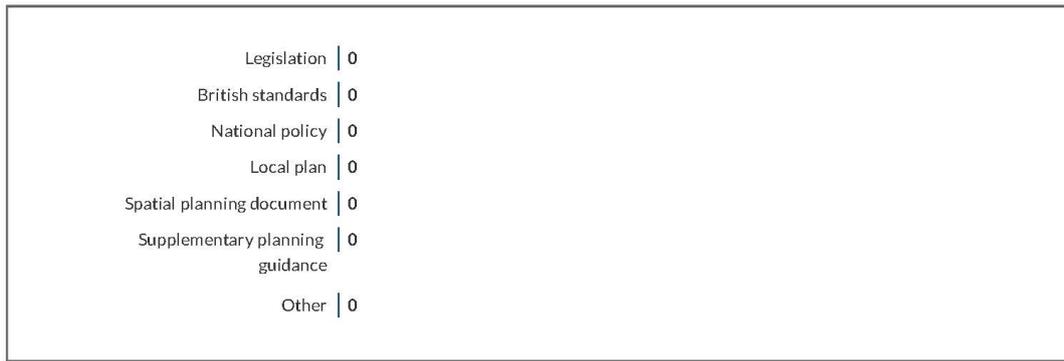
6.c Where can planning policy facilitate development that influences the lives of citizens with technology?



6.c.i If you selected Other, please specify:

No responses

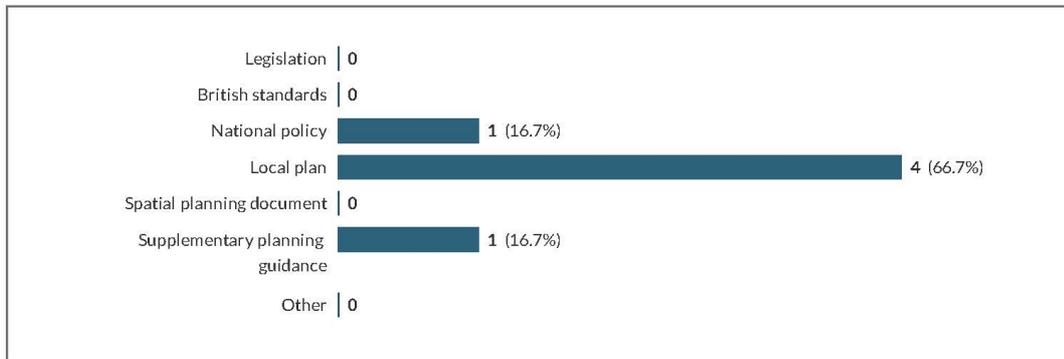
6.d Where can planning policy standardise development that influences the lives of citizens with technology?



6.d.i If you selected Other, please specify:

No responses

6.e Where can planning policy guide development that influences the lives of citizens with technology?



6.e.i If you selected Other, please specify:

No responses

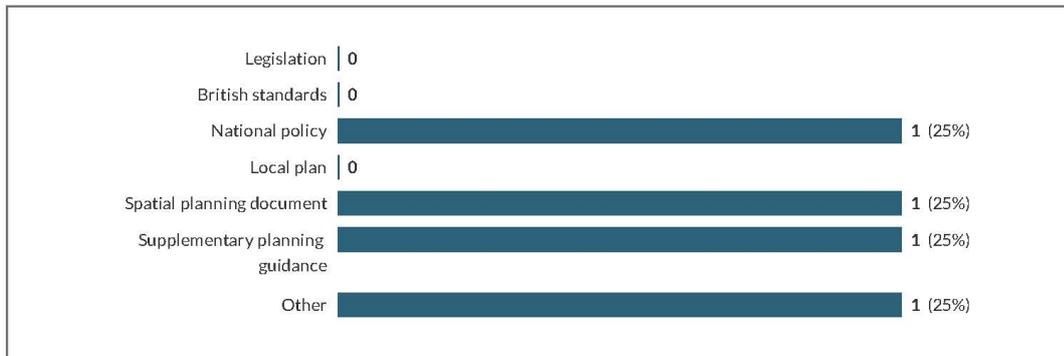
6.f Where can planning policy direct development that influences the lives of citizens with technology?

Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

6.f.i If you selected Other, please specify:

No responses

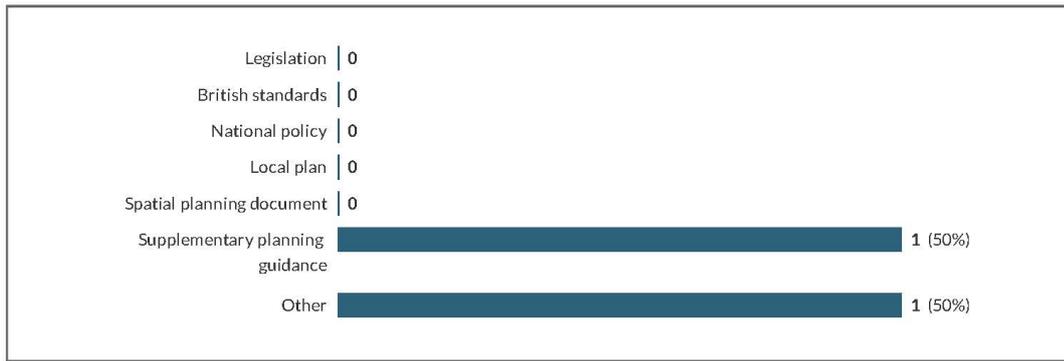
6.g Where can planning policy promote development that influences the lives of citizens with technology?



6.g.i If you selected Other, please specify:

Showing 1 response	
Encourage use of technology in the way citizens interact with the planning section (including submission of documents/comments)	333130-333122-30012290

6.h If you selected other, where can planning policy incorporate this level of oversight for development that influences the lives of citizens with technology?

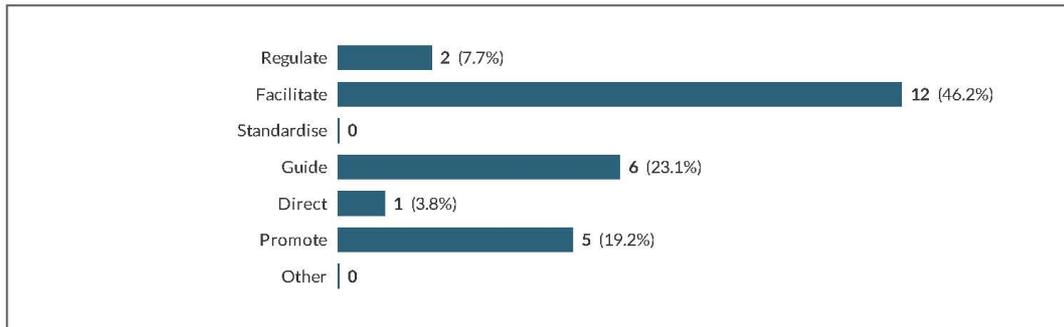


6.h.i If you selected Other, please specify:

Showing 1 response	
Nowhere, this is not big brother. The planning system is not a mechanism to influence how people use technology.	333130-333122-31079998

New environment

7 For creating a new environment of the smart city; planning should: * development.



7.a If you selected Other, please specify:

No responses

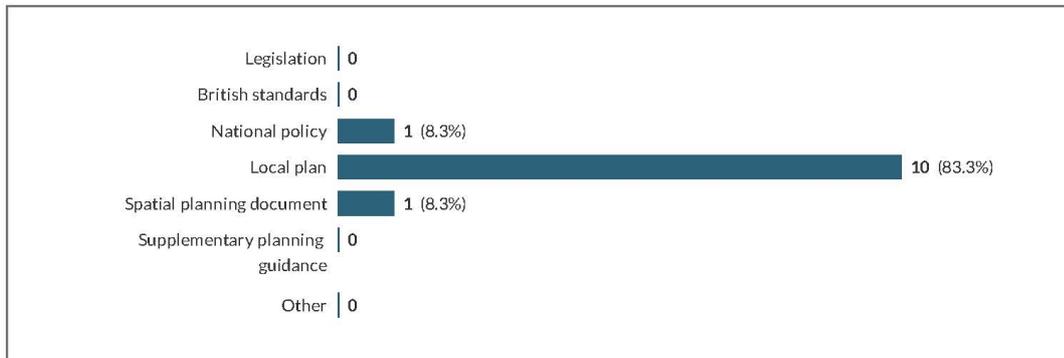
7.b Where can planning policy regulate development to create a new environment for the smart city?



7.b.i If you selected Other, please specify:

No responses

7.c Where can planning policy facilitate development to create a new environment for the smart city?



7.c.i If you selected Other, please specify:

No responses

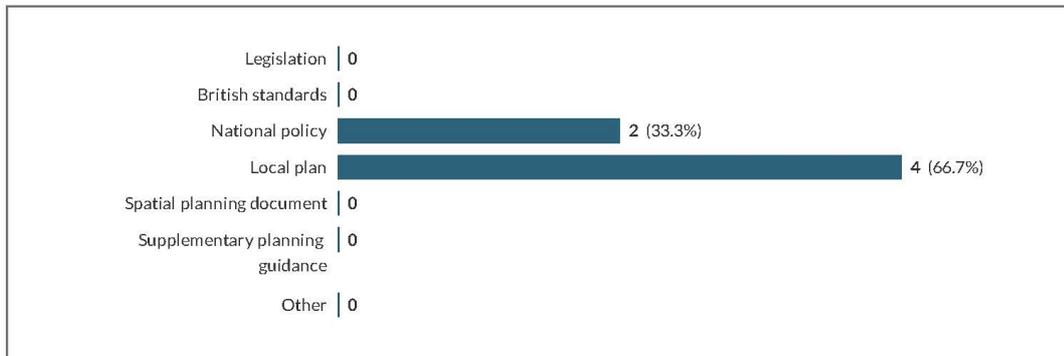
7.d Where can planning policy standardise development to create a new environment for the smart city?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

7.d.i If you selected Other, please specify:

No responses

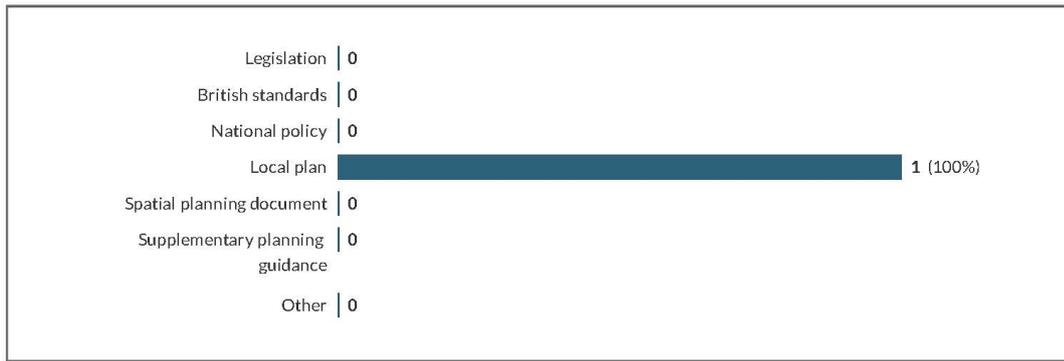
7.e Where can planning policy guide development to create a new environment for the smart city?



7.e.i If you selected Other, please specify:

No responses

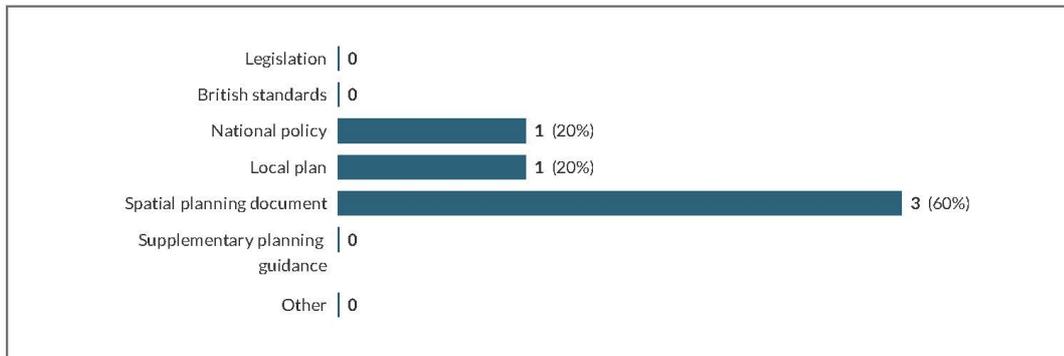
7.f Where can planning policy direct development to create a new environment for the smart city?



7.f.i If you selected Other, please specify:

No responses

7.g Where can planning policy promote development to create a new environment for the smart city?



7.g.i If you selected Other, please specify:

No responses

7.h If you selected other, where can planning policy incorporate this level of oversight for development to create a new environment for the smart city?

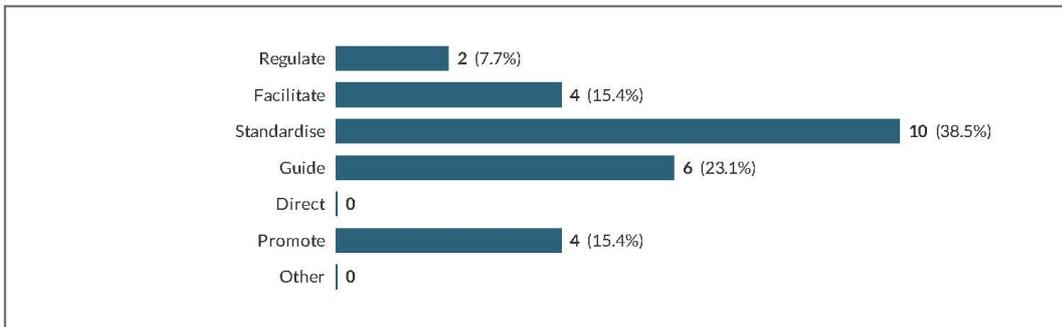
Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

7.h.i If you selected Other, please specify:

No responses

Produce

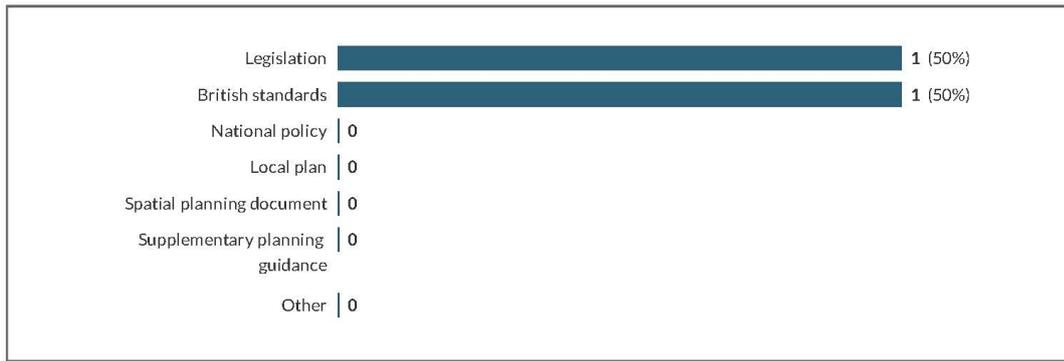
8 For projects producing data; planning should: * development.



8.a If you selected Other, please specify:

No responses

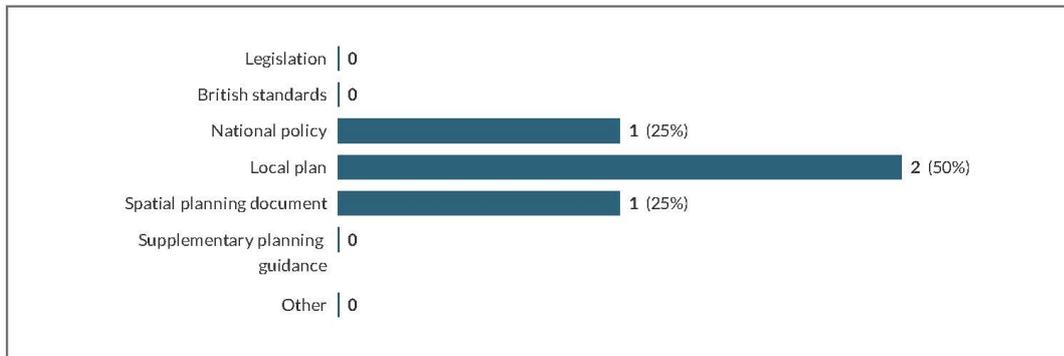
8.b Where can planning policy regulate development that produces data?



8.b.i If you selected Other, please specify:

No responses

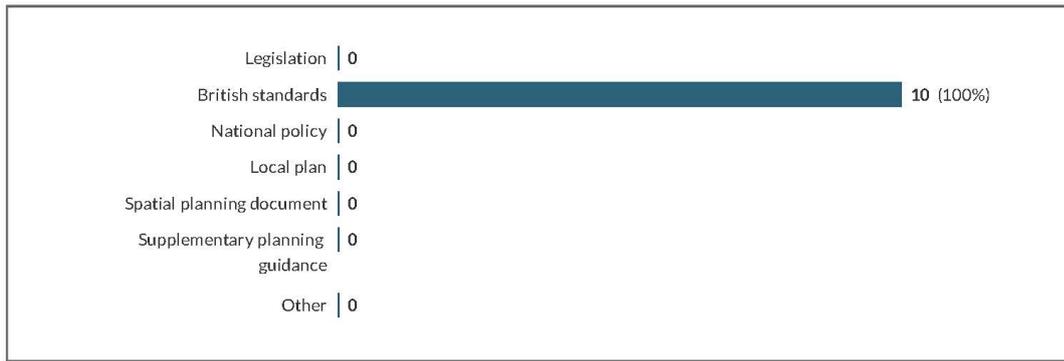
8.c Where can planning policy facilitate development that produces data?



8.c.i If you selected Other, please specify:

No responses

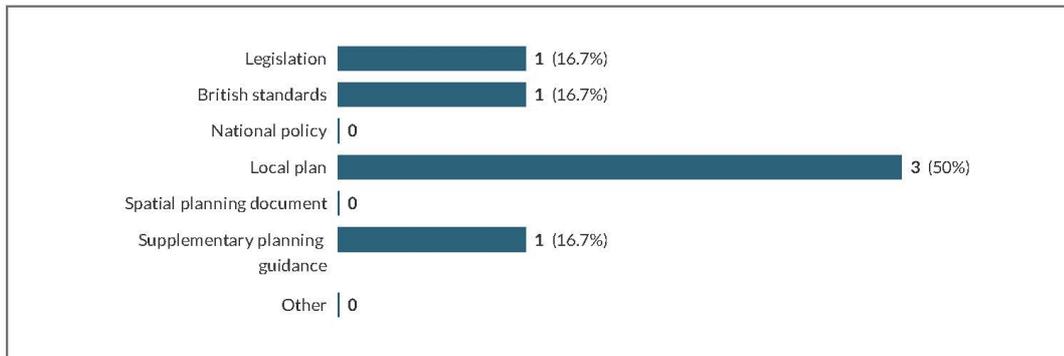
8.d Where can planning policy standardise development that produces data?



8.d.i If you selected Other, please specify:

No responses

8.e Where can planning policy guide development that produces data?



8.e.i If you selected Other, please specify:

No responses

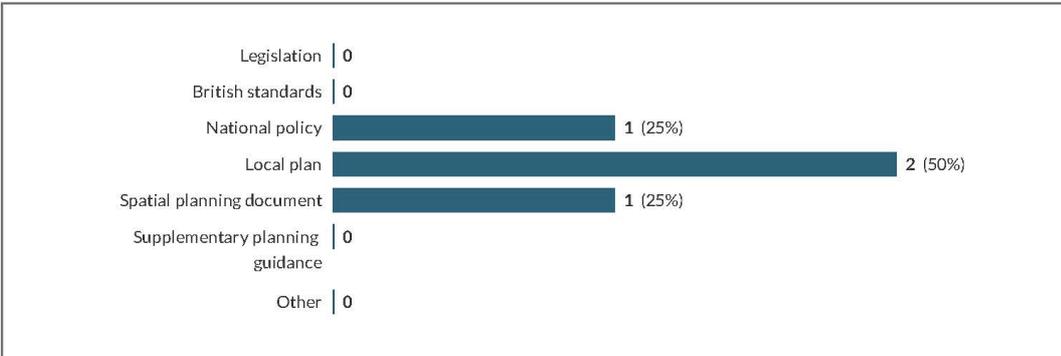
8.f Where can planning policy direct development that produces data?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

8.f.i If you selected Other, please specify:

No responses

8.g Where can planning policy promote development that produces data?



8.g.i If you selected Other, please specify:

No responses

8.h If you selected other, where can planning policy incorporate this level of oversight for development that produces data?

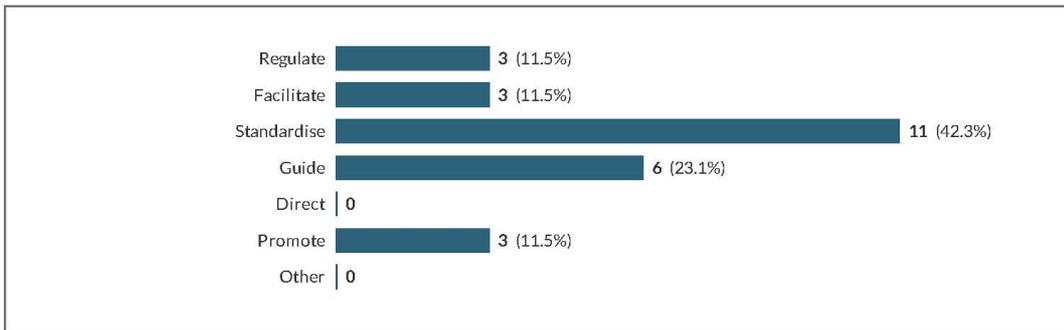
Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

8.h.i If you selected Other, please specify:

No responses

Capture

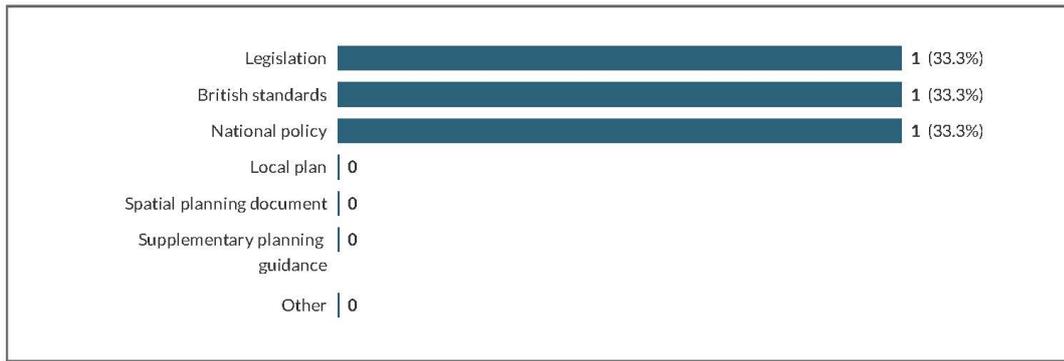
9 For projects capturing data; planning should: * development.



9.a If you selected Other, please specify:

No responses

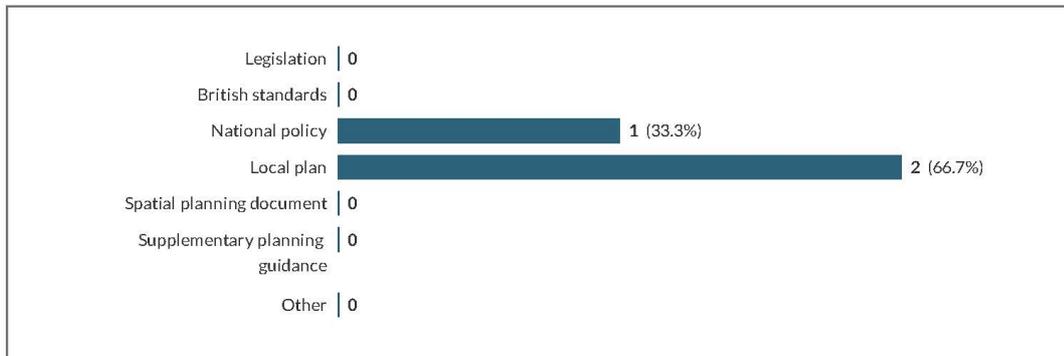
9.b Where can planning policy regulate development that captures data?



9.b.i If you selected Other, please specify:

No responses

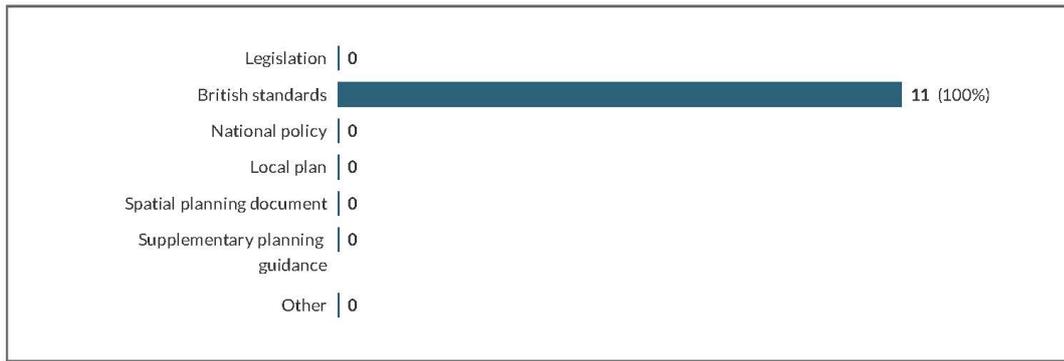
9.c Where can planning policy facilitate development that captures data?



9.c.i If you selected Other, please specify:

No responses

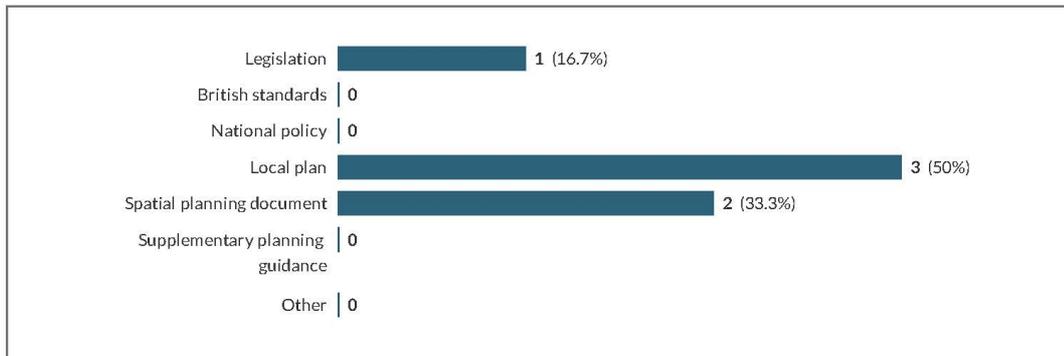
9.d Where can planning policy standardise development that captures data?



9.d.i If you selected Other, please specify:

No responses

9.e Where can planning policy guide development that captures data?



9.e.i If you selected Other, please specify:

No responses

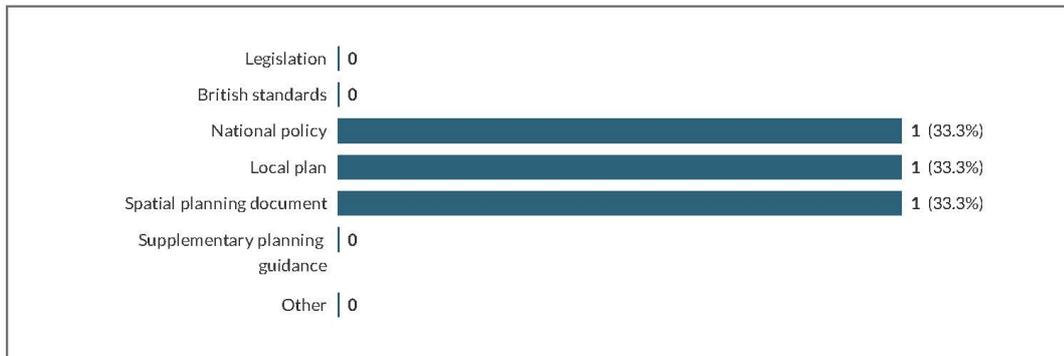
9.f Where can planning policy direct development that captures data?

Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

9.f.i If you selected Other, please specify:

No responses

9.g Where can planning policy promote development that captures data?



9.g.i If you selected Other, please specify:

No responses

9.h If you selected other, where can planning policy incorporate this level of oversight for development that captures data?

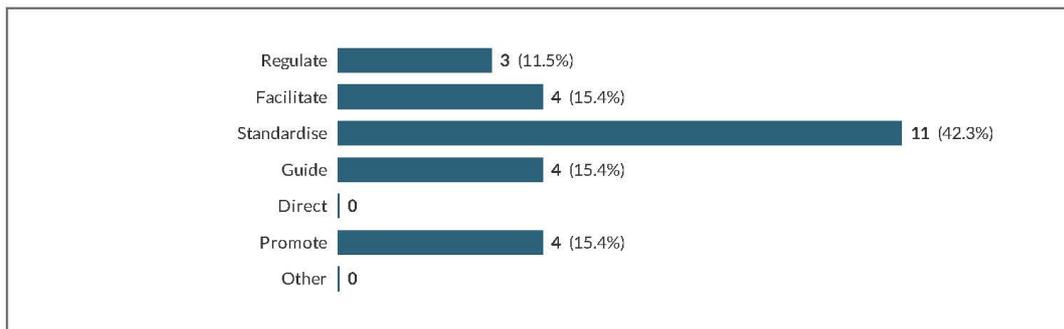
Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

9.h.i If you selected Other, please specify:

No responses

Communicate

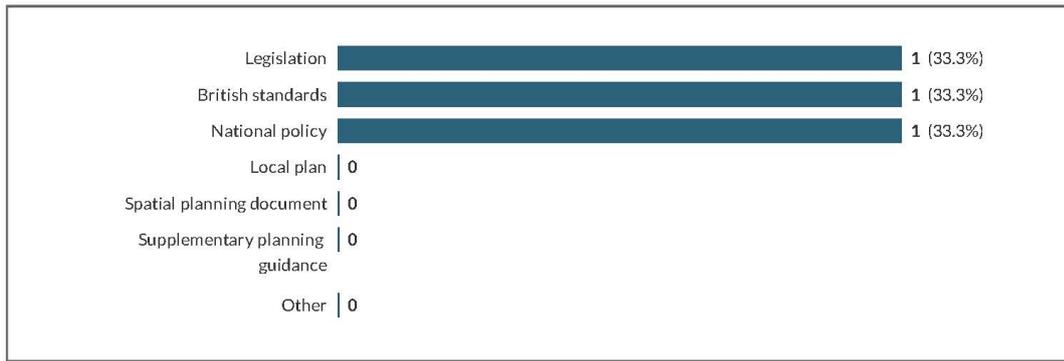
10 For projects communicating data; planning should: * development.



10.a If you selected Other, please specify:

No responses

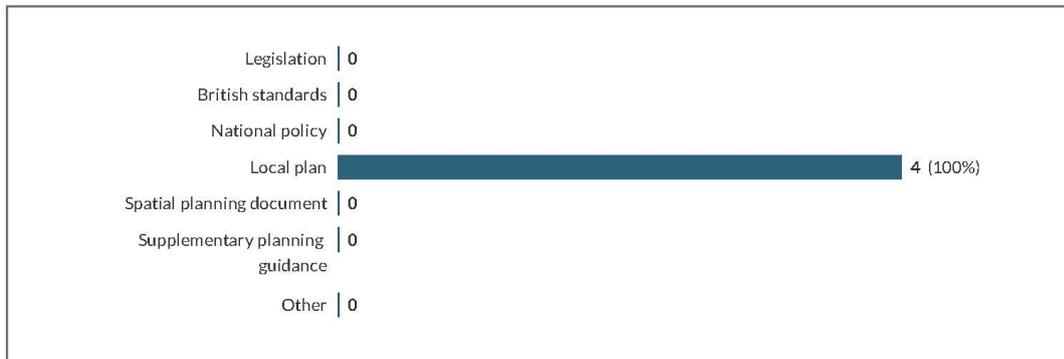
10.b Where can planning policy regulate development that communicates data?



10.b.i If you selected Other, please specify:

No responses

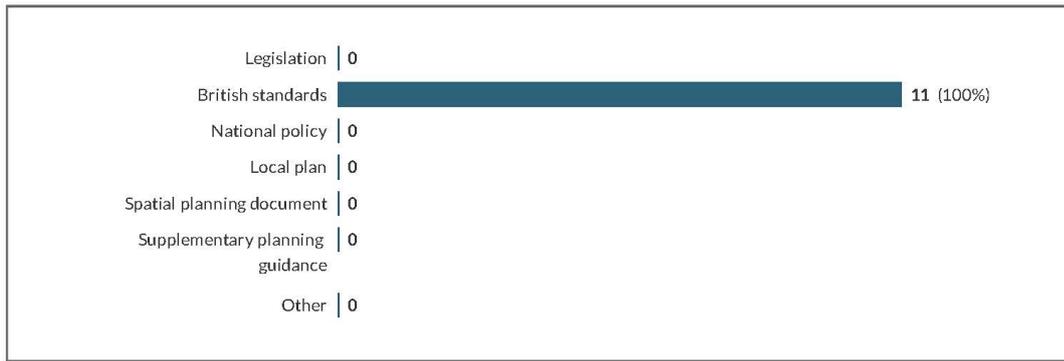
10.c Where can planning policy facilitate development that communicates data?



10.c.i If you selected Other, please specify:

No responses

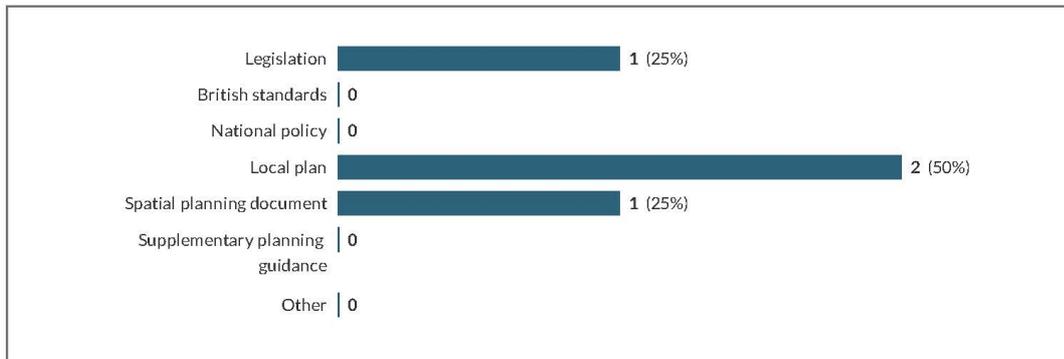
10.d Where can planning policy standardise development that communicates data?



10.d.i If you selected Other, please specify:

No responses

10.e Where can planning policy guide development that communicates data?



10.e.i If you selected Other, please specify:

No responses

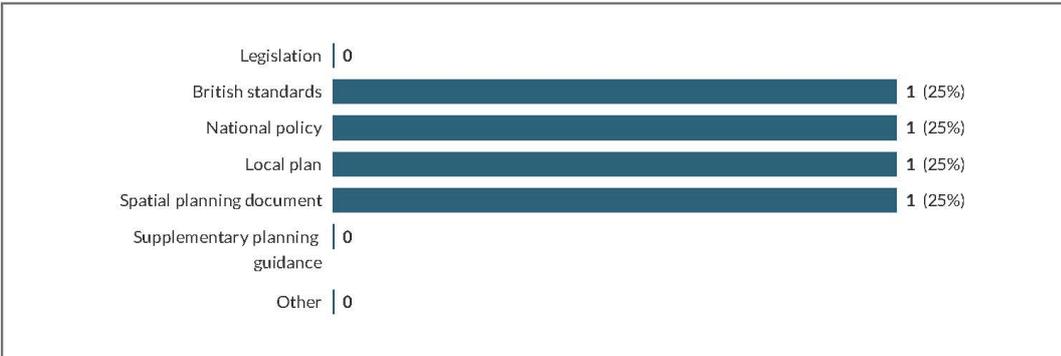
10.f Where can planning policy direct development that communicates data?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

10.f.i If you selected Other, please specify:

No responses

10.g Where can planning policy promote development that communicates data?



10.g.i If you selected Other, please specify:

No responses

10.h If you selected other, where can planning policy incorporate this level of oversight for development that communicates data?

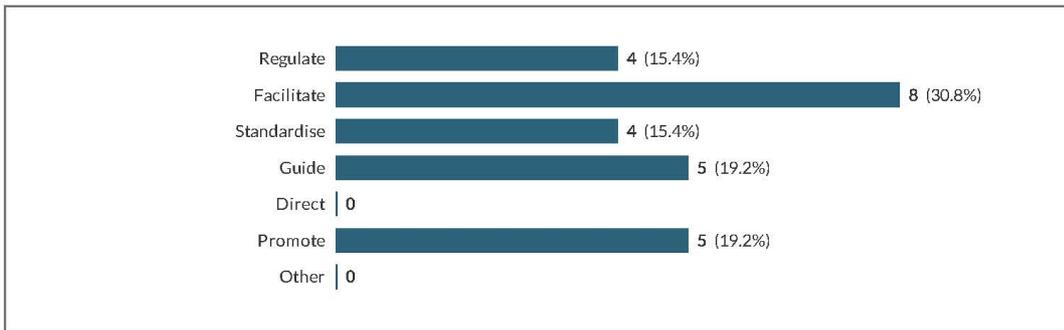
Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

10.h.i If you selected Other, please specify:

No responses

Process

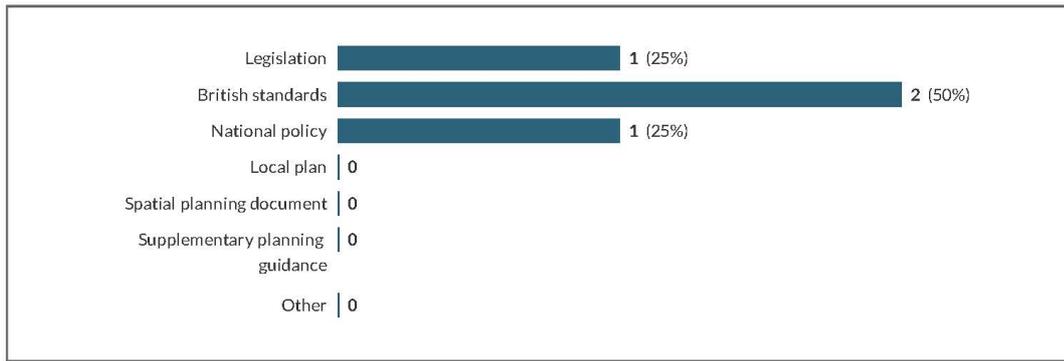
11 For projects processing data; planning should: * development.



11.a If you selected Other, please specify:

No responses

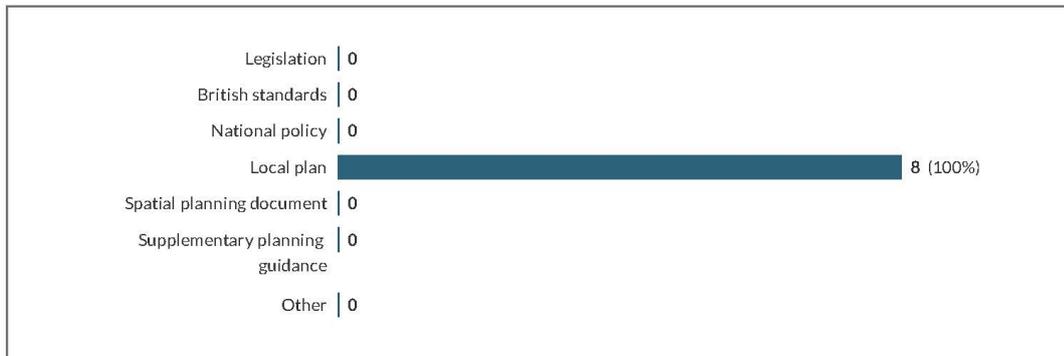
11.b Where can planning policy regulate development that processes data?



11.b.i If you selected Other, please specify:

No responses

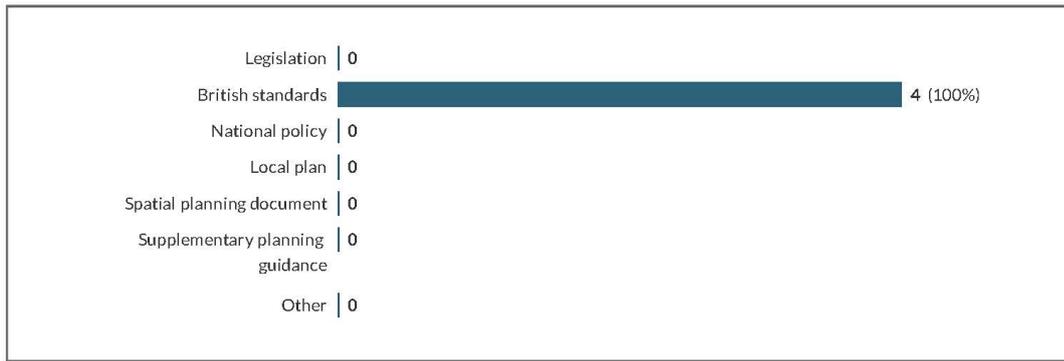
11.c Where can planning policy facilitate development that processes data?



11.c.i If you selected Other, please specify:

No responses

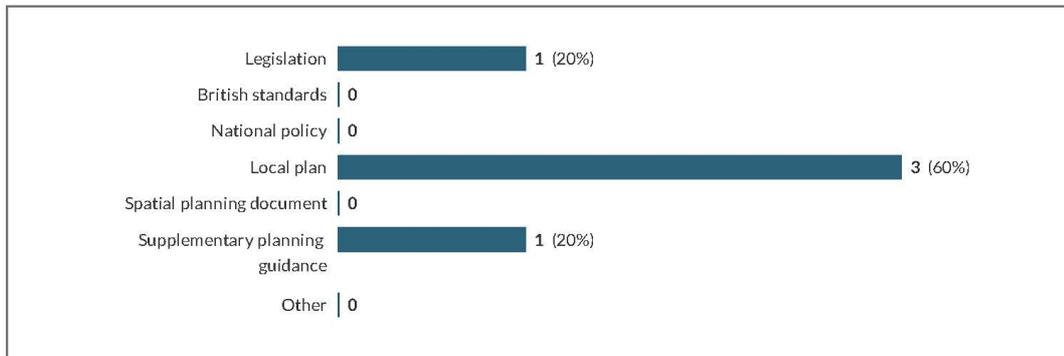
11.d Where can planning policy standardise development that processes data?



11.d.i If you selected Other, please specify:

No responses

11.e Where can planning policy guide development that processes data?



11.e.i If you selected Other, please specify:

No responses

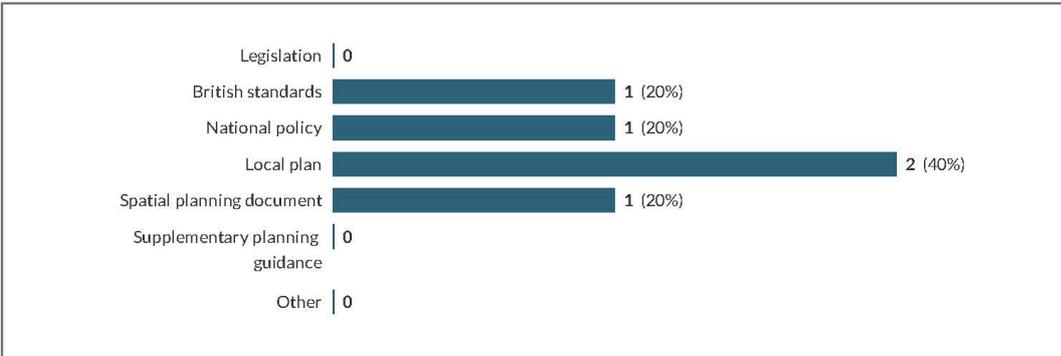
11.f Where can planning policy direct development that processes data?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

11.f.i If you selected Other, please specify:

No responses

11.g Where can planning policy promote development that processes data?



11.g.i If you selected Other, please specify:

No responses

11.h If you selected other, where can planning policy incorporate this level of oversight for development that processes data?

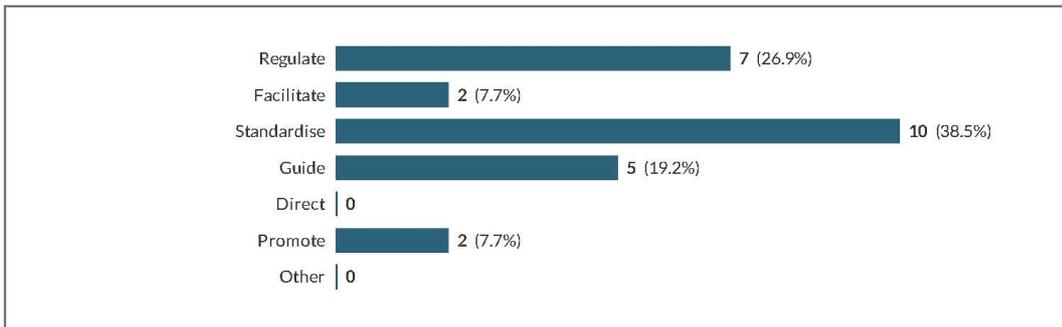
Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

11.h.i If you selected Other, please specify:

No responses

Security

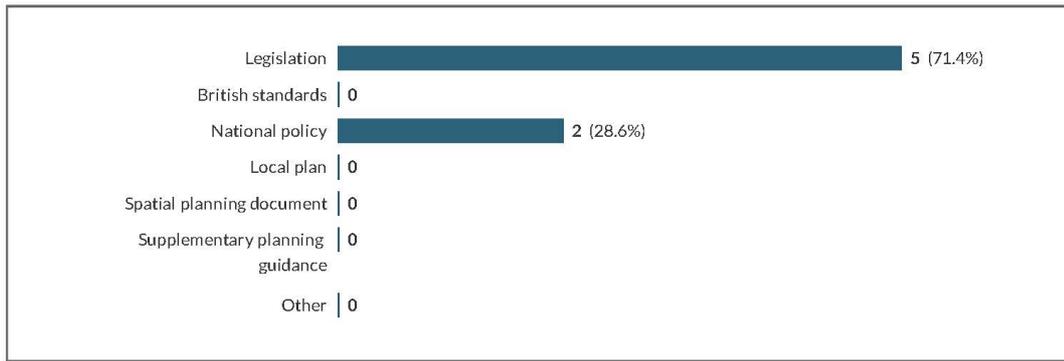
12 For the value of security in projects utilising data as a resource; planning should: * development.



12.a If you selected Other, please specify:

No responses

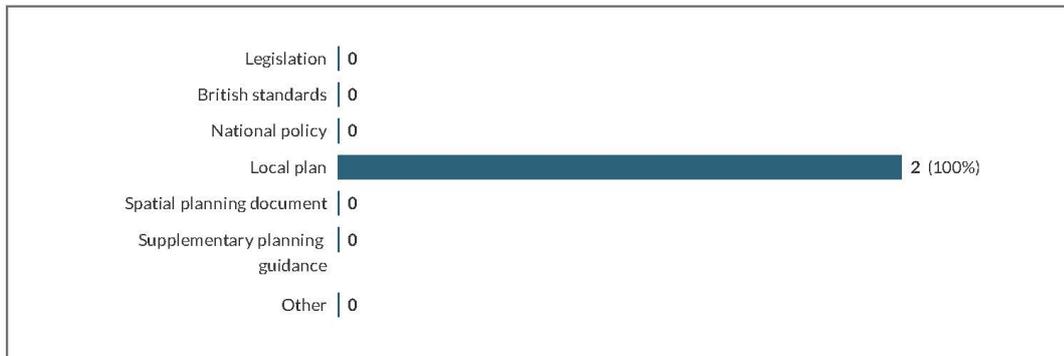
12.b Where can planning policy regulate development in security of data resource?



12.b.i If you selected Other, please specify:

No responses

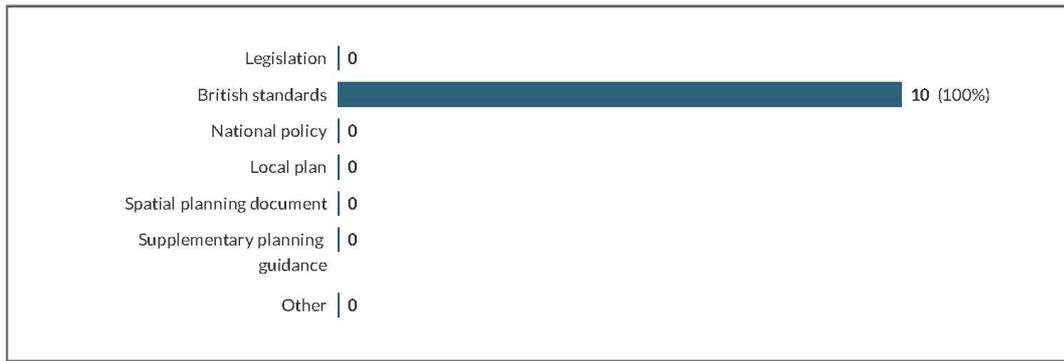
12.c Where can planning policy facilitate development in security of data resource?



12.c.i If you selected Other, please specify:

No responses

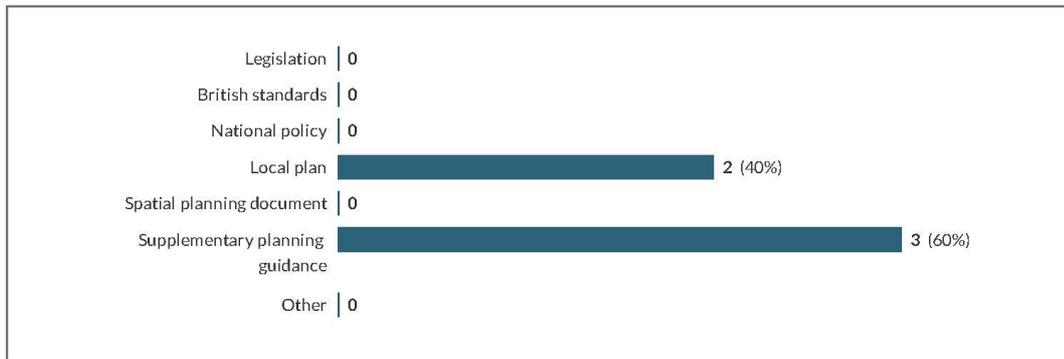
12.d Where can planning policy standardise development in security of data resource?



12.d.i If you selected Other, please specify:

No responses

12.e Where can planning policy guide development in security of data resource?



12.e.i If you selected Other, please specify:

No responses

12.f Where can planning policy direct development in security of data resource?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

12.f.i If you selected Other, please specify:

No responses

12.g Where can planning policy promote development in security of data resource?



12.g.i If you selected Other, please specify:

No responses

12.h If you selected other, where can planning policy incorporate this level of oversight for development in security of data resource?

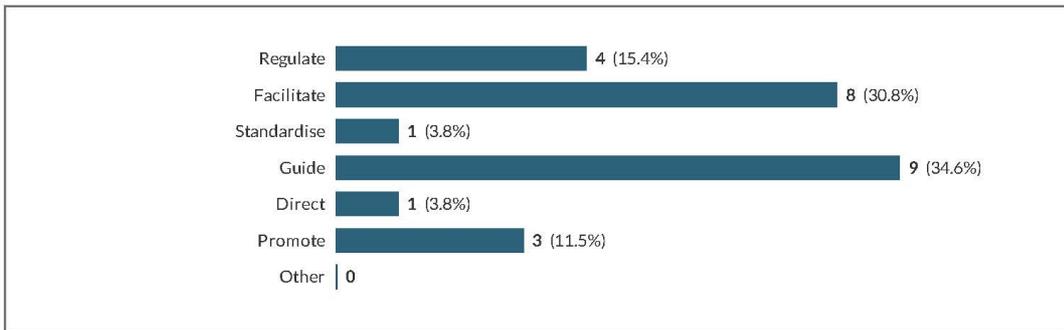
Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

12.h.i If you selected Other, please specify:

No responses

Accountability

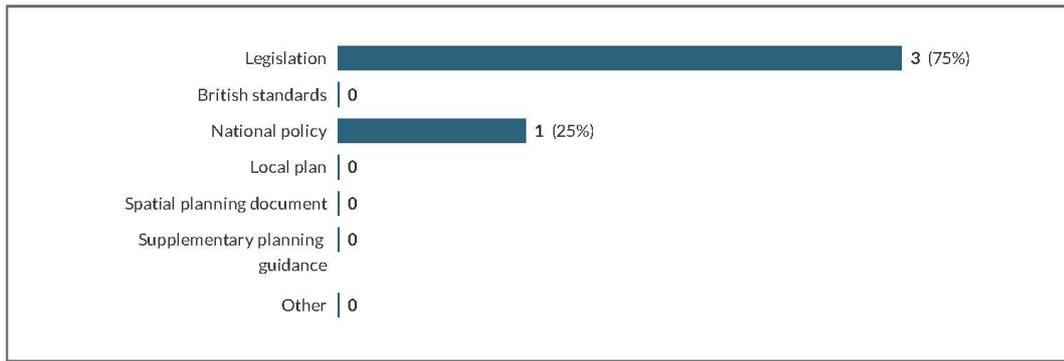
13 For the value of accountability in projects utilising data as a resource; planning should: * development.



13.a If you selected Other, please specify:

No responses

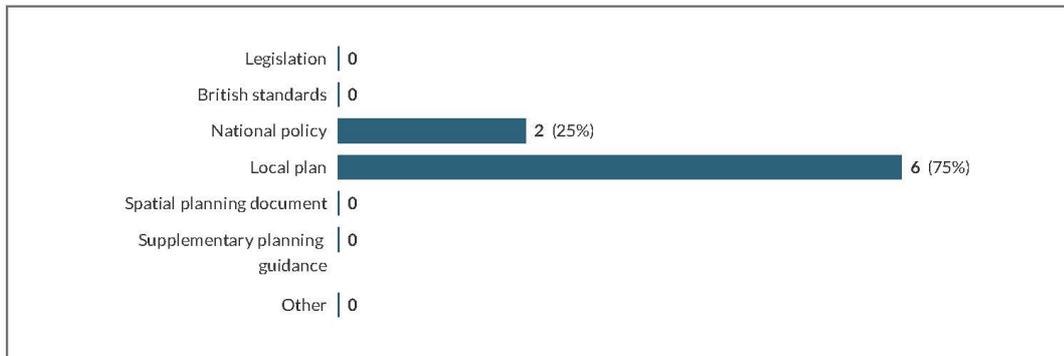
13.b Where can planning policy regulate development in accountability of data resource?



13.b.i If you selected Other, please specify:

No responses

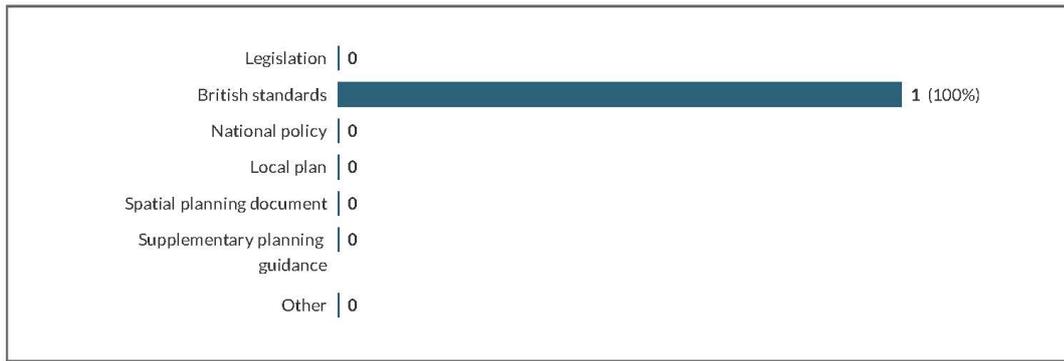
13.c Where can planning policy facilitate development in accountability of data resource?



13.c.i If you selected Other, please specify:

No responses

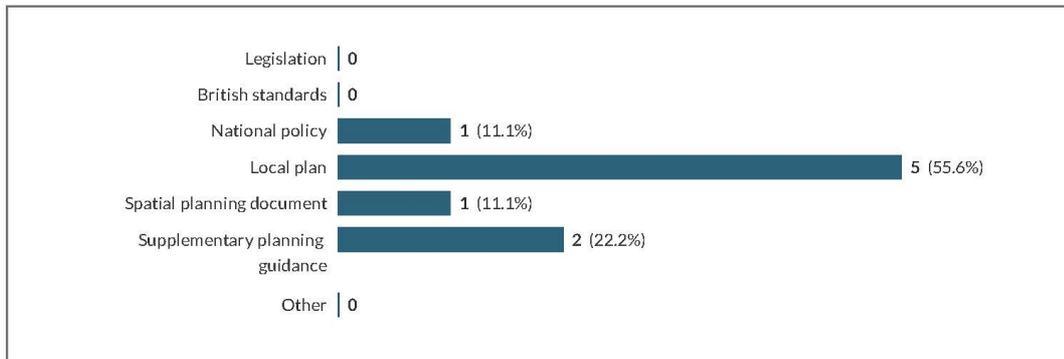
13.d Where can planning policy standardise development in accountability of data resource?



13.d.i If you selected Other, please specify:

No responses

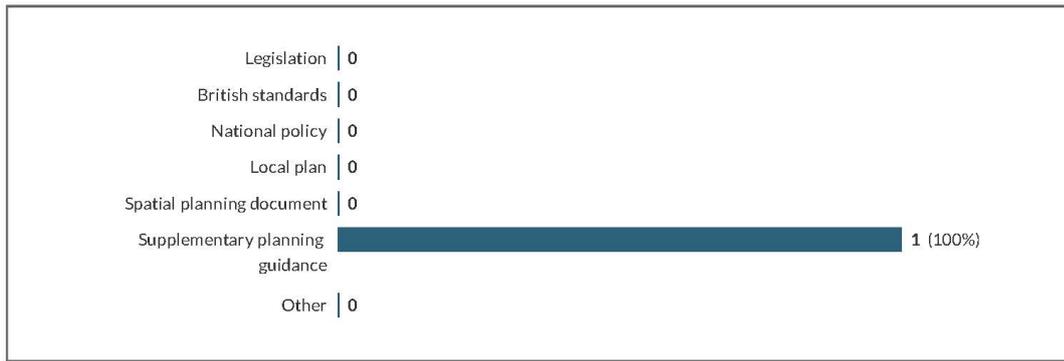
13.e Where can planning policy guide development in accountability of data resource?



13.e.i If you selected Other, please specify:

No responses

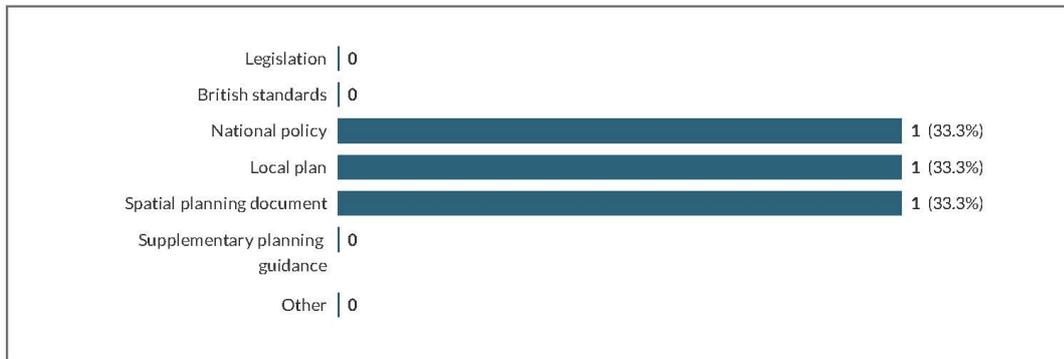
13.f Where can planning policy direct development in accountability of data resource?



13.f.i If you selected Other, please specify:

No responses

13.g Where can planning policy promote development in accountability of data resource?



13.g.i If you selected Other, please specify:

No responses

13.h If you selected other, where can planning policy incorporate this level of oversight for development in accountability of data resource?

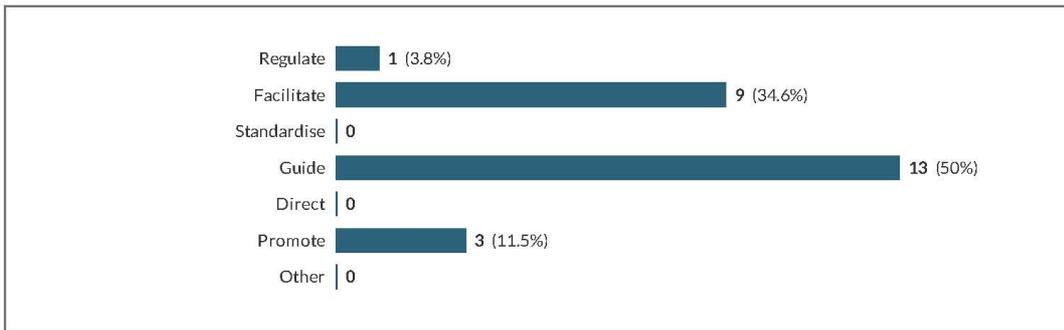
Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

13.h.i If you selected Other, please specify:

No responses

Efficiency

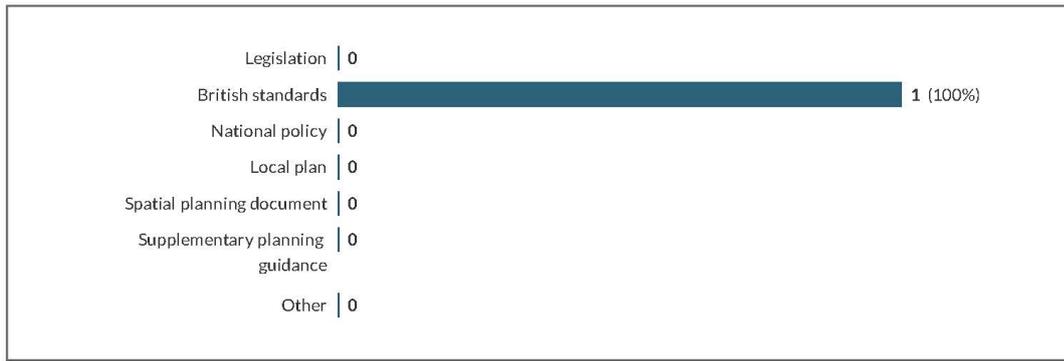
14 For the value of efficiency in projects utilising data as a resource; planning should: * development.



14.a If you selected Other, please specify:

No responses

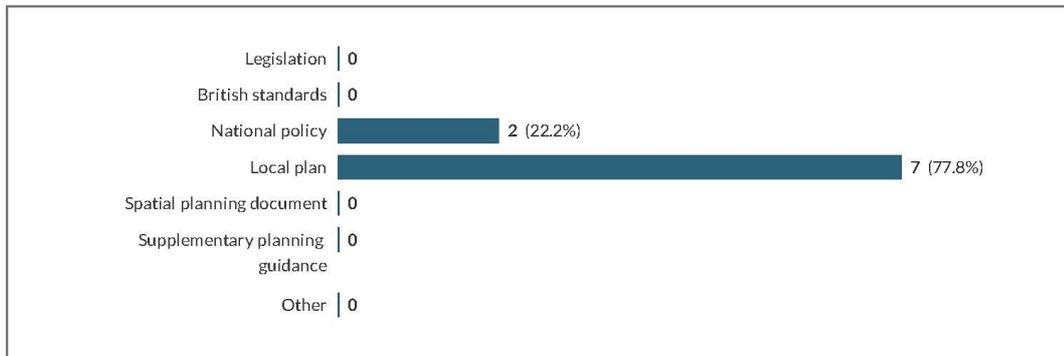
14.b Where can planning policy regulate development in efficiency of data resource?



14.b.i If you selected Other, please specify:

No responses

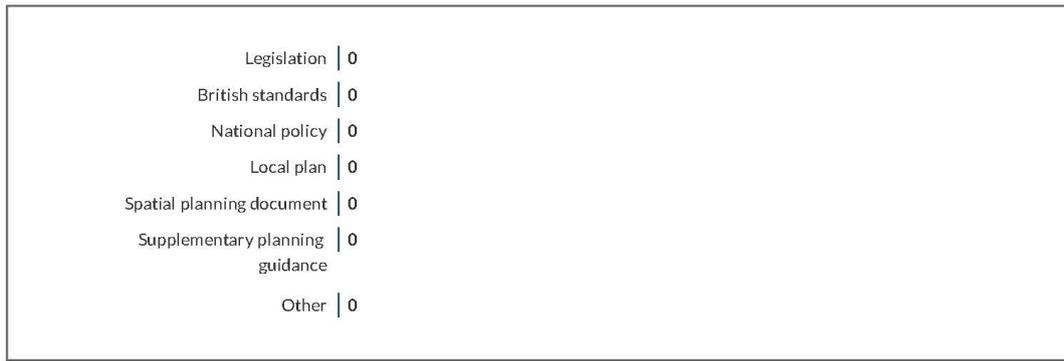
14.c Where can planning policy facilitate development in efficiency of data resource?



14.c.i If you selected Other, please specify:

No responses

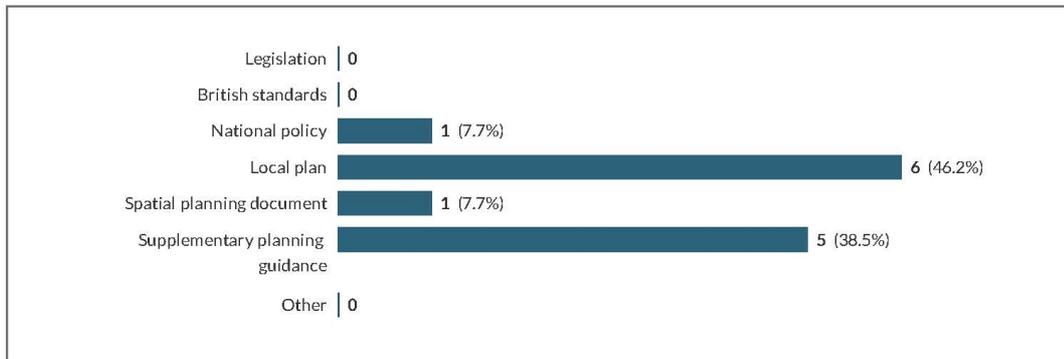
14.d Where can planning policy standardise development in efficiency of data resource?



14.d.i If you selected Other, please specify:

No responses

14.e Where can planning policy guide development in efficiency of data resource?



14.e.i If you selected Other, please specify:

No responses

14.f Where can planning policy direct development in efficiency of data resource?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

14.f.i If you selected Other, please specify:

No responses

14.g Where can planning policy promote development in efficiency of data resource?



14.g.i If you selected Other, please specify:

No responses

14.h If you selected other, where can planning policy incorporate this level of oversight for development in efficiency of data resource?

Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

14.h.i If you selected Other, please specify:

No responses

Innovation

15 For the value of innovation in projects utilising data as a resource; planning should: * development.



15.a If you selected Other, please specify:

No responses

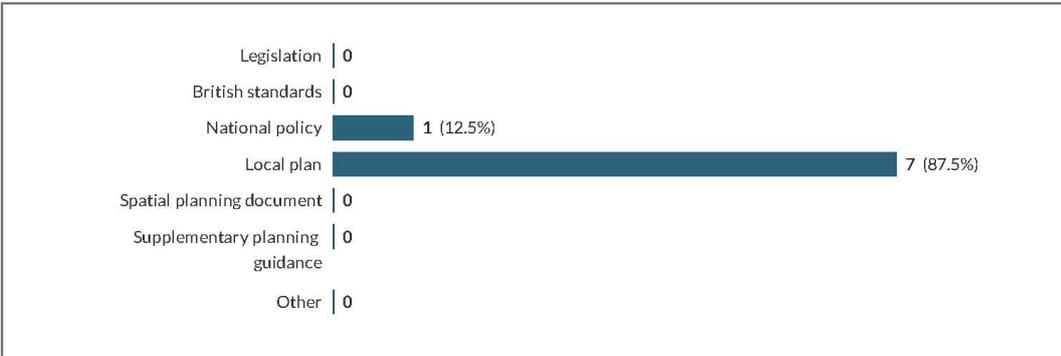
15.b Where can planning policy regulate development in innovation of data resource?



15.b.i If you selected Other, please specify:

No responses

15.c Where can planning policy facilitate development in innovation of data resource?



15.c.i If you selected Other, please specify:

No responses

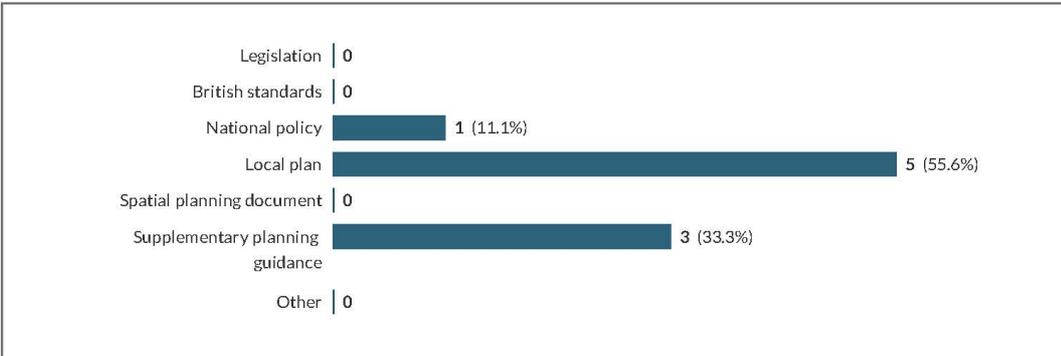
15.d Where can planning policy standardise development in innovation of data resource?



15.d.i If you selected Other, please specify:

No responses

15.e Where can planning policy guide development in innovation of data resource?



15.e.i If you selected Other, please specify:

No responses

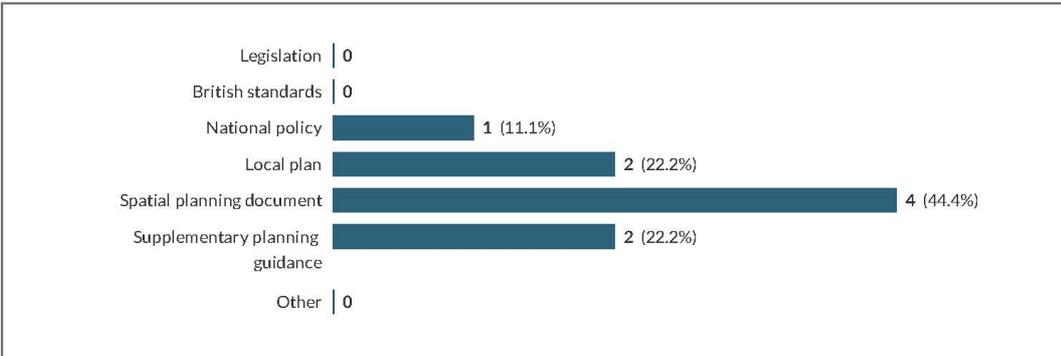
15.f Where can planning policy direct development in innovation of data resource?

Legislation	0
British standards	0
National policy	0
Local plan	0
Spatial planning document	0
Supplementary planning guidance	0
Other	0

15.f.i If you selected Other, please specify:

No responses

15.g Where can planning policy promote development in innovation of data resource?



15.g.i If you selected Other, please specify:

No responses

15.h If you selected other, where can planning policy incorporate this level of oversight for development in innovation of data resource?

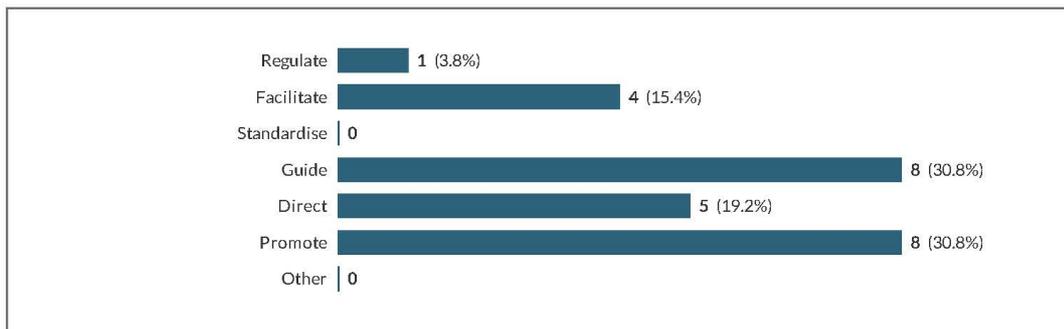
Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

15.h.i If you selected Other, please specify:

No responses

Design

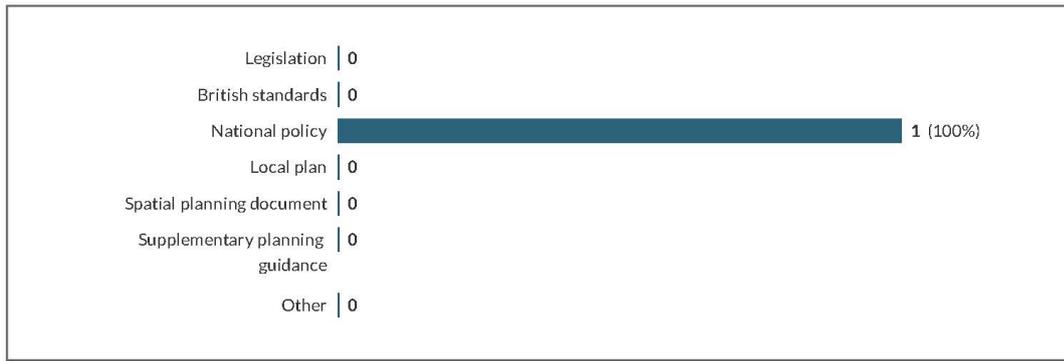
16 When designing projects; planning should: * development.



16.a If you selected Other, please specify:

No responses

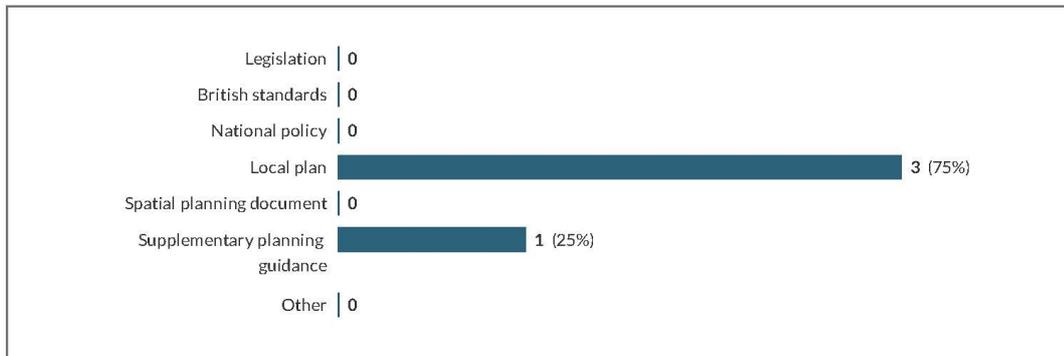
16.b Where can planning policy regulate development when designing projects?



16.b.i If you selected Other, please specify:

No responses

16.c Where can planning policy facilitate development when designing projects?



16.c.i If you selected Other, please specify:

No responses

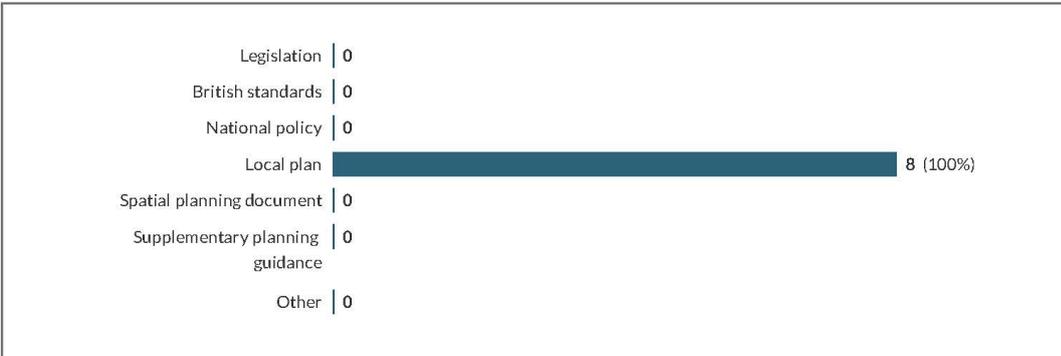
16.d Where can planning policy standardise development when designing projects?



16.d.i If you selected Other, please specify:

No responses

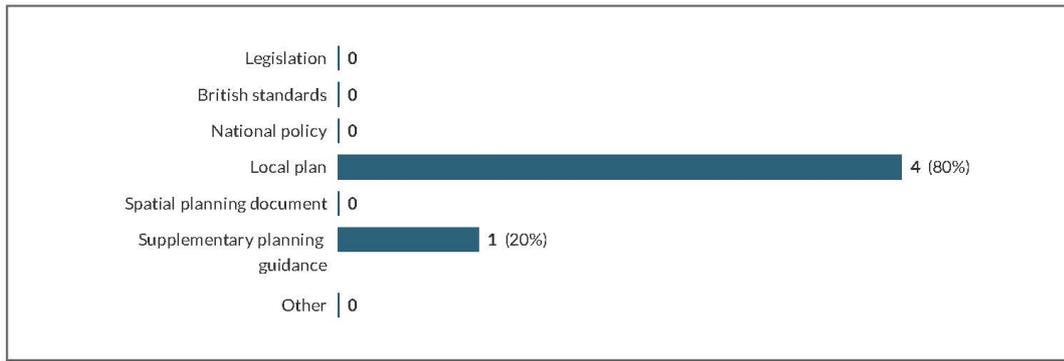
16.e Where can planning policy guide development when designing projects?



16.e.i If you selected Other, please specify:

No responses

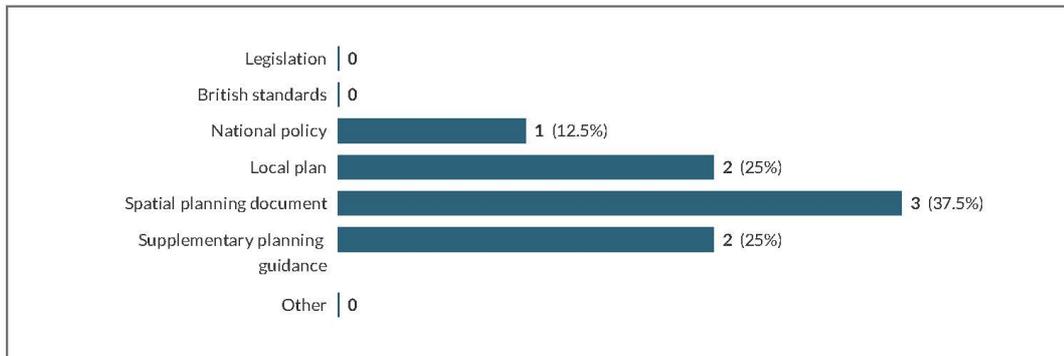
16.f Where can planning policy direct development when designing projects?



16.f.i If you selected Other, please specify:

No responses

16.g Where can planning policy promote development when designing projects?



16.g.i If you selected Other, please specify:

No responses

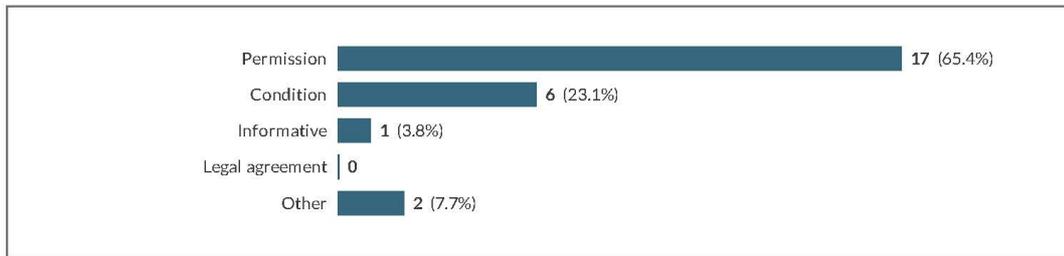
16.h If you selected other, where can planning policy incorporate this level of oversight for development when designing projects?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

16.h.i If you selected Other, please specify:

No responses

17 Which of the following planning processes would be most suited to designing smart city projects?

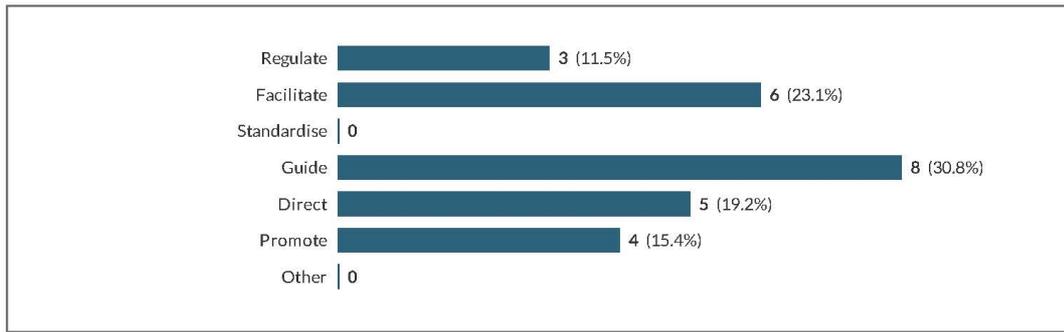


17.a If you selected Other, please specify:

Showing all 2 responses	
Pre-application discussions prior to a scheme being fully designed. This would give developers a opportunity to design it in at an early stage.	333130-333122-31543989
Policy	333130-333122-31951662

Implement

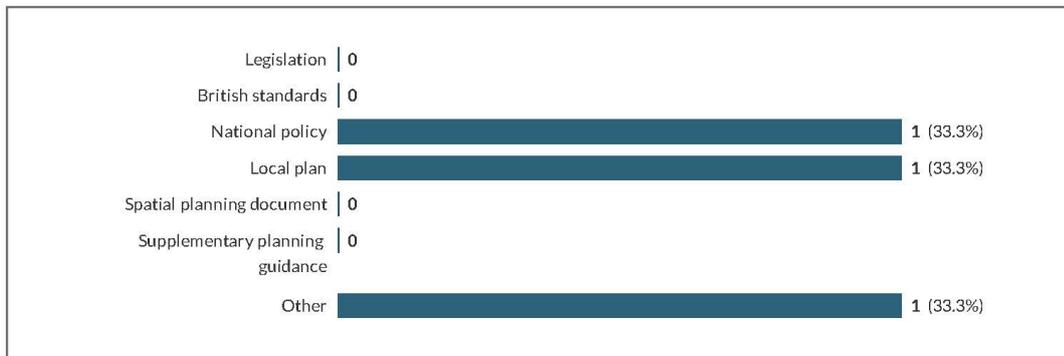
18 When implementing projects; planning should: * development.



18.a If you selected Other, please specify:

No responses

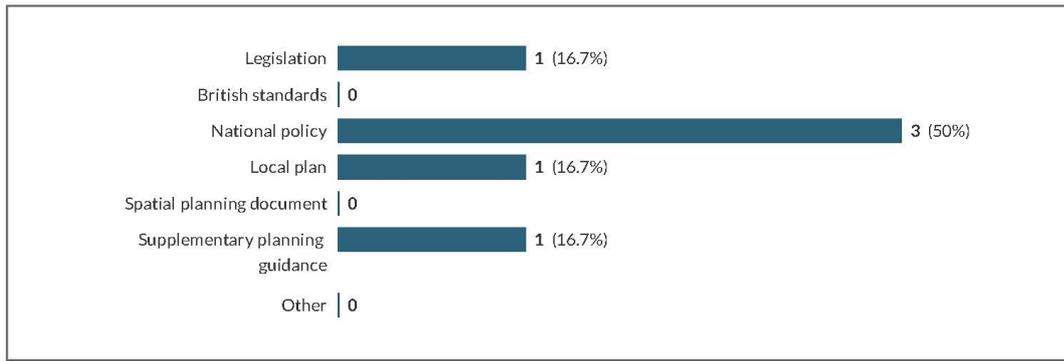
18.b Where can planning policy regulate development when implementing projects?



18.b.i If you selected Other, please specify:

Showing 1 response	
use of conditions	333130-333122-30025008

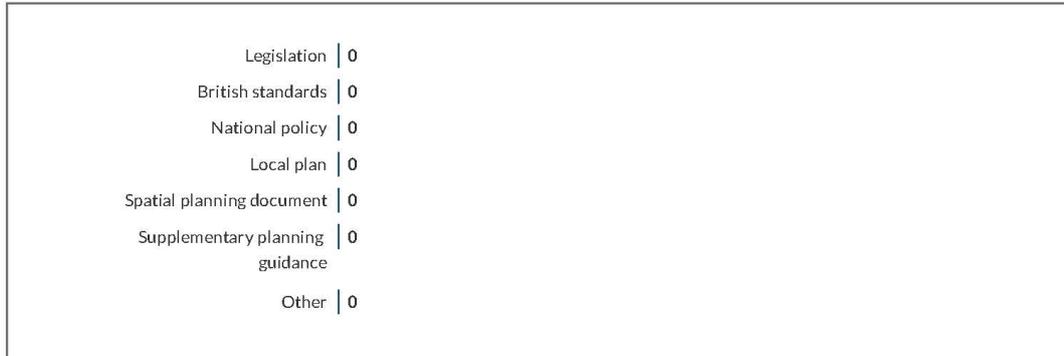
18.c Where can planning policy facilitate development when implementing projects?



18.c.i If you selected Other, please specify:

No responses

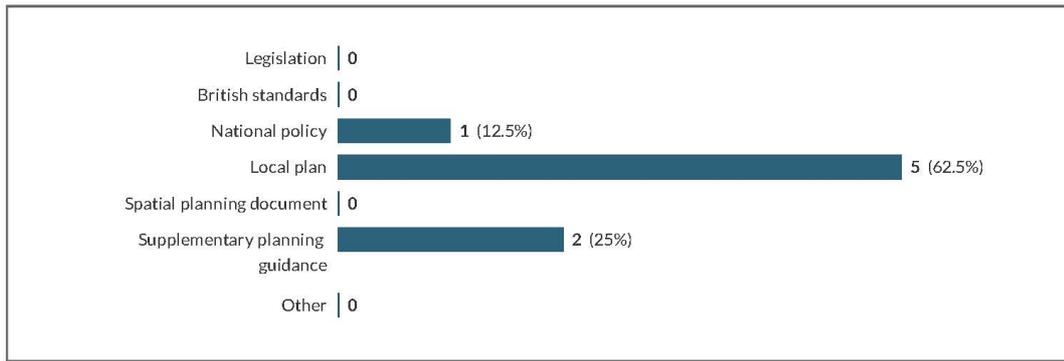
18.d Where can planning policy standardise development when implementing projects?



18.d.i If you selected Other, please specify:

No responses

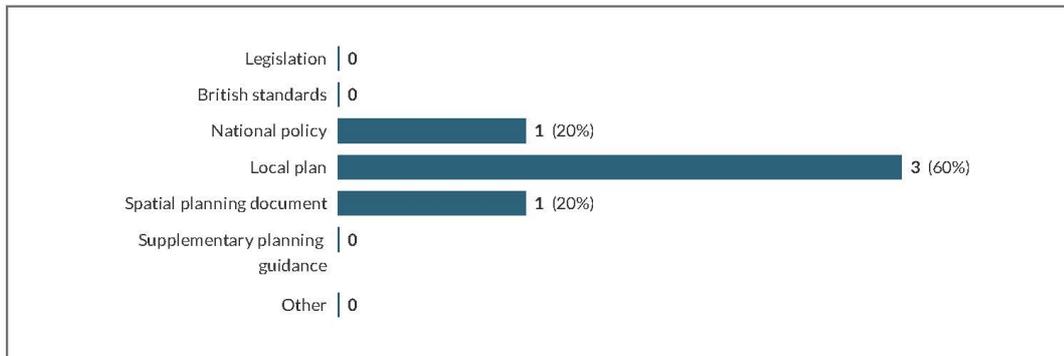
18.e Where can planning policy guide development when implementing projects?



18.e.i If you selected Other, please specify:

No responses

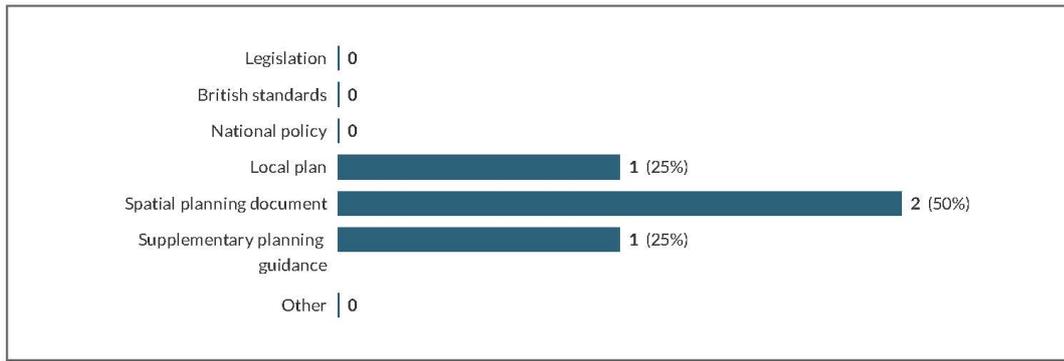
18.f Where can planning policy direct development when implementing projects?



18.f.i If you selected Other, please specify:

No responses

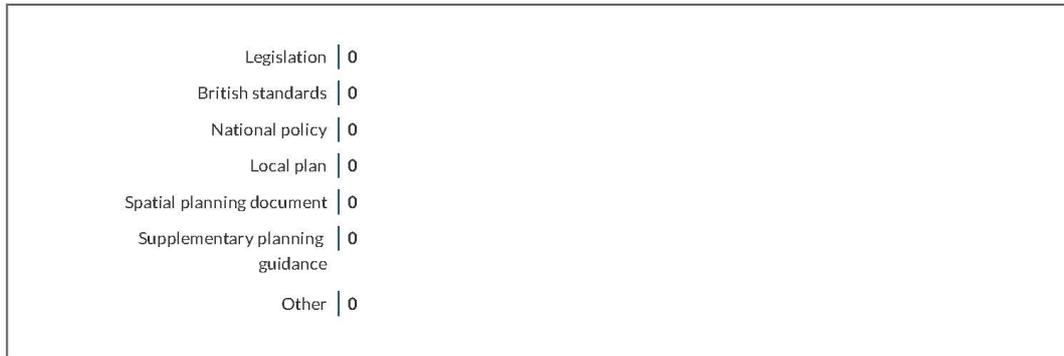
18.g Where can planning policy promote development when implementing projects?



18.g.i If you selected Other, please specify:

No responses

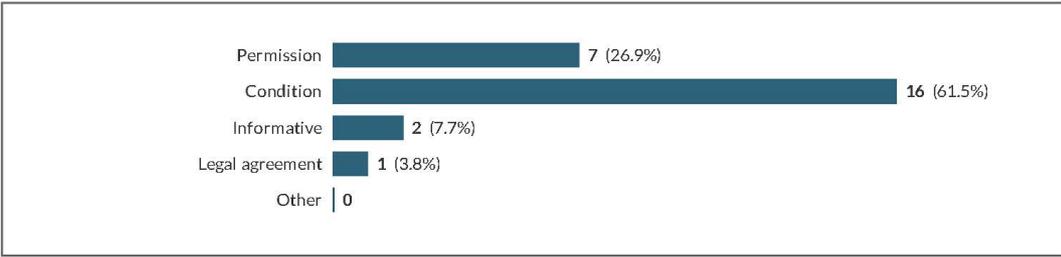
18.h If you selected other, where can planning policy incorporate this level of oversight for development when implementing projects?



18.h.i If you selected Other, please specify:

No responses

19 Which of the following planning processes would be most suited to implementing smart city projects?

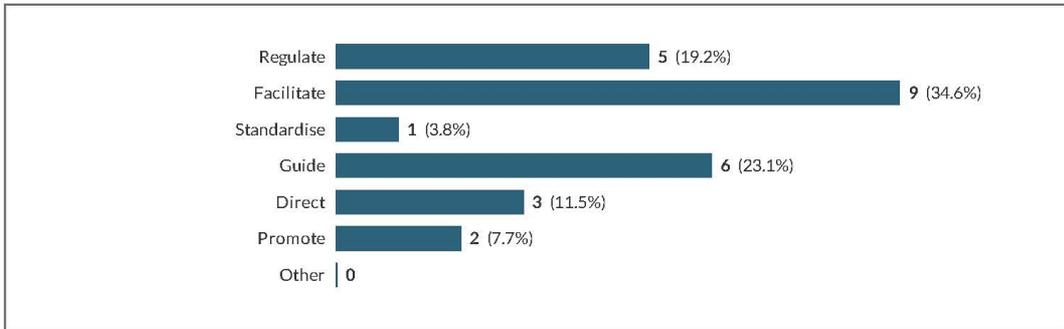


19.a If you selected Other, please specify:

No responses

Monitor

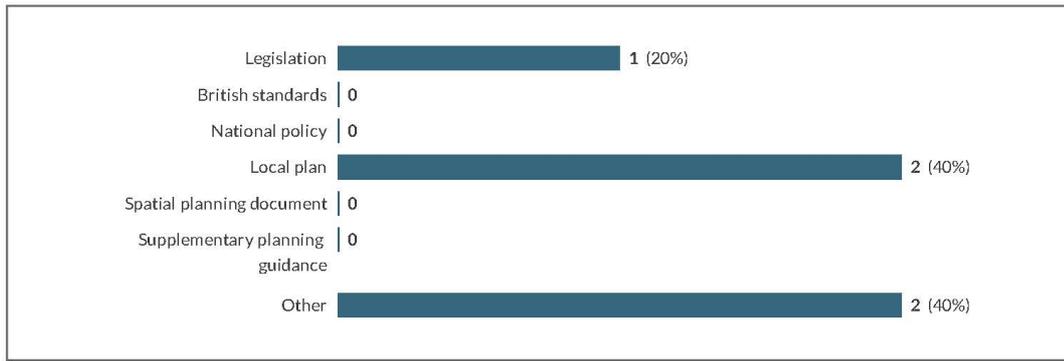
20 When monitoring projects; planning should: * development.



20.a If you selected Other, please specify:

No responses

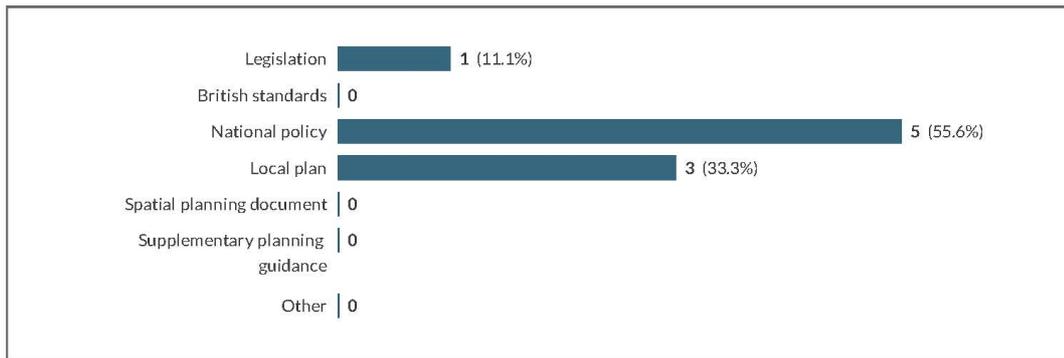
20.b Where can planning policy regulate development when monitoring projects?



20.b.i If you selected Other, please specify:

Showing all 2 responses	
use of conditions	333130-333122-30025008
IN accordance with the permission given.	333130-333122-33765540

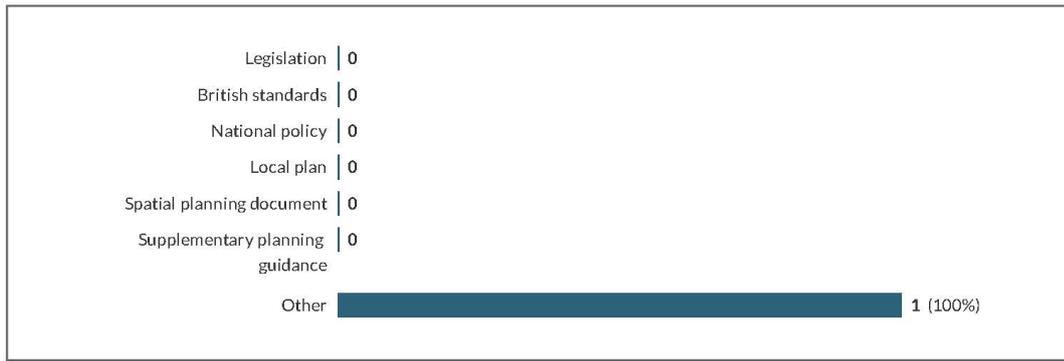
20.c Where can planning policy facilitate development when monitoring projects?



20.c.i If you selected Other, please specify:

No responses

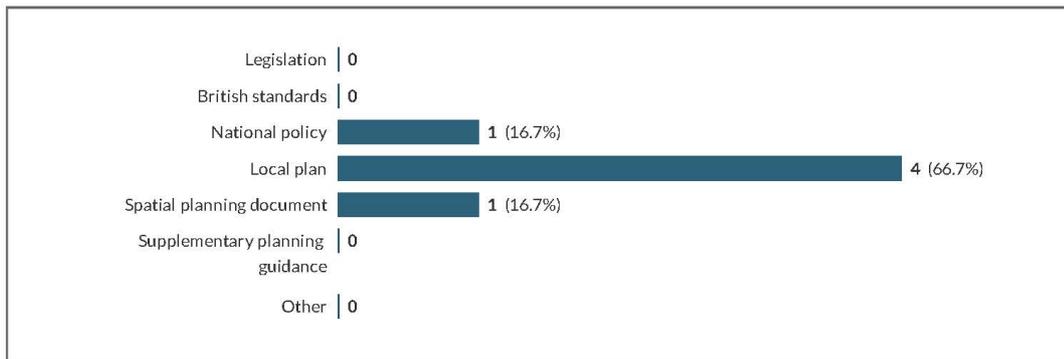
20.d Where can planning policy standardise development when monitoring projects?



20.d.i If you selected Other, please specify:

Showing 1 response	
Annual monitoring returns based on a development database, eg Landfile	333130-333122-31960791

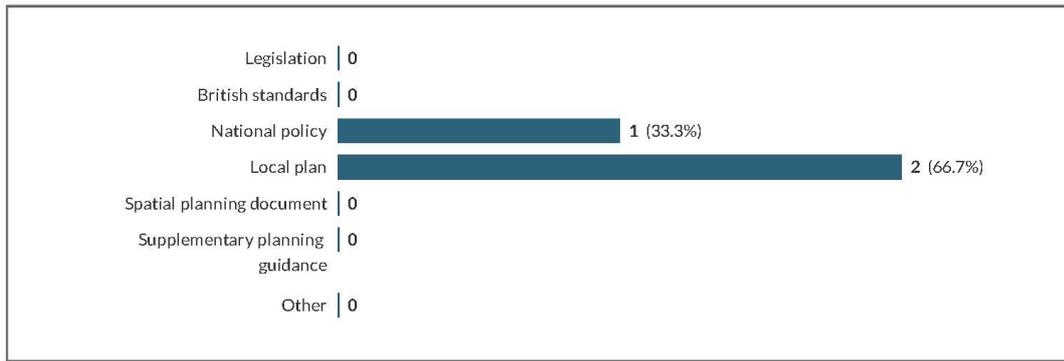
20.e Where can planning policy guide development when monitoring projects?



20.e.i If you selected Other, please specify:

No responses

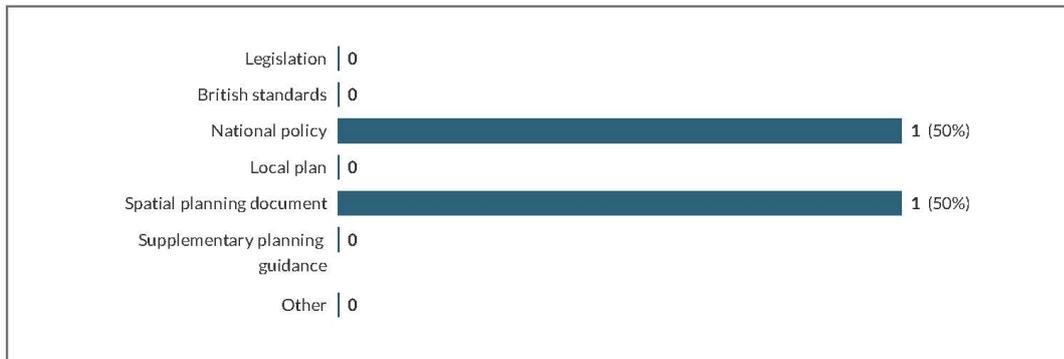
20.f Where can planning policy direct development when monitoring projects?



20.f.i If you selected Other, please specify:

No responses

20.g Where can planning policy promote development when monitoring projects?



20.g.i If you selected Other, please specify:

No responses

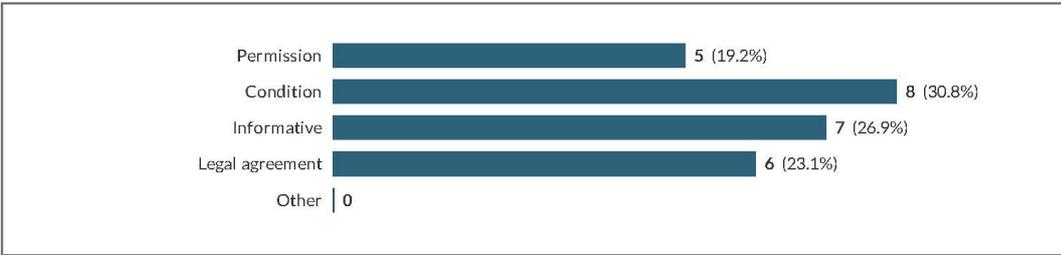
20.h If you selected other, where can planning policy incorporate this level of oversight for development when monitoring projects?

Legislation		0
British standards		0
National policy		0
Local plan		0
Spatial planning document		0
Supplementary planning guidance		0
Other		0

20.h.i If you selected Other, please specify:

No responses

21 Which of the following planning processes would be most suited to monitoring smart city projects?

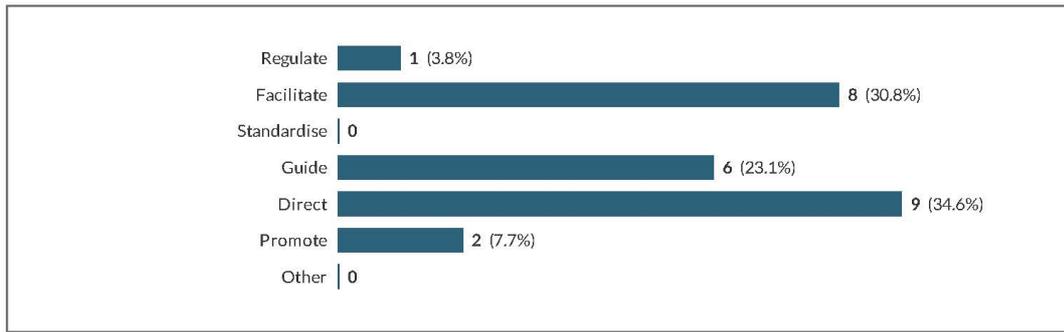


21.a If you selected Other, please specify:

No responses

Adapt

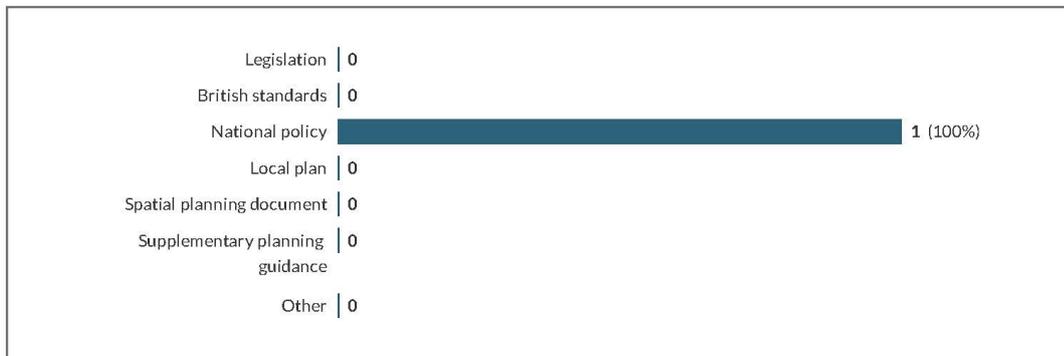
22 When adapting projects; planning should: * development.



22.a If you selected Other, please specify:

No responses

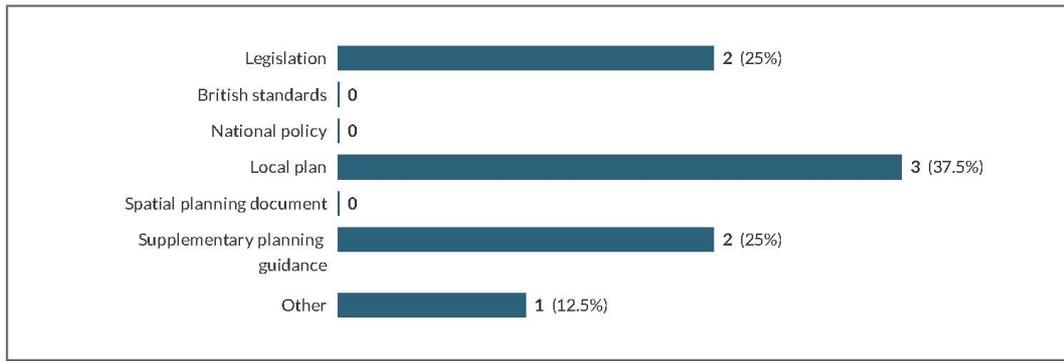
22.b Where can planning policy regulate development when adapting projects?



22.b.i If you selected Other, please specify:

No responses

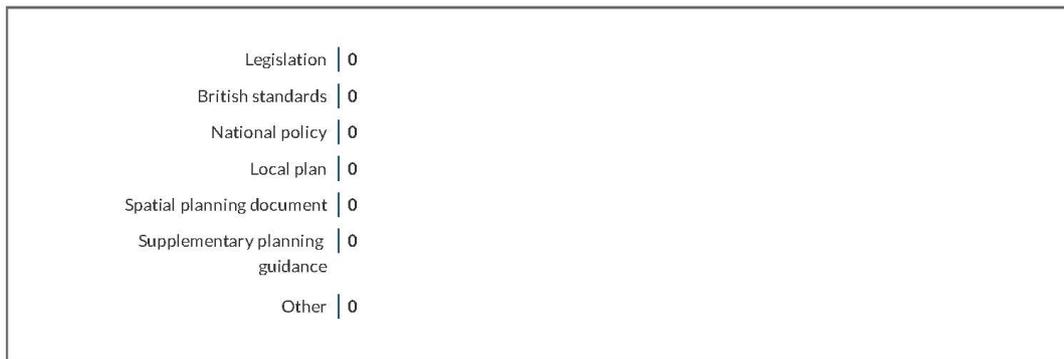
22.c Where can planning policy facilitate development when adapting projects?



22.c.i If you selected Other, please specify:

Showing 1 response	
I don't know what you mean by 'adapting' projects. Amending permission?	333130-333122-33765540

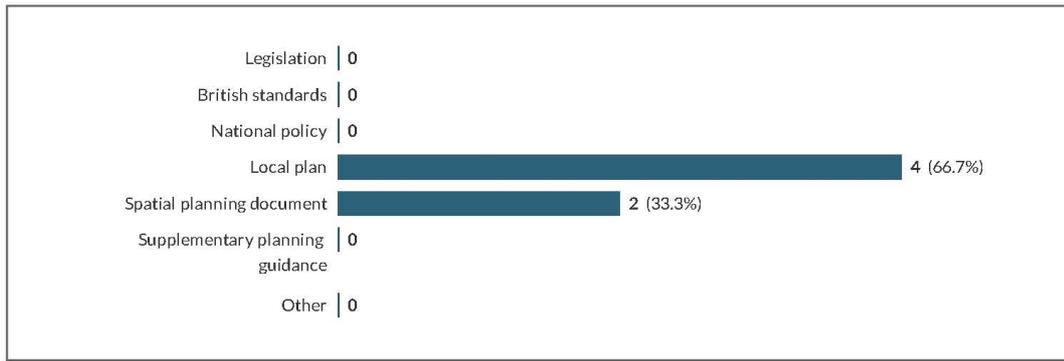
22.d Where can planning policy standardise development when adapting projects?



22.d.i If you selected Other, please specify:

No responses

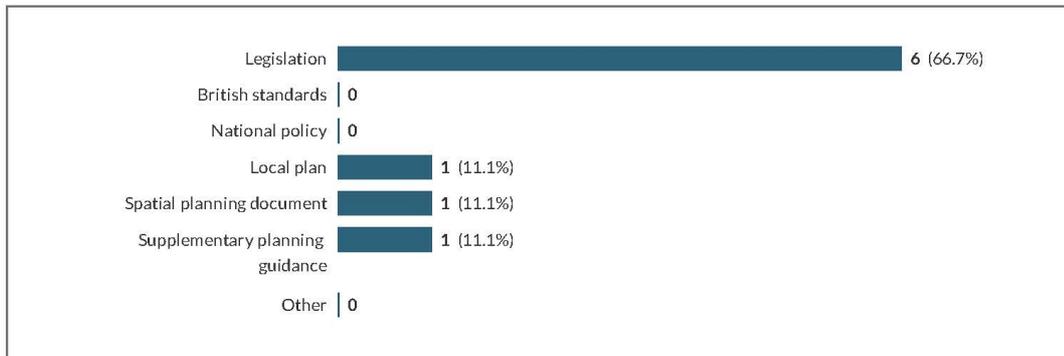
22.e Where can planning policy guide development when adapting projects?



22.e.i If you selected Other, please specify:

No responses

22.f Where can planning policy direct development when adapting projects?



22.f.i If you selected Other, please specify:

No responses

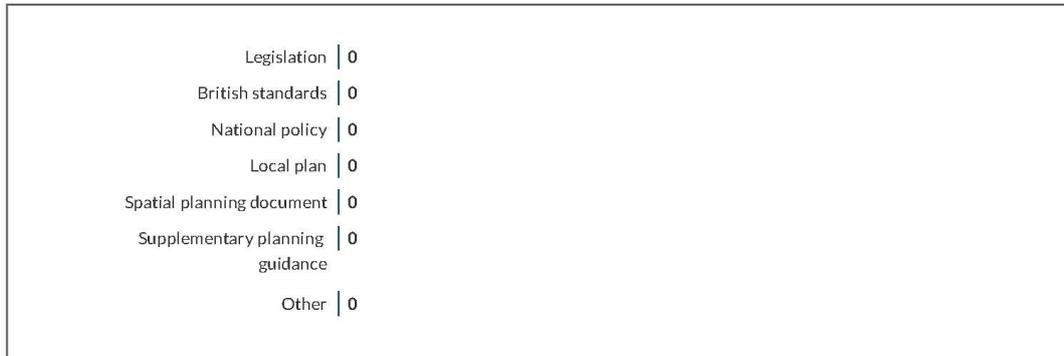
22.g Where can planning policy promote development when adapting projects?



22.g.i If you selected Other, please specify:

No responses

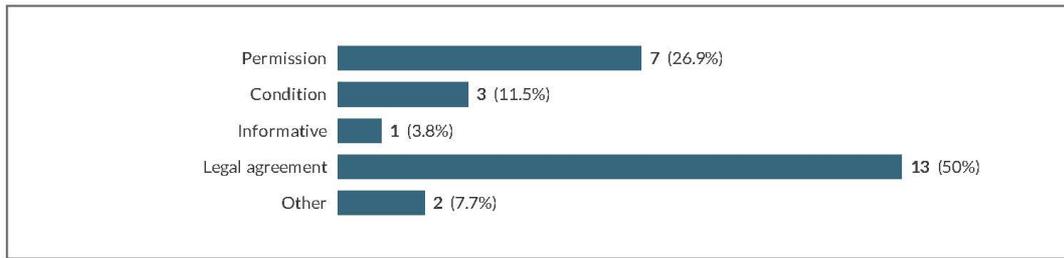
22.h If you selected other, where can planning policy incorporate this level of oversight for development when adapting projects?



22.h.i If you selected Other, please specify:

No responses

23 Which of the following planning processes would be most suited to adapting smart city projects?

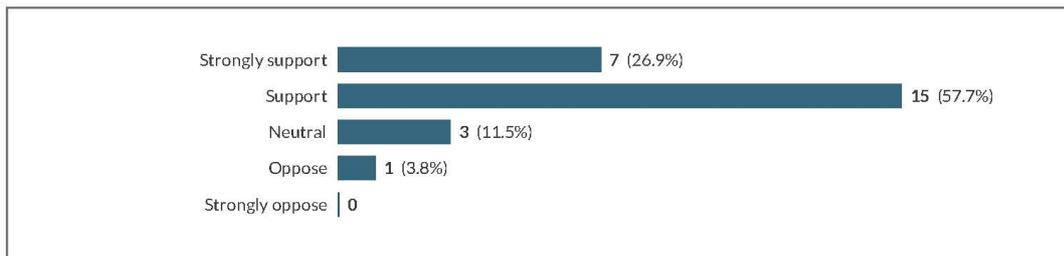


23.a If you selected Other, please specify:

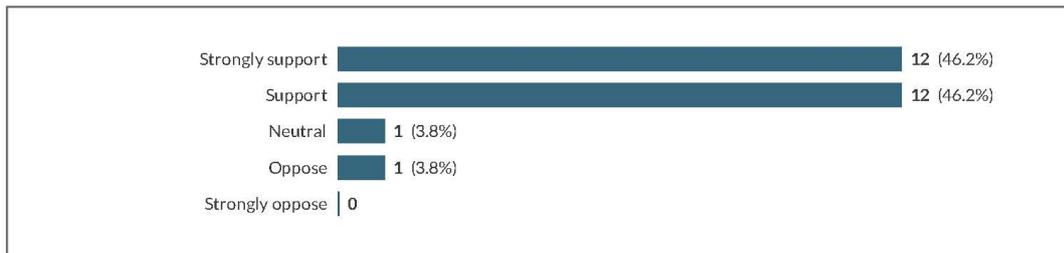
Showing all 2 responses	
Unless there is a specific condition, legal agreement or other restriction I do not think there are any planning processes which would restrict the adaptation of a smart city project.	333130-333122-31543989
I don't know what you mean by 'adapting' projects. Amending permission?	333130-333122-33765540

24 Which of the following views best represents your opinion of the following practical solutions to planning projects that incorporate elements of smart cities & the digital agenda?

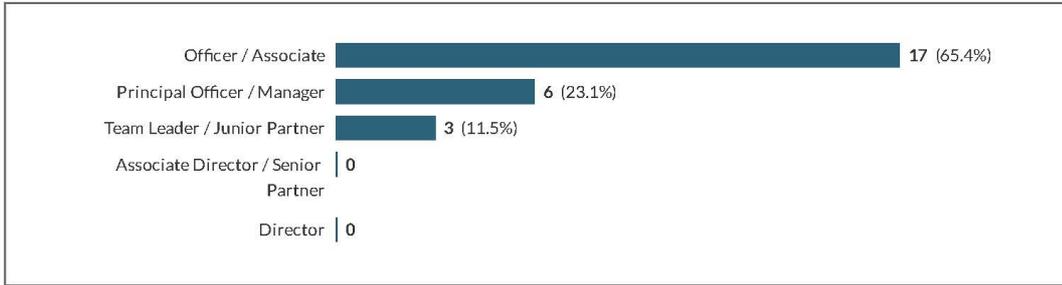
24.1 Digital consultee



24.2 Planning practice guidance note



25 Which of the below best describes your seniority level?



26 How many years experience do you have in your professional career?

