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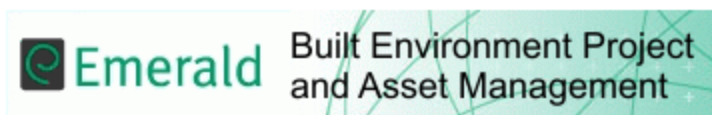
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Integrating sustainability practices into the Irish construction supply chain: Main Contractors' perspective

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Integrating sustainability practices into the Irish construction supply chain: Main Contractors' perspective

Abstract

Purpose – The low level of sustainable practices in the architectural, engineering and construction (AEC) sector continues to increase. Also, limited studies focused on integrating the supply chain into sustainable practices in large construction firms. This study examines the strategies adopted by large construction-contracting firms in Ireland to integrate sustainability practices into their supply chain networks.

Design/methodology/approach – The study adopts the mixed-method approach using questionnaires and interviews to collect data. In terms of theoretical underpinning, the study was positioned in the Resourced-Based View (RBV) theory, which focuses on the link between a firm's internal characteristics and performance.

Findings – The results revealed that trust, knowledge of the construction process, commitment, a common goal, and mutual support were the key factors driving sustainability. Also, suppliers' assessment and promoting competition in the supply chain were ranked high among the mechanisms utilised to improve sustainability performance. Additional findings revealed that long-term relationships with a supply chain organisation have little impact on the project sustainability performance; instead, close collaboration and trust amongst the project team influenced the project sustainability performance.

Research limitations/implications – The study focuses only on the main contractor's organisation making the responses biased.

Practical implications – The research demonstrates that for construction-contracting firms to contribute positively to sustainability objectives, they will have to collaborate closely with their supply chain.

Originality/value – The study provided practical and empirical evidence to guide construction-contracting firms to develop strategies to drive and implement sustainable construction practices.

Keywords: AEC, Republic of Ireland, Strategy, Sustainable Procurement, Supplier's Development, Supply Chain Management.

Article Type: Research paper

1.0 Introduction

In meeting the 2030 Sustainable Development Goals (SDGs), the Architectural, Engineering and Construction (AEC) sector have a vital role to play (Fei et al., 2021; Goubran, 2019). Also, being a major contributor to greenhouse gas (GHG) emissions, the sector can significantly drive the implementation of the climate emergency declared by the government of the Republic of Ireland in May 2019 (Government of Ireland, 2019). Nowadays, construction-contracting firms have introduced sustainability practices to their supply chain network (Chardine-Baumann and Botta-Genoulaz, 2014, Pagell and Wu, 2009). The supply chain in a construction-contracting organisation comprises many small companies that help access highly specialised skills, local knowledge and resources, and risk distribution (Hughes et al., 2006, Pryke, 2009, Vrijhoef et al., 2001). Utilising the supply chain mechanism allows creating value for clients and is a vehicle for innovation and continuous improvement (Pryke, 2009).

Sustainable Supply Chain Management (SSCM), as defined by Seuring and Müller (2008), is:

'the management of material, information and capital flow, and cooperation among companies along the supply chain while paying close attention to all the three dimensions of sustainable development, i.e. economic, environmental and social, into account which is derived from customer and stakeholder requirement'.

Large construction contracting firms rely on their supply chain in carrying out and delivering their projects (London, 2008, Oyegoke et al., 2014). Also, they take responsibility for their supply chain behaviour and products (Sancha et al., 2016, Wu and Barnes, 2016, Lin and Tseng, 2016). Therefore, a well crafted SSCM has the potential of creating value for construction firms (Adetunji et al., 2008, Loosemore and Lim, 2021, Xu et al., 2021). In creating value, firms are expected to create various strategies (Tan et al., 2011). These strategies change business practices from short-term cost minimisation to long term value creation and delivery (Walker et al., 2008). Such value could be created through organisational capabilities in three areas (Kähkönen and Lintukangas, 2012). First is through competing and responding to industry-level challenges, second exploiting relationship capabilities, and lastly understanding and responding to customers' needs.

Although, the level of adoption of sustainability objectives in the AEC sector is low (McKinsey Global Institute, 2017, Russell et al., 2018, World Economic Forum, 2016). Such a low level of adoption could be attributed to their inability in disclosing their sustainability performance. Disclosing their sustainability practice enable companies to communicate their performance, develop a reputation for responsible behaviour and gain a competitive advantage (Glass, 2012). Also, there is a lack of a comprehensive structure and a supply chain perspective in implementing sustainability practice in most organisations (Brockhaus et al., 2013, Loosemore and Lim, 2021). Upstill-Goddard et al. (2016) observed that small and medium construction enterprises (SME's) are always reactive in adopting sustainability practices. Such behaviour is because SME's will only embrace innovative practices if only they see immediate financial benefits (Upstill-Goddard et al., 2016, Ruparathna and Hewage, 2015). In addition, it is noted that most construction-contracting firms' intention in implementing sustainability is to enable them to gain a competitive advantage and legitimacy (Upstill-Goddard et al., 2015, Rietbergen et al., 2015, Russell et al., 2018).

Learning from top construction-contracting firms is vital (Riley et al., 2003) because their practices are often regarded as the benchmark and present a learning model for others (Chang, Soebarto, et al., 2016). Therefore, in motivating supply chain organisations to embrace sustainability practices, the leading construction-contracting firms have been the main drivers (Riley et al., 2003). Despite the main construction-contracting firm's position, there seems to be a paucity of studies on how

they influence and collaborate with their supply chains in driving and adopting sustainability practices. Therefore, this study explores how Ireland's top fifty construction-contracting firms integrate sustainability practices into their supply chain network.

This study is divided into four sections: the literature review, methodology, results and findings, discussion, and conclusion.

2.0 Literature Review

The literature review for this paper focuses on three key areas: sustainable supply chain management, suppliers' development, and the resource-based view theory.

2.1 Sustainable Supply Chain Management

The AEC sector must collaborate closely with its supply chains to drive sustainability objectives. Collaborating with their supply chain is necessary because of the shift from the traditional main contractor's contractual role from active participation in construction activities to a management role (London, 2008, Oyegoke et al., 2014). Although, the adoption of supply chain management in the AEC sector is slow, patchy, and inconclusive (Loosemore and Lim, 2021, Fernie and Tennant, 2013). One of the reasons provided for such challenges includes the complexity of the AEC sector and the need to involve various actors in delivering projects (Tennant and Fernie, 2014, Ageron et al., 2012, Papadonikolaki, 2018). Successful sustainable supply chain management is characterised by collaboration and the involvement of interdisciplinary partners (Riley et al., 2003, Patrucco et al., 2021). Such success is determined by the procurement route adopted for a project (Mollaoglu-Korkmaz et al., 2013, Woo et al., 2016, Naoum and Egbu, 2016).

In understanding the supply chain network structure, Adetunji et al. (2008) explained that two schools of thought exist in the literature relating to conditions of successful implementation of supply chain management (SCM) in the construction industry, as shown in Figure 1. The first school of thought (A) is based on operational efficiency and effectiveness through collaboration based on equitable relationships. In comparison, the second school of thought (B) is based on strategic efficiency and effectiveness through collaboration based on power relations.

Figure 1: The Two School of Thoughts for Achieving SCM (Adetunji et al., 2008)

The first school of thought (A) explained that fragmentation, adversarial culture, low profits margin, and trust issues in the construction industry could be managed through integration and cooperation. In contrast, the school of thought on strategic efficiency and effectiveness (B) argues a flaw in assuming that successful SCM is based on trust and equitable relationships. The second school of thought further argues that successful SCM is achieved through collaboration based on a power regime. Power regime is exercised when the dominant player is strategically placed and creates a structural hierarchy of relatively dependent suppliers (Adetunji et al., 2008, Cox, 2007). Also, the dependent suppliers pose no threat to the flow of value appropriation and are forced to pass a value to the dominant player. In gaining a competitive advantage, such dominant players usually widen their suppliers' alternatives to promote innovation and commitment (Stannack, 1996, Adetunji et al., 2008). Despite the differences in the two schools of thought, there are areas of consensus between the two groups, as shown in figure 1. These consensus areas are internal and external alignment through coordinated teams and cross-functional integration to ensure flexible,

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3 adaptive, and open organisations; appropriate exchange of information and knowledge transfer
4 leads to innovation. Other areas of consensus are effective communication in terms of frequency
5 and quality of information, willingness to share information to improve overall performance;
6 commitment to a common goal and mutual support; and continuous innovative effort. Therefore,
7 how construction-contracting firms utilise such strategies in developing long-term relationships is
8 further explored in this study.
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11 12 **2.2 Suppliers Development** 13

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15 Leading construction-contracting firms have a crucial role in promoting sustainability in delivering
16 a construction project (Riley et al., 2003). Korkmaz and Singh (2011) argued that delivering
17 sustainable projects in a complex sector with diverse actors is challenging and requires a high level
18 of interaction and leadership to achieve a positive result. Supporting and encouraging an
19 organisation's supply chain can significantly contribute to the project and organisation
20 performance (Hardie, 2010, Patrucco et al., 2021). Such support could be carried out through an
21 effective supplier selection, supplier development and supplier performance review (Kumar and
22 Rahman, 2016). The Chartered Institute of Procurement and Supply (CIPS) (Chartered Institute
23 of Procurement & Supply, 2018) defined supplier's development as a process that involves
24 embracing the supplier's expertise and aligning it to the buying organisation's business need. CIPS
25 further explained that the supplier's development might involve developing a supplier's business,
26 such as helping the supplier evaluate and redesign its corporate strategy. Also, Meehan and Bryde
27 (2015) argued that the procurement consortia's ability to transfer knowledge and requisite skills to
28 individuals and their supply chains would effectively deliver sustainable construction projects.
29 However, earlier studies by Lönngren et al. (2010) observed few practical examples of managing
30 supply chains in the construction industry and little empirical evidence.
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35 Supply chain performance can be improved through supplier assessment, incentives, instigating
36 competition among suppliers, and partnership with the supply chain organisation through training
37 and knowledge sharing (Krause et al., 2000, Sancha et al., 2016). Sancha et al. (2016) further
38 revealed that assessing supplier practices improves the main contractor's social performance while
39 collaborating with them enhances their social performance. Such collaboration and partnership
40 could be improved by regular engagement of the supply chain organisation (Noorizadeh et al.,
41 2018). Regular engagement of supply chain organisations has contributed to their social capital
42 accumulation and trust building (Noorizadeh et al., 2018). The higher the partnership level, the
43 more consistency there would be in the supply chain's performance (Gosling et al., 2015, Patrucco
44 et al., 2021). Such partnership could be developed and shared through social learning (Rizzi et al.,
45 2014). Hojem et al. (2014) explained that social learning enables the collective act of exploration,
46 discovery, and analysis, which improve the project objectives and enhances innovation.
47 Developing social learning strategies enables the incorporation of trust elements and identification
48 of contract benefits by various actors (Sparrevik et al., 2018).
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52 Additionally, trust and identifying the contracts' benefits can stimulate the supply chain members
53 to be proactive in achieving the project objectives (Sparrevik et al., 2018, Loosemore and Lim,
54 2021). Other factors that can drive the adoption of sustainability among the various supply chains
55 are the governance mechanisms (transactional or relational), collaborative relationships (mandated
56 or collaborative approach), and innovations (improving performance) (Lin and Tseng, 2016,
57 Govindan et al., 2016). However, it is vital that the procurement entity (main-contracting firm)
58 assesses the requirement and expected outcome/benefit before developing a supplier (Cox and
59 Ireland, 2002, Loosemore and Lim, 2021). Assessing such requirements is essential because an
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3 organisation's intention to develop a sustainability strategy amongst its supply chain might be at
4 odds with retaining its competitive advantage in the pursuit of profit (Glover et al., 2014). Driving
5 sustainability provides a rare opportunity to create value or profit in the short term (Adetunji et
6 al., 2008).
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10 ***2.3 Resource-Based View (RBV) Theory***

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13 The value of using the RBV theory has long been recognised by researchers in the built
14 environment in understanding construction innovation and organisational strategies in the
15 construction industry (Goh & Loosemore, 2017). The RBV theory studies the link between a firm's
16 internal characteristics and performance (Barney, 1991). The theory suggests that competitive
17 advantage can be sustained when the capabilities creating the advantage are supported by valuable,
18 rare, imperfectly imitable resources and not easily duplicated by competitors (non-substitutable)
19 (Barney, 1991; Hart, 1995). Organisational resources are inputs of the production process. These
20 resources are classified as physical capital resources (physical technology, plant and equipment,
21 and buildings), human capital resources (training, experience, and workers in a firm), and
22 organisational capital resources (informal relations among groups within a firm and those in its
23 environment). Supply chains are classified under the organisational capital resources because they
24 are vital in enhancing a firm's sustainability performance (Chardine-Baumann & Botta-Genoulaz,
25 2014; Pagell & Wu, 2009).
26
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28 Large construction firms possess valuable, rare, imperfectly imitable, and non-substitutable
29 resources. Barney (1991) explained that a firm's resources could be imperfectly imitable for one or
30 a combination of three reasons: unique historical conditions, causally ambiguous, and social
31 complexity. However, despite the strategies adopted by top construction firms in driving
32 sustainability practice (Berry & McCarthy, 2011; Tan et al., 2011), there seems to be a gap in
33 understanding how these firms utilise the various resources they possess to drive their sustainable
34 construction practices. Although it is often challenging to unfold some of the strategies adopted
35 by large firms to gain a competitive advantage, awful lessons are learned from their practices (Hart,
36 1995, Barney, 1991).
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41 **3.0 Methodology**

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45 This section of the paper focuses on the methodology adopted for the study and addresses issues
46 such as the philosophical stance, research design, the target population and sampling criteria.
47 Similarly, the methodology section also presents the design of data collection instruments, using
48 the questionnaire survey and interview for the quantitative and qualitative phases, respectively.
49

50 The study aims not to provide a statistical generalisation but analytical. Such analytical
51 generalisation is by providing an inference of the best explanation (abduction). The abductive
52 approach enables constant switching between empirical observations and theory, which generates
53 a greater understanding of empirical phenomena and theory (Upstill-Goddard et al., 2016, Dubois
54 and Gadde, 2002).
55

56 In examining the strategies adopted by the top fifty construction-contracting firms in the Republic
57 of Ireland, the mixed-method research approach was adopted. The mixed-method approach allows
58 triangulating the data to corroborate research findings within a study (Saunders et al., 2015). This
59
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approach enables the researcher to draw from the strengths and minimise the weaknesses of a more traditional single approach (Mitchell, 2018).

3.1 Sampling criteria

Data were purposively collected from the top fifty construction companies based on their annual financial turnover listed by the Construction Industry Federation (CIF) in 2018. The study aimed in collecting between 120-150 responses from practitioners working for the top 50 construction companies. Denscombe (2014) and Onwuegbuzie and Collins (2007) suggested that the sampling technique's choice should be based on the type of generalisation of interest, either a statistical generalisation or analytic generalisation.

3.2 Design of Data Collection Instrument (Questionnaire)

The questionnaire was divided into two parts. The first part focuses on the respondent's general information (role of the respondent, annual turnover, and years in business). The second part of the questionnaire examined the various strategies utilised by contracting firms in collaborating with their supply chains. The strategies examined were developing a long-term relationship and improving supply chain performance. A five-point Likert scale was used because it ensures an objective data scale with few neutral items and less extreme items at either end of the continuum (Oppenheim, 1992). In addition, the five-point Likert scale's suitability maximises data reliability and validity (Krosnick and Presser, 2010). Finally, the web-based survey was utilised for data collection. The benefits of the internet survey are that it saves time, saves money, speed up data processing, allow comprehensive geographical coverage, and provide an environmentally friendly approach to conducting research (Denscombe, 2014).

The online survey was sent out between December 2019 to February 2020. Intensive follow-up and reminders through emails and telephone calls were made to the participants. A total of sixty-five (65) online surveys were received, but after examining the survey, three (3) were found not suitable, leaving sixty-two (n=62) suitable for further analysis. Sixty-two (62) response rates represent fifty-two per cent (52%) of 120 expected. A total response rate of 52% was found adequate because a response rate of 20-30% in built environment research is satisfactory (Fellows and Liu, 2008, Enshassi et al., 2018, Hoxley, 2008). Similarly, Shih and Xitao (2008) explained that the web-based survey method generally has a low response rate of about 10% lower on average.

3.3 Data Analysis

The data collected were analysed using descriptive statistics and the Relative Importance Index (RII). The descriptive statistics are presented in tables and charts that provide general information about the respondents. The RII was used to analyse the firms' strategies in developing long-term relationships and supplier's development mechanisms.

The RII technique is used extensively in construction research for measuring attitude or perception. An ordinal scale was used to measure variables, and the respondents were asked to assign a level from 1 to 5. For each criterion, 1 being 'Not at all or Never' and the highest 5 being 'Very high, or Always'. The RII ranges from 0 to 1. The RII is given as:

$$\frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where w = the weighting given to each factor by the respondent, ranging from 1 to 5

A= the highest weight (i.e., 5 in the study)

N= the total number of respondents

3.4 Interviews

The semi-structured interview approach was used in the collection of the data. The approach allows respondents to answer more questions on their terms, providing better clarification and elaboration on the answers given (May, 2001). Interviews were conducted to explore the experiences and views of both the main contractor's team and supply chains on issues that relate to sustainable construction practices. A total of eight (8) participants (four each from the main contractor and supply chain) were purposively selected and interviewed. There have been many arguments regarding the adequacy of the number of participants in an interview (Sim et al., 2018, Flick, 2007). However, Sim *et al.* (2018) argued that it is not the number of cases that matters; it is what you do with them that counts. The interviews lasted between 1 hour to 1 hour 30 minutes. Interviews were recorded, transcribed, and sent back to the participants to ensure that the transcription was the actual information discussed during the interview.

4.0 Results and Findings

The questionnaire survey and interviews were analysed and presented in tables and charts. The first part presents the respondents' general information based on the questionnaire survey. The second and third parts present the findings of the questionnaire survey and interviews on the strategies for developing long-term relationships and supplier's development mechanisms.

4.1 General Information of the Respondents

Table I shows the various roles of the respondents that completed the survey. From the results, it is shown that twenty-one (21) of the respondents are at the director level, while thirty-one (31) at the managerial level and other roles had ten (10) respondents. These other roles are Project managers, Design and BIM managers, Quantity Surveyors, and Site managers/engineers. The result indicates that good insight and understanding will be expected from the findings.

Table I: Role in the Organisation

Regarding the annual financial turnover and years in business, Figure 2 shows that 16% (10) have a turnover between €10-€50 million out of the sixty-two responses obtained, while 84% (52) have a turnover of over €50 million. Likewise, regarding years in construction business, the results showed that 68% (42) have been in the construction business for over 45 years and above. While 18% (11) have been operating between 30-45 years, 15% (9) have been operating between 15-30 years.

Figure 2: Based on Annual Turn-over and Years in Business

Overall, the results indicate that all the firms sampled will have a good level of experience regarding the adoption of sustainability. Firms with high financial turnover are motivated in adopting

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3 innovative practices like sustainability (Adetunji et al., 2003, Boyd and Schweber, 2012, Chang et
4 al., 2016). Additionally, Barney (1991) explained that long years in business (unique historical
5 condition) are an essential determinant of a firm's long-term performance.
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8 **4.2 Developing Long-Term Relationship**

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11 In unveiling how main construction-contracting firms collaborate with their supply chain in driving
12 sustainability, findings from interviews revealed that two factors determine the level of
13 collaboration. These are the type and nature of the project and the size of the supply chain
14 organisation. The respondents explained that the type of project usually determines the supply
15 chain to be engaged. Also, some clients have a long-lasting relationship with certain supply chains;
16 therefore, they will want them to be engaged in the project. Regarding the supply organisation's
17 size, the respondents explained that bigger supply chains like the cladding, insulation, glazing,
18 roofing, and concrete trade contractors have higher sustainability performance than smaller trades.
19 However, they revealed that their company have a long-lasting relationship with most of their
20 supply chain. They further explained that opportunities are always created for new entrants. One
21 of the respondents (Commercial manager) explained that a long-lasting relationship has made most
22 supply chains understand their company procedures and policies (like sustainability issues) and are
23 always willing to project a positive image of the company.
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27 *"So that might be an advantage to us to have a subcontractor who would kind of have gone with you on*
28 *the journey for the better job for the clients. Also, the subcontractors we would use, and reuse would be*
29 *somebody who would make us look good.*
30

31 Furthermore, the level of collaboration at the planning and delivery stage of a project was further
32 examined. In planning a project, the respondents revealed that their supply chains' early
33 engagement had been found to enhance collaboration. As explained by the respondents, some of
34 the benefits of early engagement enabled the main contracting team to understand the problem
35 and need of their supply chain. Also, it provided an opportunity for the supply chain to suggest
36 alternative materials and construction methodology that are sustainable. One of the Façade sub-
37 contractor sharing their experience said that because they were engaged early, they could contribute
38 at the planning stage of the project in terms of logistics, materials alternative, and site planning.
39 Sharing their experience in one of the projects the Façade Sub-Contractor said:
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43 *"Typically, doors in some of the lodges were built so high, and it was carving above. A timber sill is detailed*
44 *like a concrete sill, but it must be timber; it was quite wide. So, I comment that I would not recommend*
45 *using the ideal because, with time, it will twist or split because it is wide. We would have to join the board*
46 *that was recommended, which would be suitable".*
47

48 However, the Pre-Cast concrete sub-contractor, sharing their experience in one of the projects,
49 explained that though they have had a long working relationship with the main contractor for over
50 sixty years, the early engagement mainly was centred on the area of cost rather than construction
51 methodology.
52

53
54 *"......all the early engagement was around the area of the cost; it was a QS type of engagement. There was*
55 *no re-engagement regarding the area of buildability and use of craneage and stuff like that".*
56

57 The sub-contractor (pre-cast concrete) explained that it would have reduced the project's risks if
58 technical issues were discussed. Although, they explained that the procurement method adopted
59 provided enough ground for collaboration amongst team members.
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4 Comparing the findings from the interviews with the questionnaire survey results, the Relative
5 Importance Index (RII) shown in Table II returned an RII score of 0.7 and above of the 11 factors
6 identified by Adetunji et al. (2008). The first three factors, trust (RII 0.929), high knowledge of the
7 construction process (RII 0.900), and level of commitment (RII 0.894), tend to be of great
8 importance to main contractors. These factors promote long-term relationships and enhance close
9 collaboration amongst the team. The ranking of factors 4 to 8 is related to the first three factors,
10 while the last three factors (9-11) would probably not concern the main contracting firm. The
11 questionnaire results agree with the interview results that leading contracting firms are mindful of
12 their image and want to engage supply chains that will positively project them.
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Table II Long-term Relationship with Supply Chains

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4.3 The mechanism for Improving Supply Chain Performance

To further understand the contracting firm's strategies, the mechanism for improving supply chain performance was explored. Findings from interviews revealed that supplier's assessment, training, and rewards and incentives are regularly utilised to improve their supplier's performance. Depending on the project, the supplier's assessment is carried out bi-monthly, and each supply chain is provided with feedback on its performance. Such feedback identified their areas of strength and where they need to improve. Both formal and informal mechanism was used. The formal feedback was through site meetings, early morning whiteboard meetings, and weekly progress meetings. At the same time, the informal approach is through site tours and discussions. One of the respondents (Contracts Manager) explained that the informal approach yielded a better and positive outcome.

"So, it is not something that is always recorded; it is more on an informal basis and can sometimes have a very good effect because it is not a sit-down meeting with everybody around the room."

The respondents explained that various training is provided to their supply chain regarding training. Such training, they explained, helped the supply chain to step up its performance. However, they noted that some supply chains are always resistant to adapting to new practices. Nevertheless, a sub-contractor (Timber Frame sub-contractor) sharing their experience explained that it was their first time working for the main contractor but found their support quite helpful and productive.

"The contracts manager will go through our plan and resources and would identify any sort of clashes. He will go through the program in detail and then tell us areas of improvement, like the location of our crane, lorries, and storage, in terms of coordinating deliveries to avoid congestion on site. Good job coordination also helps our development as a company".

Finally, awards are given to the supply chains that perform well and are assured of regular engagement. Such incentives were found to influence supply chain behaviour by upholding the company's ethics.

The findings of the interviews agree closely with the questionnaire survey (Table III). The supplier's assessment ranked the highest score with an RII of 0.768. While the 2nd and 3rd highest ranked mechanism with an RII of 0.694 and 0.623 was instigating competition amongst supply chains and training supply chain members. Mechanisms like providing incentives for improved performance and helping in organisational restructuring/investing resources in supply chain organisations had an RII of 0.561 and 0.545, ranked 4th and 5th. Although, providing incentives (4th ranked) is likely related to the 2nd ranked mechanism (instigating competition). The last three mechanisms/strategies (ranked 3rd, 4th, and 5th) have been suggested by different authors as they key elements to be considered in influencing supply chains in delivering sustainable projects (Meehan and Bryde, 2015, Polat et al., 2017, De Giacomo et al., 2018).

Table III: Mechanism for Improving Supply Chain Performance

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5.0 Discussion

The findings revealed how top construction-contracting firms in Ireland had developed strategies for integrating sustainability practice into their supply chain network. Developing long-term relationships and supplier's development mechanisms are the main strategies adopted. The level of trust, high knowledge of the construction process, and commitment are some of the factors identified in enhancing the long-term relationship between a supply chain and the main contractor. These findings agree with earlier studies that successful sustainable procurement is characterised as collaborative and interdisciplinary (Riley et al., 2003, Loosemore and Lim, 2021). The ability of main construction contracting firms to develop such a long-term working relationship with their supply chains could be attributed to the firm's unique historical conditions or social complexity (Barney, 1991).

Nonetheless, the main contractor's organisation creates opportunities for new entrants. Such a strategy adopted by the main contracting firm explains their position as dominant players in promoting innovation and commitment (Stannack, 1996, Adetunji et al., 2008). These findings agree with an earlier study by Adetunji et al. (2008) that in diffusing sustainability into the supply chain network, the relationship is based on the extended structural dominance and power regime (school of thought B, figure 1). Another exciting finding was the early supply chain engagement at the project's planning stage. Early engagement could be beneficial in driving sustainability when the governance mechanism is relational rather than transactional (Lin and Tseng, 2016, Govindan et al., 2016). Despite the benefits derived from the early engagement, the study revealed that such an approach was not necessarily aimed at driving sustainability practice.

Additional findings revealed that supplier's development is mainly carried out at the project level. A possible explanation for this might be that construction-contracting firms are mindful of investing their resources in supply chain organisations. Investing in their supply chain at the organisational level in driving sustainability might be at odds with retaining their competitive advantage in pursuit of profit (Glover et al., 2014). Nevertheless, Barney (1991) explained that some strategies require a particular mix of physical capital, human capital, and organisational resources to implement. Also of importance from the findings is the benefits derived from social learning. Sparrevik et al.(2018) explained that social learning enables incorporating trust elements and identifying the contracts' benefits by the various actors. Despite some of the limitations in the study, it will be rewarding to explore further using a different theoretical lens. Theories such as the transaction cost economics theory (Williamson, 1975) and diffusion of innovation theory (Rogers, 2010) to understand the implication of large construction-contracting firms investing in the organisational structure of supply chains.

6.0 Conclusion

The study unveils the various strategies adopted by the top construction-contracting firms in Ireland in integrating sustainability practices into their supply chain network. Understanding these strategies is essential because major contracting firms take responsibility for their supply chain behaviour and products (Sancha et al., 2016, Wu and Barnes, 2016, Lin and Tseng, 2016). The study provided practical evidence that will guide other construction-contracting firms to develop strategies in driving sustainable construction practice. A firm historical condition and social complexity determine their long-term relationships with their supply chain. Also, the type and nature of the project and the size of the supply chain organisation are key factors that influence a long-term relationship. However, despite the long years of a business relationship between the supply chain organisation and that of the main contractor, findings revealed that the main contractor always creates opportunities for new entrants. Further findings revealed that the top construction-contracting firms utilise different mechanisms to improve their supply chains' performance. Also, social learning through informal communication was beneficial in developing trust and collaboration.

Therefore, the implication from the findings suggests that for construction-contracting firms in the Republic of Ireland to positively compete and respond to the industry challenges and their client's needs, they would have to develop and implement various strategies. Such strategies will see them collaborating closely with their supply chain in disclosing their sustainability performance. Disclosing their sustainability performance could positively contribute towards meeting the implementation of the United Nations 2030 SDGs goals and the climate emergency target. Nevertheless, this study further contributes to knowledge by demonstrating that long-term relationships impact sustainability performance less. Instead, relatively close collaboration and trust drive the sustainability performance.

Notwithstanding the contribution made by the study, some limitations in terms of scope are noted. The questionnaire survey focuses on only the main contractor's organisation in the Republic of Ireland, making the responses biased. Further study will add to the body of knowledge if the scope in the future will consider supply chain organisations' opinions and increasing the number of main contractor's organisations.

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Integrating sustainability practices into the Irish construction supply chain: Main Contractors' perspective

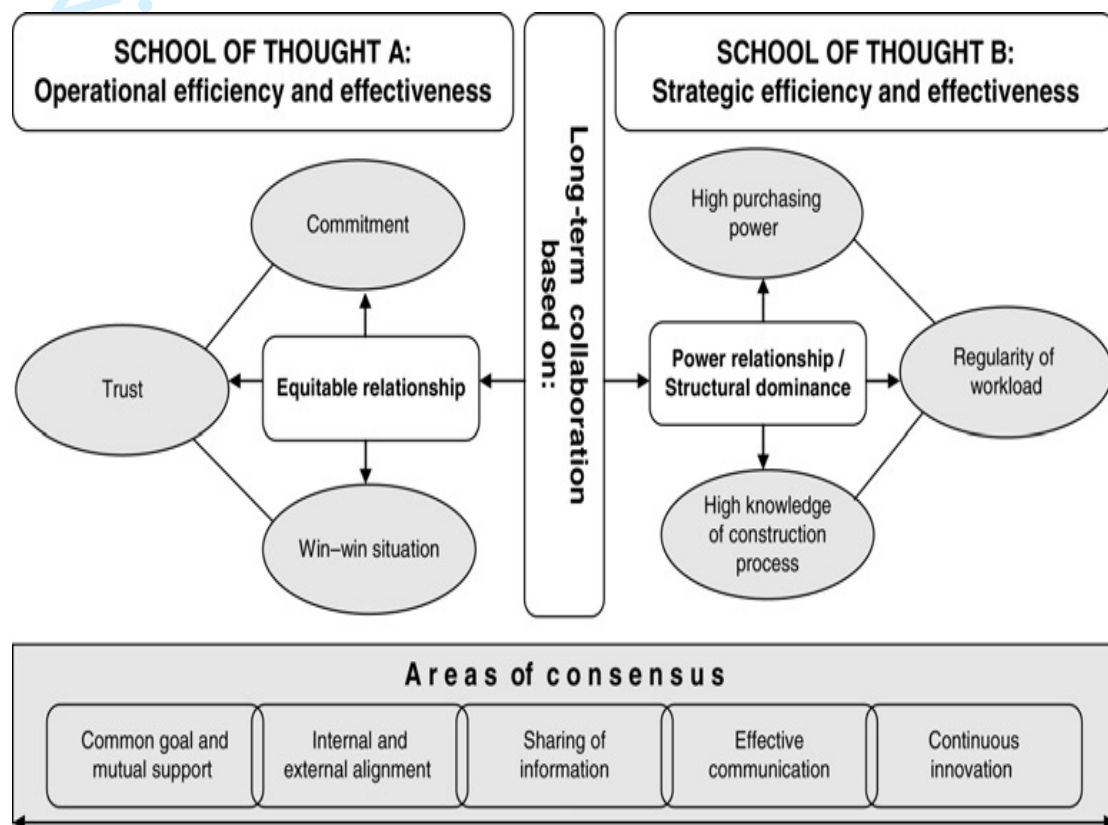


Figure 1: The Two School of Thoughts for Achieving SCM (Adetunji et al., 2008)

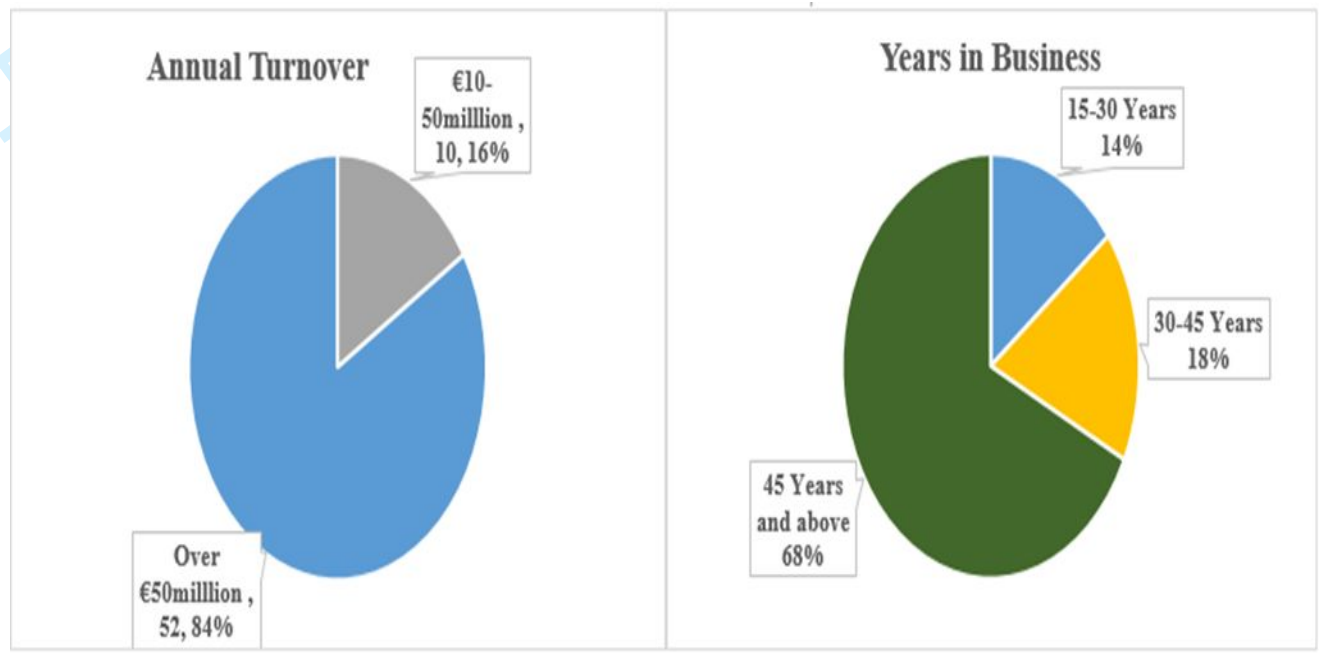


Figure 2: Based on Annual Turn-over and Years in Business

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Project and Asset Management

Integrating sustainability practices into the Irish construction supply chain: Main Contractors' perspective

Table I: Role in the Organisation

Role	Frequency	Percentage
Managing Director	7	11%
Regional Director	7	11%
Director	7	11%
Commercial Manager	11	18%
Contracts Manager	10	16%
Sustainability Manager	1	2%
Strategy and Business Development Manager	1	2%
Procurement Manager	4	6%
Chief Estimator	4	6%
Others	10	16%
Total	62	100%

Table II Long-term Relationship with Supply Chains

S/N	Factors	Very High	High	Moderately High	Low	Not at all	Total respondents (N)	Weighted total	RII	Rank
1	Trust	42	18	2			62	288	0.929	1
2	High Knowledge of construction process	33	27	2			62	279	0.900	2
3	Level of commitment	31	29	2			62	277	0.894	3
4	A common goal and mutual support	25	29	8			62	265	0.855	4
5	Effective communication	23	33	6			62	265	0.855	4
6	Win-win situation	18	37	6	1		62	258	0.832	6
7	High purchasing power	21	27	14			62	255	0.823	7
8	Continuous innovation	14	37	9	2		62	249	0.803	8
9	Regularity of workload	12	34	16			62	244	0.787	9
10	Sharing of information	12	30	20			62	240	0.774	10
11	Internal and External alignment (through coordinated teams and cross-functional integration)	7	37	18			62	237	0.765	11

Table III: Mechanism for Improving Supply Chain Performance

Factors	Always	Very Often	Sometimes	Rarely	Never	Total respondents (N)	Weighted total	RII	Rank
Suppliers' assessment	13	31	14	3	1	62	238	0.768	1
Instigating competition amongst supply chains	10	23	17	10	2	62	215	0.694	2
Training of Supply chains members	4	14	30	13	1	62	193	0.623	3
Providing incentives for improved performance	1	8	35	14	4	62	174	0.561	4
Helping in organisational restructuring/ Investing resources in supply chain organisation	2	11	23	20	6	62	169	0.545	5

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