Research Article

Journal of Management Education
1–48

DOI: 10.1177/10525629251399886
journals.sagepub.com/home/jme


Examining Grand Challenges Through a Systems Thinking Lens: An Innovative Multi-Day Case Study Approach to Exploring Sustainability

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Abstract

In this article, we present an innovative 4-day intensive course which responds to the urgent need to explore issues related to the grand challenges of our time. The course was iteratively designed and developed over a 14-year period. It is designed to utilize systems thinking ideas within a management education domain to deepen student capabilities of collaboratively dealing with complex socio-ecological challenges. The aim is to encourage development of practical capabilities to transform multifaceted problems.

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This article is part of the Special Issue, "Preparing Leaders to Tackle Grand Challenges."

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To provide evidence for the efficacy of this approach, we draw learning themes from student feedback and faculty members' reflections from the most recent iteration of the course. We highlight three key student learning themes related to a holistic systems thinking approach to understanding the complex issues within a selected sustainability issue in one of today's grand challenges: (1) interconnectedness, (2) conceptual modeling as a basis for intervention, and (3) dialogic and participatory action planning. The information and materials we share are those used in recent iterations of this course, which focused on reducing poverty through an analysis of issues related to informal settlements.

Keywords
grand challenges, systems thinking, experiential learning, active learning, role play, simulation

Introduction

As management educators, we are called to urgently embed and explore issues related to grand challenges in our courses through socio-ecological (Colombo et al., 2024; George et al., 2016; Kiss et al., 2024; Mailhot & Lachapelle, 2024) and social science lenses (Lindebaum, 2024). Grand challenges are complex large-scale problems that are bigger than normal research goals, and are often global in scale, yet offer the hope of ultimate resolution (Gould, 2010). Thus, they are a more positive way of tackling what used to be labeled *wicked problems*. Many of the grand challenges are found in the United Nations Sustainable Development Goals (UN SDGs; Macht et al., 2020) as pointed out by management researchers (George et al., 2016; Ika & Munro, 2022). Although we acknowledge our responsibility for preparing future business leaders to address these issues, many of us struggle with navigating the interdisciplinary complexities of developing student competencies in this area (Shantz et al., 2023).

Recent empirical and theoretical work has examined the multiple underlying reasons for this struggle. Shantz et al. (2023) highlight three barriers management educators face in understanding and exploring grand challenges: (1) stakeholder considerations, (2) radical uncertainty, and (3) complex, evaluative moral and values-based framing. Similarly, Gatzweiler et al. (2022) present three cognitive barriers to addressing grand challenges in teaching, including cognitive overload (which limits one's ability to learn, mobilize, and act), emotional detachment (which happens when a problem is so

abstract, distant, or large that any form of action appears futile), and organizational obliviousness (a belief that the problem will go away on its own or is overstated/exaggerated). Finally, in a review of management research on four primary grand challenges, Brammer et al. (2019) use a matrix framework to capture the complex dynamics of grand challenges over time, from challenges faced today to those that will be faced by future generations (see Figure 1). They use wildfires as an illustrative example; wildfires are often local challenges but can quickly emerge as a societal challenge of climate change, if the underlying causes for their emergence are not addressed.

As organizations spread and collaborate over geographical boundaries and cultures, they become "a melting-pot, [of] complexity and dynamism" (Chowdhury, 2019, p. 10), and a more connected approach to thinking is needed, moving away from early management research which favored reductionist approaches. While organizations have realized the value of working across silos to deal with complexity, Rosenberg (2023) argues that educational institutions are unable to follow suit because of their structure, which prevents them from teaching across disciplines due to the "force of economics and demographics" (p. xii) and the resultant constraints faced by "college governance and culture" (p. xii) to change. This is supported by Brammer et al. (2019) who note that factors such as financial success and ranking of universities based on academic excellence support an instrumentalist view, which is not traditionally aligned with a focus on addressing grand challenges (p. 10).

Despite these impediments, Chowdhury (2019) argues for a systems thinking core capability in research and teaching to help managers "learn about and harness the various systems methodologies, methods and models, so that they can best be used by managers to respond to the complexity, turbulence and heterogeneity of the problem situations they face today" (Jackson, 2006, p. 653). Jackson (2019) traces how Critical Systems Thinking (CST) evolved from early systems approaches that could deal with easily defined problem situations but were found wanting when problem situations increased in complexity due to different stakeholder perspectives. This led to the development of approaches such as Soft Systems Methodology (SSM; Checkland, 1981). Soon it became clear that stakeholder empowerment was necessary in coercive contexts. This prompted the development of additional approaches such as Critical Systems Heuristics (CSH; Ulrich, 1987) and CST (Flood & Jackson, 1991). As a foundation in what this content includes, utilizing CST requires: (1) critical awareness (understanding the strengths and weaknesses of different systems approaches), (2) social awareness (identifying the impact of societal and organizational pressures in designing interventions in a specific context), (3) pluralism of methods (complex problem

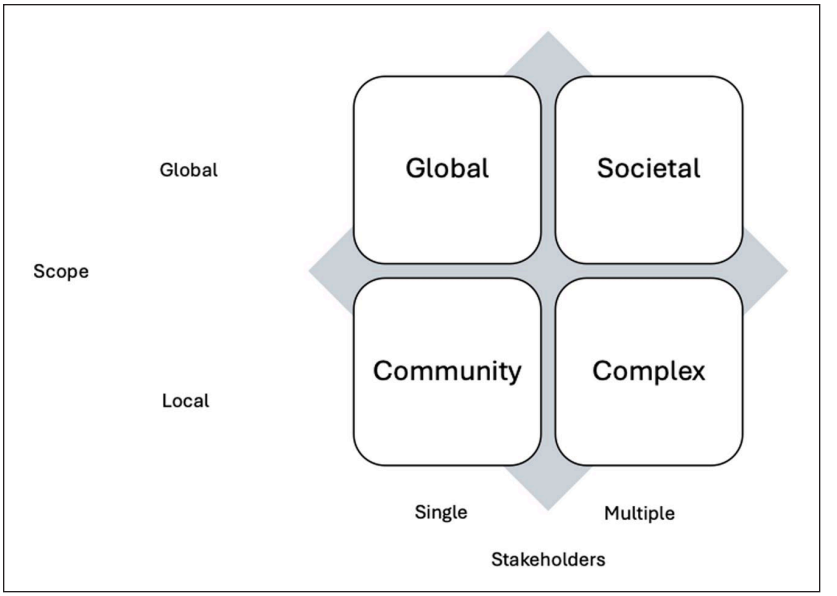

Figure 1. Grand challenges typology (based on Brammer et al., 2019, p. 527).

solving requires a multimethodological approach), (4) pluralism of theories (understanding which theories apply in specific contexts), and (5) emancipation (the improvement in the quality of life through human empowerment; Jackson, 2003, pp. 16–17).

The instructional innovation shared in this article is built upon the belief that as management educators we need to incorporate a CST stance into our practices. It addresses the issue of *how* we can innovatively encourage future leaders to engage in systems thinking approaches as they tackle societal grand challenges. Our key contribution is the combination and application of several systems methodologies within a 4-day intensive course, including case studies, simulations, and role play, to build interdisciplinary competencies in addressing a selected societal grand challenge that is linked to UN SDGs (Aboulnaga et al., 2021; Wall et al., 2024). This pedagogical approach aims to provide students with immersive, yet contextually specific, experiences along with pragmatic experimentation and the opportunity for critical reflection (see Chen & Martin, 2015; Galloway, 2024; Morris, 2019 for recent examples). The exercises used were designed to enable students examine the interconnectedness of conflicting issues within a societal challenge, reaching accommodation through conceptual modeling and dialogical action

planning. Through the application of systems thinking tools, students learn to employ a holistic approach to problem structuring in addressing complex issues required for responsible management education and learning (Laasch et al., 2023; Wall, Österlind & Hallgren, 2025).

The 14-Year Journey Underlying This Instructional Innovation

This course was developed by two management educators at an Australian university in 2009 as part of a Master of Professional Management (MPM) degree. They were researching ways in which they could teach more engaging and authentic project management courses. One of their significant realizations was that practicing project managers needed to develop more innovative ways to address the uncertainties and ambiguities found in contemporary projects. Creating ways for students to learn how to contextualize and embed projects within the realities of complex societal challenges was the driver for the 14-year development and design of the instructional innovation. With a course design utilizing an authentic project management timeline, the management educators needed to select experiential exercise formats that would stimulate learning in complex topic areas. In particular, they were interested in teaching project managers how to use systems approaches to address the increasing complexity in projects (Bakhshi et al., 2016; Geraldi et al., 2011).

Over time, the course has developed further to address the needs and knowledge levels of a multidisciplinary cohort. Its content and mode of delivery has been adjusted to address the needs of a general manager working across multiple disciplines. Initially, the educators used some systems methodologies from Jackson's (2006) System of Systems Methodology (SoSM) framework. However, over the years, more methodologies have been added to cater to the mix of students in the course and the increased complexity of situations used as case studies (see Figure 2). This framework suggests a variety of systems methodologies that are applicable in different situations.

In unitary situations, participants share values and beliefs that help them to work toward common goals. When participants share such a common purpose, hard systems thinking is useful to address simple and complex problems. These approaches, such as Operations Research, Systems Analysis, and Systems Engineering, were developed by systems practitioners during the Second World War and applied to military logistics problems. Later development in hard systems thinking included system dynamics (Sterman, 2000) and the Viable Systems Model (VSM; Beer, 1984), influenced by cybernetics. In contrast, participants in pluralist situations have different values or beliefs but can find a way forward through debate and deliberation. In such

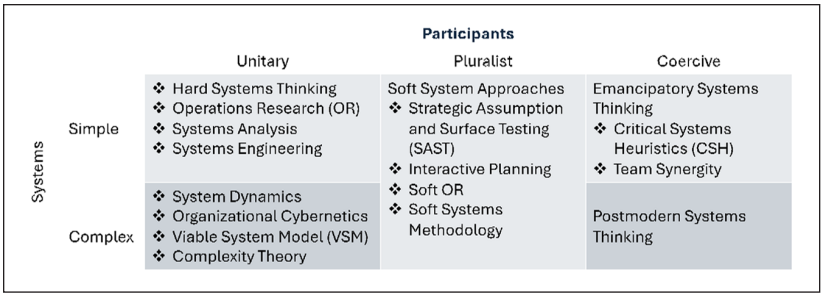

Figure 2. System of systems methodologies (adapted from Jackson, 2006, p. 24).

situations, SSM (Checkland, 1981) is more useful than hard systems approaches. However, in coercive situations where participants have few interests in common and power, politics, and coercion play a constraining role, approaches like CSH (Ulrich, 1987) are needed.

As Jackson (2019, p. 512) notes, "given the complexity, turbulence, diversity of most problem situations confronting decision makers in the 21st century, it is hardly surprising that no one systems approach can supply the answer." As such, our instructional innovation has a CST foundation, showcasing the criticality of exploring the rich variety of systems methodologies, methods, and models that can be used in combination to promote more successful interventions in complex organizational and social problem situations. The current iteration of the instructional innovation includes the following systems methodologies using a CST framework:

- System Dynamics—"hard" tools such as Causal Loop Diagrams (CLD) and Stock and Flow Diagrams (SFD) which help predict a system's behavior (Unitary and Complex in Figure 2; e.g., Sterman, 2000).
- Soft Systems Methodology (SSM)—"soft" tools which help define, structure and design interventions in complex settings (Pluralist and Simple/Complex in Figure 2; e.g., Checkland & Poulter, 2007).
- Viable System Model (VSM)—diagnostic tools used to help diagnose a system for its viability in various applications such as businesses, governments, charitable organizations and families (Unitary and Complex in Figure 2; e.g., Espejo & Harnden, 1990).
- Critical Systems Heuristics (CSH)—"coercive" tools to help define boundaries and stakeholders relevant to those boundaries (Coercive and Simple in Figure 2; e.g., Midgley & Rajagopalan, 2020; Ulrich, 1987).

Alongside the various systems methodologies, a role-play was designed so that students could become emotionally involved with the topic (also see Fries & Wall, 2023; Wall, Österlind, Lehtonen, et al., 2025, forthcoming). The management educators also played roles which helped lessen participant inhibition and encourage higher levels of learning. By switching between different roles such as project manager, systems thinker, and facilitator, the management educators could further illustrate course concepts, encourage interaction, and keep the focus on design development and creative thinking. The intensive format, designed to mimic the realities of managing projects within compressed timelines, evolved over 14 years based on student feedback, faculty reflections on the feedback, and the management educators' own thoughts on what worked well and what had to be improved. The evolution was also influenced by the diverse cohorts of students who registered on the course. For example, in the latest offering we had nearly an even split of Master of Project Management, Master of Business Administration, and Master/advanced diploma students from other disciplines.

We have detailed the evolution of the course to its present state in Appendix A, including a summary of dates when significant changes occurred and some challenges we encountered.

Outlining the Systems Thinking for Managers Course

The course introduces ways for managers to examine hard, soft, and coercive systems thinking approaches to develop an understanding of the interrelationships between various elements of a project and the environment in which they are executed. It is designed to equip students with systems diagnosis, systems thinking, and modeling tools needed to analyze issues that arise in projects and design ways to maintain internal stability within a project while increasing its adaptive capability to deal with factors beyond its control in its external environment.

The pedagogical approaches used in the course include lectures on key concepts (discussed below), guest lectures, and active learning opportunities through group work and in-class student presentations. Flipped learning strategies are employed, including readings and multimedia content, which students use to prepare for the course. A pre-course assignment helps students assess their levels of understanding and prepare for the large amount of information that will be processed through the interactive exercises embedded in the course. During the intensive course, students work in groups and play the role of stakeholders in a complex situation. A post-course assignment allows students to reflect on and apply what they have learned to a situation within their own organizations. As such, the key course learning outcomes are:

1. Demonstrate a capacity to analyze and communicate a way forward to improve a situation at work by applying systems thinking.
2. Use systems thinking and systems diagnosis tools to address issues arising in projects.
3. Demonstrate a systemic thinking approach to practice.

Target Audience. The course has evolved to become an MBA elective, attracting postgraduate students and executives from health, architecture, urban planning, information systems, property development, and a variety of business disciplines. As the course content is easily adaptable, we accommodated a mixture of students from across disciplines to increase the richness of the discussions.

Teaching Modality, Class Size, and Supplies. The course is best delivered either face-to-face or online. Hybrid and asynchronous modalities are not recommended. The class size can vary between 25 and 50 students; we recommend 35 to 40 students so the instructor can create between 7 and 10 groups. The case chosen will determine the number of groups; a group size of five (ideal) to eight students provides adequate opportunities for each student to contribute. We suggest the groups are formed prior to the course based on the profiles posted, the complex issue to be addressed, and stakeholder roles to be chosen.

The classroom space should be reasonably large and have audiovisual facilities, moveable desks, whiteboards, or flipcharts, and at least one long wall on which to post drawings. Instructors should have a large supply of colored markers, large sticky notes, and red and green sticky dots. Large poster-style sticky notes are used during the rich picture sessions, where students draw thoughts and ideas on them as part of the process. The red and green sticky dots are used for voting at the Town Hall Meeting (see details later on); each student will need three green dots and one red dot. Typically, groups work at their own table and have a board or a wall to draw on or post their work. Some space at the back of the classroom is useful for holding the Town Hall Meeting, posting the ideas presented by each group, and allowing the voting to take place. We recommend that a bell be taken to the Town Hall Meeting, so that the chairperson (the instructor) can maintain order.

Timeline. Most of the instruction occurs during the 4-day course. Students should be given 3 weeks to prepare the pre-course preparation and first assignment. Students have 4 to 5 weeks to submit the final post-course assignment.

Teaching Preparation. Those involved in teaching the course must be informed well in advance to ensure their availability. In the planning stages, the management educators should meet to review student feedback from the previous year to determine if any changes are needed to the content or delivery. They will also need to decide the main issue to be explored during the course, identify a prospective client, and agree on the dates for preparing and posting slides, reading lists, and assignments. We have found that having two management educators and one tutor is optimal for the intensive exercises and provides students with valuable access to different perspectives and advice, similar to what they might encounter in a real-world situation.

The Flow of the Course

Figure 3 provides an overview of the content and flow of the course.

Students must complete Assignment 1 prior to attending the course (see example in Appendix B). Depending on the case chosen, Assignment 1 requires students to draw either a CLD, a system diagram, or an influence diagram. These diagrams are useful in helping students to think more systemically. Reading materials are listed on the course learning management system or LMS (e.g., Canvas and Brightspace) and include a link for a book (e.g., Ison, 2001) that is useful for students who are unfamiliar with the diagrams used in systems thinking. Students are also provided with links to articles that explain how such diagrams are created using a systems view of an organization (e.g., Lane & Morris, 2001) as shown in Appendix B.

Case Context and Preparation

As noted earlier, the complex problem chosen for the course should be identified roughly six months prior and the management educators must locate a client willing to participate and provide input to the materials needed by the students to complete Assignment 1. The topic should be a contemporary complex problem that has multiple stakeholders with different views.

To be able to participate fully, students should have some familiarity with the issue. There should be sufficient information publicly available or posted on the course LMS. We find two or three meetings with the prospective client are sufficient to comprehend the complexities of the issue, as well as for gathering the preparatory materials for students. The management educators and the client should decide who the prominent stakeholders are so that students can choose their roles. Students are asked to rank the stakeholder roles they would like to assume during the group work. This ranking will create options for the management educators to form groups which are the optimal

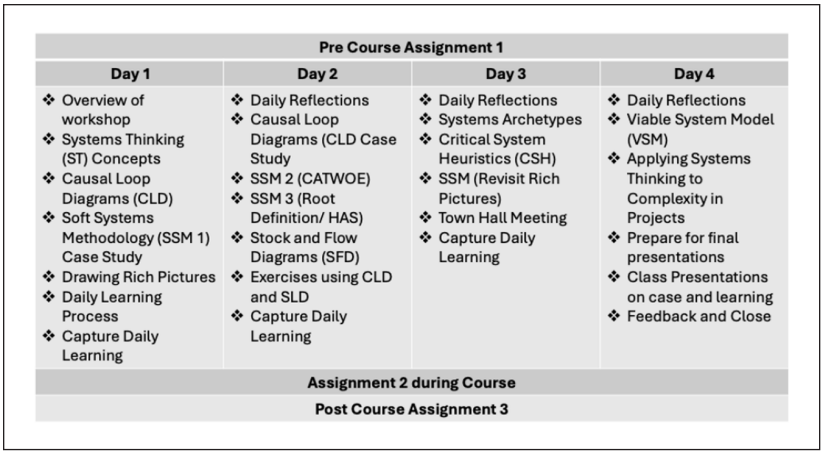

Figure 3. Overview of the 4-day course and assignments.

size and diverse in terms of student experience and demographics. The first assignment works best if the students start "in their role" as they work to address the issue.

As an example of topic selection, it was decided that informal settlements in the context of urban governance would be ideal for the 2023 course. This was in light of UN-Habitat (2022) reporting that "1.6 billion people or 20 per cent of the world's population live in inadequate housing, of which one billion reside in slums and informal settlements" (p. xvi). One of the management educators was familiar with the work of a recent PhD graduate on the impact of informal settlements on urban planning in the largest slum in India—Dharavi. The researcher agreed to be involved as a client. The client outlined the possible stakeholder roles for the course (see Appendix C for examples of roles from 3 years of projects) and suggested preparatory materials that students could use to become familiar with the issue. They also provided links to videos and articles they had published, and suggested some additional readings (see Appendix B).

Detailed Schedule

Figure 4 provides a visual of the general framework followed for the role-playing simulation. This visual, along with a brief description of models and processes to be used at each step, is posted on the LMS.

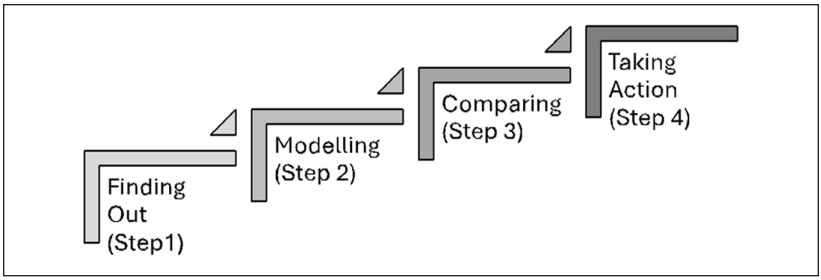

Figure 4. Simulation steps (adapted from Hindle, 2011).

a) Step 1, also called "Finding Out," requires you to start using Soft Systems Methodology (SSM). Students will draw Rich Pictures (SSM 1) to represent different stakeholder views.
b) Step 2 is the modeling stage. Here you complete, for your chosen role, Causal Loop Diagrams CLDs or Stock and Flow Diagrams (SFDs), Critical Systems Heuristics (CSH), SSM 2, and SSM 3. The CLDs and SFDs are used to explore interconnections, and CSH is used to ensure that no critical stakeholders are missing. SSM 2 is completed through the development of a CATWOE (Customer, Actors, Transformation, Worldview, Owner, and Environment). SSM 3 involves the development of a Root Definition for Transformation and a Human Activity Systems (HAS) model.
c) Step 3—Comparing, evaluates the transformation proposed using the 3 E's—Efficacy, Efficiency, and Effectiveness.
d) Step 4—"Taking Action" is the final step. Here students participate in a Town Hall Meeting and create a Viable Systems Model (VSM). This is where stakeholder groups begin moving toward accommodation and propose innovative ideas and design a viable organization to implement the selected action and set up a governance structure.

Simulation (Role-Play) Instructions

The simulation begins immediately after the client has made their Day 1 presentation and continues through to Day 4 when the VSM is completed. For 2023, the following information was posted on the LMS along with the case context, prework materials, and Assignment 1 instructions:

Introduction. The course is designed to use SSM as an overarching methodology for addressing the societal challenge. During the course other systems methodologies including systems dynamics and CSH, are used to establish a high-level scope to explore transformations to improve the situation agreed upon by the students taking on roles as key stakeholders. Toward the end of the course a collaborative process called Town Hall Meeting is used to bring stakeholders together to move toward some innovative ideas to further advance. VSM is then used as a methodology to create a well-designed organization to carry out the selected solutions.

Case Context. Originally a fishing village in Mumbai, Maharashtra, India, Dharavi became a "human dumping ground" (Weinstein, 2014, p. 25) as migrants and refugees moved in as informal settlers and, increasingly, the site of the region's polluting industries; earning the title of Asia's largest slum by the 1980s. Contributing to the state's economy through small-scale manufacturing for leather tanning, textiles and pottery, that were shunned by city dwellers, Dharavi's population gained political influence in the state through the labor unions. However, despite several promises made by politicians, efforts to redevelop Dharavi were never realized. Today, several skyscrapers dwarf the slum's shelters, and the land occupied by Dharavi (about 2.4 km^2) is steadily growing in value. The slum is attracting the attention of private investors. Recently there has been an agreement between the government and the billionaire businessman Gautam Adani to convert the slum into urban real estate and relocate the slum dwellers (Dias & Patidar, 2023). The proposal to hand over the redevelopment of the area to a private entity is causing significant anxiety to Dharavi residents who are unsure about their future.

The following video by British designer and television presenter Kevin McCloud helps contextualize the case: https://www.youtube.com/watch?v=Im0tHRs9Bng.

Prework—First Assignment

To complete the assignment and understand the problem studied, students must read the articles, and newspaper reports on the LMS, as well as view the prescribed videos to which links are posted. The assignment requires students to develop a diagram related to a specific role.

Day 1: Systems Concepts and Rich Pictures

The importance of structuring a problem before finding a solution is emphasized (Mingers & Rosenhead, 2004). The course introduces students to

systems thinking concepts (such as boundary, emergence, and behavior over time) and CLDs. The essential elements of the SSM are reviewed in the context of the case. Student resources are made available on the LMS and include access to a textbook chapter on SSM and a suggested reading list with direct links to the library (see Appendix D).

After the client meets with the class, either in person or over Zoom, the management educators discuss the drawing of rich pictures (a tool used in SSM). They explain the characteristics of a good rich picture (Bell et al., 2016) and what makes a good rich picture and what does not (see Appendix E), and posts this information on the course LMS. Working in stakeholder groups, students draw their rich pictures. For a 2023 delivery of this workshop, these stakeholder groups represented the Local Leaders (of the informal settlement), Residents, Neighbors (of the informal settlement), and Urban Planners (including local government positions).

The management educators walk around while the pictures are drawn to coach students on what elements are missing. Student groups approach the exercise in different ways. Some use sticky notes to identify what should go in the pictures and then draw them, some start spontaneously drawing the pictures as a group on the board or flipchart, and others sketch an initial picture and redraw it later. Once the rich pictures are completed, each group presents their picture to the other groups so that the groups can understand each other's perspectives of the situation. At the end of each day, we use concept mapping techniques to help students to capture their learning; this process helps the groups with their day 4 presentations.

Day 2: Applying Systems Dynamic and Critical Systems Thinking

Each day begins with reflection, with each group asked to specify what was learned the previous day using three categories—Data, Information, and Knowledge. One of the groups is asked to share their reflections and we then use a poll (e.g., Mentimeter, https://www.mentimeter.com/) to identify new learnings or insights. These new insights may be added to the outputs a group produced the previous day.

Following these reflections, students are asked to identify some causal relationships from the rich pictures drawn on Day 1. This helps them to think about the important issues that must be addressed to help change the situation. They also learn how to use a software called Vensim (García, 2020) to draw CLDs and SFDs. The management educators take additional effort to accommodate the needs of international students from non-English speaking

backgrounds—spending time to explain concepts and encouraging them to speak/present to increase their confidence. There were 15 such students out of 22 international students in the 2023 student cohort.

To prepare students for the next stage, we give a short lecture on roles and values and the impact of power and politics. These dynamics are useful to consider during an SSM intervention. The lecture includes a brief overview of CSH, the concept of boundary critique, and an explanation of the 12 critical questions that must be asked (Ulrich, 1987) to identify critical stakeholders in the situation. The lecture concludes with a review of CATWOE; introducing the terms, their meaning, and a few examples (Burge, 2015; Checkland & Poulter, 2007).

The groups are then asked to prepare a CATWOE diagram to plan a transformation that the stakeholder group desires. After the CATWOEs are completed, we discuss and provide examples of the characteristics of a good Root Definition (Bergvall-Kåreborn et al., 2004; Burge, 2015; Checkland & Poulter, 2007). The groups then develop a Root Definition for their desired transformation. Using their CATWOE and Root Definition, the stakeholder groups can create a Human Activity System (HAS) visual to develop a high-level scope statement for their transformation (Checkland & Poulter, 2007).

Day 2 ends with a lesson capturing process similar to the one described for day 1.

Day 3: Moving Forward, the Town Hall Meeting

After debriefing the previous day's learnings, instructors review some typical archetypes identified by systems thinkers (see Senge, 1990). Groups are asked to identify if any of these are in the CLDs they developed (D. H. Kim & Anderson, 1998). The students are given time to revisit their own and other groups' SSM work in preparation for the Town Hall Meeting. Students are instructed to begin working together to propose innovative ideas that would help improve the situation presented by the client. We review how to prepare for and vote at the Town Hall Meeting. These instructions are posted on the LMS (Appendix E).

Day 4: Viable Systems Model and Group Presentations

Following the morning's daily reflections, instructors introduce the VSM (Beer, 1984). Groups are asked to create a VSM for the idea they liked best from the Town Hall Meeting. Developing a viable system requires students to think about how they might begin to set up a governance model for the transformation.

At the end of day 4, groups prepare a 20-min presentation on their learnings using the artefacts they had created over the 4 days (see Appendix E for presentation instructions). Instructors provide feedback once all groups have presented.

Post Work—Final Assignment

After the course, each student submits an assignment where they apply some of the tools, they learned to a challenge in an organization they are familiar with.

Evidence of Learning Impact

After obtaining an institutional ethics approval to analyze and share selected student data, the instructors were allowed to draw themes from student responses to two questions from the anonymous student feedback received in 2023 (what they learned and how it was useful in their work). In total, 59% of the students who attended the course provided feedback which exceeded the normal rate of feedback received in other courses on this Masters' program. These data were then integrated with the personal reflections of the two lead management educators for the 2023 course on student-created artifacts and their final presentation. Taken together, this data highlights that there are three key learning areas for students: (1) interconnectedness, (2) conceptual modeling as the basis for intervention, and (3) dialogic and participatory action planning.

Interconnectedness. A key theme of learning concerned the deep interconnectedness of issues that are immediately reflective of grand challenges, with a specific focus on informal settlements. It was clear that the students demonstrated their understanding of complex social systems that resist change despite several attempts by governments to reform them. It was observed during the presentations that students were surprised by structures that existed within settlements to help their survival, and that the complexity of informal settlements required layers of understanding. Students understood the interactions between actors (stakeholder groups) and how these created tensions because of "connections" and different, often competing, "perspectives." As an example, "neighbors" often blocked any attempts to provide basic services like water and sanitation to "residents" of the informal settlements. The students also demonstrated an understanding of the power balance between stakeholders that impacted issue resolutions.

The rich pictures below are examples of how students expressed their views within the stakeholder roles assigned to them. The challenge and

significance of this learning should not be underestimated; not only is this an important capability to develop in relation to the grand challenges, but it also remains a very difficult capability to develop given the imperatives of wider systems (see Avtar et al., 2019; Baffoe et al., 2021). As can be seen in the rich pictures shared here, students used visuals to convey understanding that is normally not expressed well in words. Students noted in their feedback that the use of the informal settlements as the focus created the right engagement during the course leading to interesting insights during the group work. The processes used also gave students the confidence to begin addressing real-life challenges they faced at work by enabling them to consider multiple perspectives and their interconnectedness. See Exhibits 0 to 4 for illustrations of student learning shared through rich picture creation and description.

Exhibit 0: Vignette of Case Study

A synopsis of the 2023 course offering. For more details refer to the section on "Simulation Instructions" in this article.

Challenges faced by Informal Settlements—
A Case Study of Dharavi (Largest Slum in Mumbai, India)

Dharavi

Toward the end of 2022, we (the management educator team), searched for a suitable societal challenge for the 2023 course. A member of the team was familiar with a researcher who had investigated the impact of "informal settlements" on urban planning and suggested this as a topic. Nearly 1.1 billion

people across the globe live in slums with poor sanitation services, lack of electricity, and safe drinking water, often under the constant threat of eviction. We approached the researcher who had investigated and researched the impact of informal settlements on urban planning globally (Chatterjee, 2019). The researcher agreed to act as a client in the course.

The researcher met with us via Zoom to scope the issue, identify key stakeholders for the role-play, to curate a suitable reading list, and develop the pre-course student assignment. In this instance, there were four stakeholder groups identified—residents, neighbors (of informal settlements), local leaders (inside the slum who wielded informal power), and urban planners. Identification of the roles was important as, prior to the course starting, the students would select the roles that they would like to play.

In early 2023, we created a Learning Management Site (LMS) in which we posted the requirements for the first assignment, with readings, videos, and books about Dharavi, and information on how to create an influence diagram (Ison, 2001; Lane & Morris, 2001). We also included the course slides and the daily reading list on the LMS (see Appendix D for the daily reading list explaining all the tools). As is typical on day 1, the team introduced themselves, provided a course overview, and explained the activities over the 4-day course.

Day 1—Following an introduction to systems thinking concepts and causal loop diagrams (Kim, 2016a), students were given a short overview of Soft Systems Methodology (SSM; Checkland & Poulter, 2007) and its four simulation steps—Finding out, Modeling, Comparing, and Acting. For the "Finding Out", we explained how rich pictures can help participants visualize the "problematical situation" (term used by Checkland, 1981) from the viewpoint of the stakeholder group they represent. Students were also given guidance on how to draw rich pictures, with some examples (Bell, 2016). The client joined the class using on Zoom and presented the situation in all its complexity. The students then drew rich pictures on whiteboards or flipcharts (see Exhibits 1–4).

Next, the students walked around the classroom to look at each other's pictures. Each team presented highlights from their rich pictures and the other teams were encouraged to ask questions. We actively encouraged more critical thought by asking questions. The walkabouts help to achieve what Checkland (1981) calls "accommodation" of views. It is important to explain that accommodation is not a compromise but provides a more collaborative way to transform the situation. In short, this process helped the teams to develop a common understanding of stakeholder issues and build teamwork. The team then explained a daily learning process to be carried out at the end of days 1, 2, and 3.

On days 2 to 4 a daily reflection exercise, incorporating questions on a polling tool called Mentimeter (https://www.mentimeter.com/), was used to reflect on what the teams had learned the previous day. On day 2 teams were asked to revisit their rich pictures to identify any causal loops that could point

to actions for resolving some of the issues identified. After this, students worked in smaller groups with our management educator team and a tutor, who would guide them on how to draw casual loops properly, creating logical relationships between the variables they had identified.

Following the causal loop exercise students were introduced to two more analyses used in SSM that help encourage them to think more broadly while using the next set of tools. The first was for student teams to develop a model to identify a desirable transformation that could help the stakeholder group to make a change in informal settlements considering different stakeholder views. This was done by drawing a diagram called CATWOE (Customer, Actor, Worldview, Owner, and Environment) and a T—a transformation—to improve the situation. The specific meanings of each of the CATWOE (Checkland, 1981) terms was carefully explained so that the students could plan a practical transformation within their own stakeholder groups. The teams went on a walkabout again, visiting each other's work, asking questions and developed a better understanding of others' viewpoints. Exhibit 5 shows one of the CATWOEs and the Root Definition of the transformation which is the next step in the process. They were also cautioned that in real life it takes time to do these exercises as it requires detailed investigation to collect data.

Next, the teams were asked to develop a "Root Definition," which is similar to a mission statement to achieve the transformation, listing what will be achieved. We emphasized the importance of thinking about how all the elements of CATWOE play a role in the Root Definition and that stakeholder support is needed to move ahead within constraints posed by the environment. We also reminded students that the transformation should also align with the worldview of the stakeholder group. Additionally, at this point, we spent considerable time and effort in helping students get their Root Definition right by providing examples and a simple framework for a mission statement (Basden & Wood-Harper, 2006). Once the Root Definition was satisfactory, each team was asked to examine each other's mission statement and ask questions. This helped to revise the Root Definitions.

Day 3 started with daily reflections. The concept of systems archetypes was introduced to help the students identify some archetypes in the causal loops drawn on day 2. We explained Critical System Heuristics (CSH; Ulrich, 1987), which helped students to critique the boundary that they have created for their system of interest that may leave out some important stakeholders. The teams were then given some time to revisit their rich pictures, CATWOE, and Root Definitions to see if they had neglected anything after learning about CSH.

Once the teams had revisited their rich pictures, CATWOEs, and Root Definitions they were told that going forward, everyone needed to work

together to help the client. By this time, the whole class understood each other's views and the value of achieving "accommodation" of their views to work collaboratively.

Lastly, we created a "Town Hall" environment where students could discuss innovative ways to improve the situation. This space was located in an area away from where the teams had been working. We placed a table at the front of the Town Hall with one of us assigned the role of the mayor to manage the proceedings, and the other helped to facilitate the process. Specific instructions were provided on how the Town Hall process was expected to work. Each of the teams presented some of their innovative ideas that they had recorded on a flipchart, students were encouraged to ask questions and get clarifications on the ideas. Exhibit 6 shows some of the ideas.

The flipcharts were then posted on a wall so students could further gather around to discuss and debate the ideas. Before the voting started, we checked for similarities in ideas and grouped them together on one of the flipcharts. Each person who was participating was given three sticky green dots and one sticky red dot. The green dots were to be placed on the ideas the students thought had the most potential for addressing the challenges of informal settlements. They were allowed to post all three green dots on one idea or distribute them among a few ideas. Once the green dots were posted everyone was asked to stand back and see how the voting had been distributed. Then everyone was asked to post their red dot on the one idea that had the highest priority for them. Students were told to think about what was "feasible" and "desirable" (Step 3, Comparing) as well as easily achievable to create quick wins while selecting their idea. Once all the votes were cast everyone was asked to reflect on what happened and then present one or more of the ideas in their teams on how it could be implemented the next day (day 4). Two examples of ideas posted and voted on during this iteration of the course are included in Exhibits 6 and 7.

On day 4, students moved to the "Taking Action" step using both SSM and Viable System Model (VSM) to implement the innovative ideas they had agreed upon. The day started with reflections followed by an explanation of the VSM to help students design an organization for implementing their ideas. The VSM defines five subsystems from the board to operations to manage activities. Communication channels were also identified within the model. Students were then asked to choose one or two ideas from the ideas voted upon on day 3 to develop a viable system for an organization that could be set up to implement the transformation. Students were asked to develop a HAS or conceptual model (suggested by SSM) to lay out key steps needed to carry out the transformation. Student teams were then asked to develop a presentation to explain what they had learned from the course using the artefacts they had created. We then asked students to submit a final assignment to

explain how they would apply what they learned from the course to address a complex situation in an organization.

In Exhibit 1, created by the local leaders group, the red cross in the center depicts the adverse effects that dumping rubbish has on the health of informal settlers, culminating in hospitalizations. The conflict between residents and neighbors is represented as people fighting with an emotive word "violence."

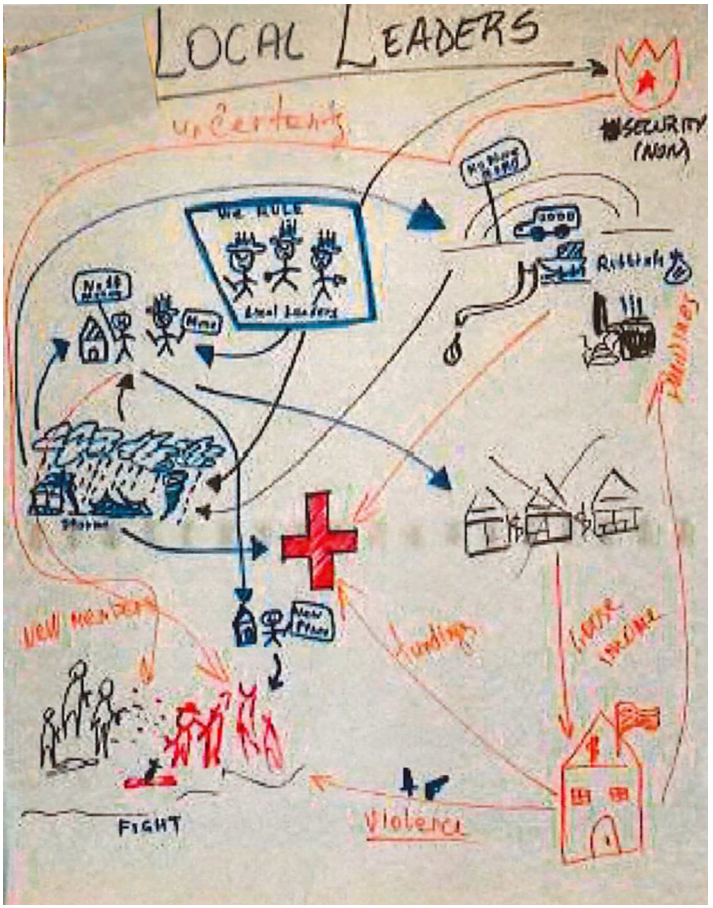

Exhibit 1. Local leaders rich picture—informal settlements.

In Exhibit 2, drawn by the resident group, there is also a red cross used to symbolize health issues. Here, they connect health to hygiene through representing the lack of toilets (with "X" denoting no toilets)—which is a major issue in slums. The tall buildings shown alongside the small, overcrowded house show the contrast between the city dwellers and dwellers in informal settlements—imagery often invoked to portray Dharavi (https://www.re-thinkingthefuture.com/rtf-fresh-perspectives/a1569-contrast-in-the-cityscapeof-mumbai/).

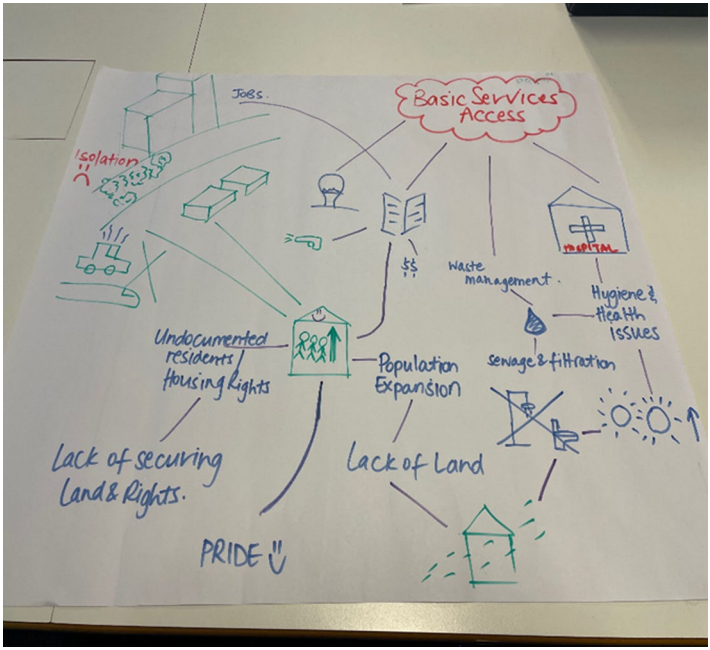

Exhibit 2. Residents rich picture—informal settlements.

The urban planners (Exhibit 3) use ticks and crosses to indicate the multiple issues impacting on the overall urban planning of the city, including the lack of essential facilities to support improved living standards in informal settlements, alongside population density and corruption. These interconnections prevent effective action despite several government reports.

Finally, in Exhibit 4, the neighbors share their annoyance with the crime, drugs, noise, safety issues, unpleasant views of the settlement and water pollution, all the while accepting the low-cost labor provided by the residents of the informal settlement.

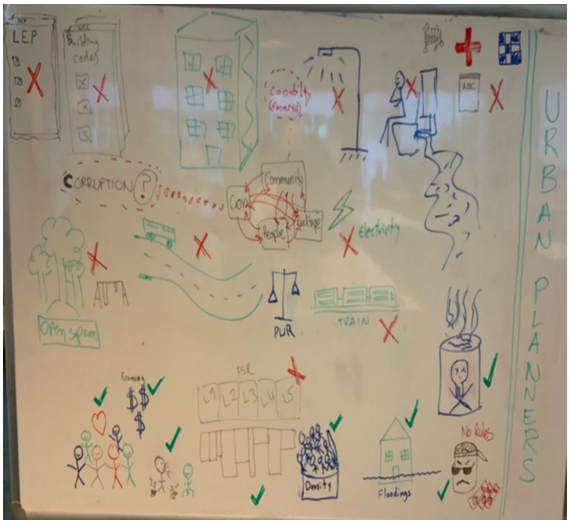

Exhibit 3. Urban planners rich picture—informal settlements.

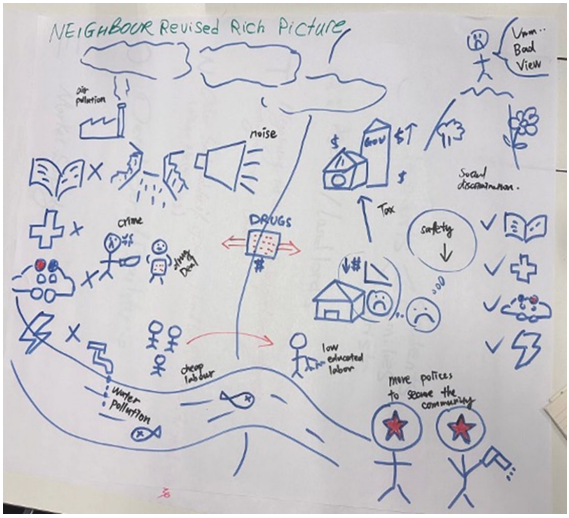

Exhibit 4. Neighbors rich picture—informal settlements.

Conceptual Modeling as a Basis for Intervention. A second learning theme is related to the use of conceptual modeling as a basis for intervention. Students demonstrate this learning through applying the tools of CATWOE, Root Definitions, and HAS to build a model for transformation. CATWOE, presented in Exhibit 5, shows a collaborative articulation of key stakeholder perspectives (or worldview); the Root Definition reflects the conceptual world; and the HAS provides the conceptual basis on which to compare and contrast with the real world. Students are asked to draw their CATWOEs by starting with the desired transformation, "T", based on their worldview or "W." They are asked to express the transformation of moving from the current problematic state to a new improved state from the perspective of their assigned stakeholder role. This group identified the importance of rubbish disposal to the settlement and looked for ways to achieve this by working with identified stakeholders. The worldview of the local leaders (Exhibit 5) shows their concern with environmental damage caused by pollution in and around the settlements.

The management educators have observed that students often struggle in developing a clear Root Definition (or Mission Statement) that describes the transformation they wish to accomplish. Jackson and Checkland (2000, p. S27) advise that "greater specificity [in a Root Definition) leads to a more useful model." To that end, management educators try to assist students in developing a more complete Root Definition by encouraging them to consider the views of the Owner, those impacted by the improved system (e.g., users). Students are also encouraged to reflect on the stakeholders they identified, their CATWOE analysis, and which actors would be mobilized to carry out the transformation. In this instance, the expectation is that the local government could step in to prevent the transformation; equally, the customers (or beneficiaries) could support or oppose the transformation. Exhibit 5 shows a particularly good Root Definition developed by the local leaders group.

Dialogic and Participatory Action Planning. The final student learning activity provides a basis on which to translate analyses into real-world action. Here, students act from oppositional positions and as a collective. They translate different stakeholder perspectives into options and a practical way forward. To generate commitment from different stakeholder groups, students used participatory voting on possible solutions to waste management (see Exhibits 6 and 7). This helped them to narrow down the options to a single innovative idea to be presented and potentially pursued. Before voting, students are reminded to consider both "feasibility" and "desirability" of the suggested solutions. As key SSM concepts, feasibility and desirability ensure that solutions are achievable and have stakeholder support.

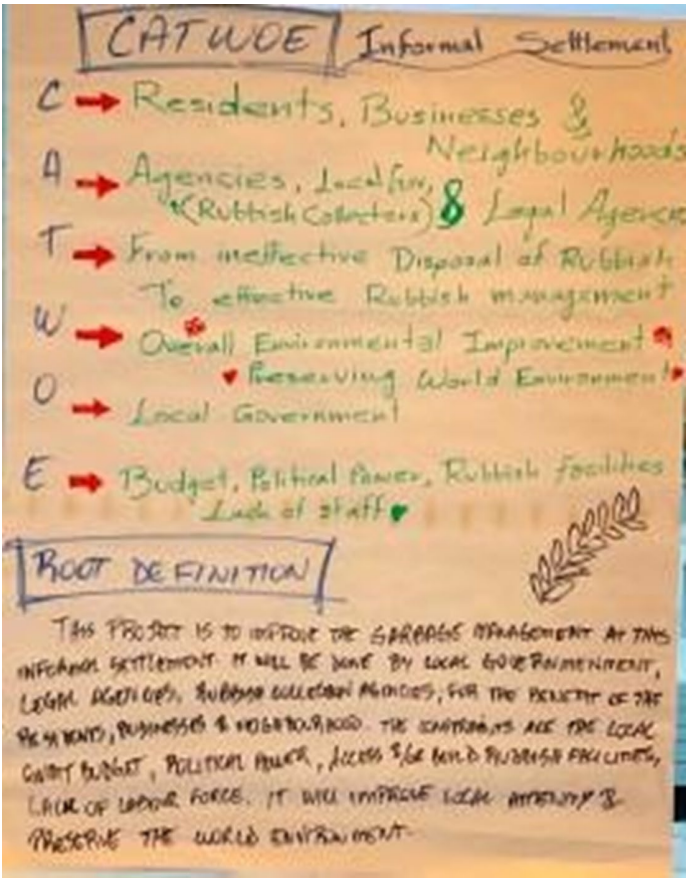

Exhibit 5. Local leaders CATWOE and root definition—informal settlement.
Root Definition—This Project is to improve the garbage management at this informal settlement. It will be done by local government and legal agencies for the benefit of the residents, business, and neighborhood. The constraints are the local government, political power, access to, and/or building rubbish facilities, lack of labour force. It will improve local amenities and preserve the world environment.

In Exhibit 6, both recycling and landfill solutions received more red votes, indicating stakeholder commitment. The recycle solution could be achieved through education. The landfill alternative was framed using a business case, which proposed that land could be reclaimed for housing and thus draw

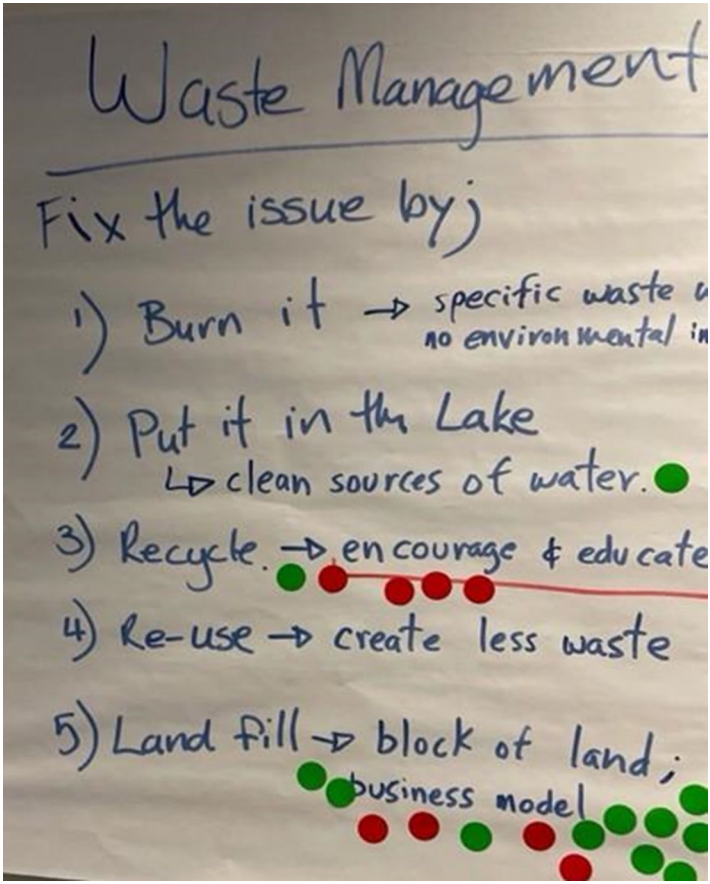

Exhibit 6. Student group ideas presented and voted on at Town Hall Meeting (Group A).

investors to Mumbai (perhaps this proposal reflected the predominance of MBA students in the class). In Exhibit 7, different waste management solutions were voted on, with recycling and reuse being the most popular. These votes supported incentivizing recycling and reusing waste to create building materials. In all examples, the options were voted on by the four stakeholder

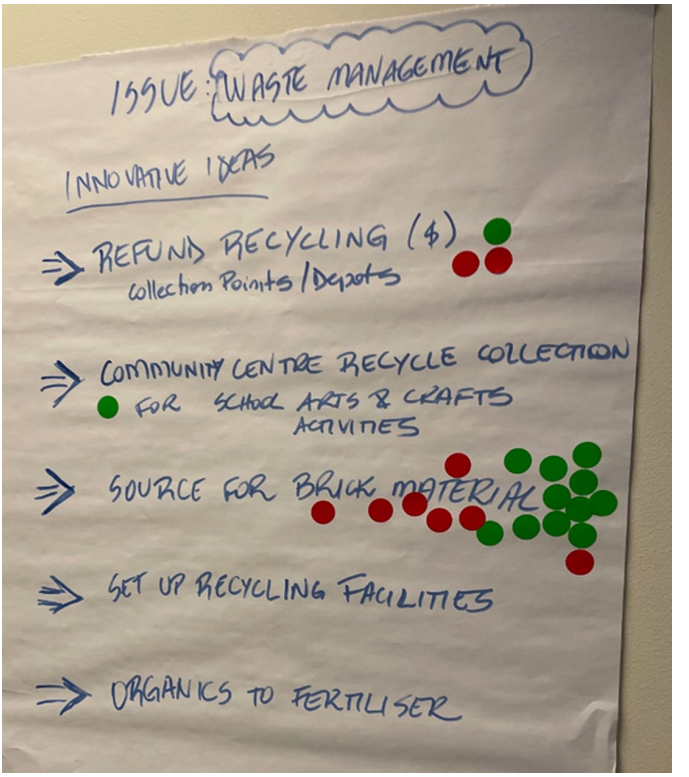

Exhibit 7. Student group Ideas presented and voted on at Town Hall Meeting (Group B).

groups, indicating that the solutions not only represent multiple worldviews, but stakeholder buy-in to the transformative changes.

We now provide a synopsis on what went well, what needed to improve, and offer a few general observations. Unfortunately, due to restrictions by the University's ethics authorization we were allowed to use only the 2023 student feedback. Students appreciated that:

- Systems thinking could be applied widely and in their own work contexts. This was confirmed by the final assignments they submitted.
- The structure allowed time to frame a problem rather than jump to conclusions.

- The process encouraged a different way of thinking about issues (systemic instead of linear) —to see the forest through the trees.
- The course helped to mix theory and practice, engaging students in a practical and relevant way.
- Application of the concepts and processes would be useful in the future, and many students indicated that they had already started applying these ideas at work.
- The mixture of group work, self-study, case study, role play, and the town hall was fun.

Students were also generous in providing insights and potential solutions for course improvements including the (1) provision of more examples of the use of tools, (2) more weaving of theory into the course activities, and (3) to devise ways to have more time for learning the basic concepts. Over time we have tried to implement many of these suggestions and have noted that each course iteration has resulted in the final assignments showing increased evidence of the practical use of the tools. This was encouraging, particularly when we saw the range and size of the projects the concepts had been applied to (construction, banking, IT, health care, construction, etc.). More details are provided in Appendix C.

We are pleased to share that three previous students have used systems thinking approaches in pursuit of their doctoral qualifications. One of the students was inspired to apply system dynamics to problems that ignored the impact of productivity in calculating resources. This student helped to teach this course. The second student addressed the societal problem of parents looking for homes for their adult disabled children within a caring community as the government disability schemes were lacking. The third student explored decision making by managers in complex situations using the Cynefin framework (Snowden & Boone, 2007).

Conclusions and Recommendations

While this 4-day course does not result in the development of concrete plans to address a grand challenge, it equips students with systems thinking skills to establish the first steps in understanding challenges and the perspectives of stakeholders involved. Recognizing the time constraints of a university semester and a 4-day teaching block, this teaching innovation has been intentionally designed, and iteratively developed, over a 14-year period around a problem structuring method and a variety of tools to explore paths forward in dealing with this challenge.

The instructors of this innovation and authors of this article hope that this will inspire other educators to adopt some, or all, of this approach to

encourage multidisciplinary student groups to learn from each other. The journey we share here is one that brings together a diverse group of post-graduate students and educators to create a shared educational space. The students work with and learn from a client who shares their own intimate knowledge and experience of an issue within a selected sustainability grand challenge area. Using an innovative design thinking-based systems approach, there is much we can learn and do to address the grand challenges of our time as long we work together.

The evolution of this course from a SoSM approach (Jackson, 2006) to a critical systems stance (Jackson, 2019) has helped student develop critical awareness by learning about the strengths and weaknesses of different systems approaches. They become more socially aware of the societal and organizational pressures acting on societal concerns when they address them as stakeholders taking on different roles. They learnt the value of pluralism of methods (System Dynamics, SSM, VSM, and CSH) and approaches (hard/soft/coercive) on addressing a problem presented in the classes. The innovative ideas proposed during the Town Hall Meeting enabled students to consider human emancipation to enhance the quality of life of people affected by the problem they analyzed such as the residents of informal settlements discussed in this article.

Note to Readers: The lead author can be contacted if more details are needed about the details of the 4-day intensive course. For example, we have a "Check List for preparation: Systems Thinking for Managers" we are happy to share with others as well as a sample invitation letter to potential clients, a list of student industry profiles from 2023, and a typical timetable for the intensive course which may be of use to those interested in replicating or adapting this multi-day exercise.

Appendix A: The Evolution of the Course Over 14 Iterations

We discuss below the innovative improvements made to the course since it was originally designed in 2009 along with the rationale for making adjustments.

Between 2009 and 2011 the course was called Systems Thinking and Management Modeling with a hard systems focus while covering Soft Systems Methodology (SSM) briefly. The student cohort was primarily graduate project management students. On the first day students played the Beer Game that was developed to introduce managers to "systems dynamics in a fun and engaging way" (see Martinez-Moyano, 2024). The activity was useful in demonstrating to project managers, who had been taught to break down tasks to manage them, that interconnectedness between tasks can lead to

unintended consequences. Most of the course concentrated on learning Systems Dynamics and using software for simulating the effect of interrelationships. It was not until day 3 that we introduced SSM and required groups to create rich pictures to better appreciate how project stakeholders could have conflicting objectives. As discussed by Gatzweiler et al. (2022), the use of visuals and images help us engage with and comprehend a complex problem. The Viable System Model (VSM) was introduced on the last day with a lecture on the use of systems thinking to understand complexity in projects.

From 2012 to 2014 we expanded the use of SSM and integrated the application of SSM and VSM to projects. This was triggered by the reflection after teaching the course in 2011 that, with the enrolment of MBA students into the course, composition, and expectations changed. It was also becoming clearer to the management educators that some of the modeling tasks were too technical for the desired outcomes. As students tended to use SSM in their final assignments and the project management bodies had begun promoting the importance of soft skills, we decided to increase the content of SSM. Inspired by a systems conference in Washington DC, we began teaching SSM using four steps (Hindle, 2011). The steps were—finding out, modeling, comparing, and taking action. We also decided to introduce a complex problem that students could use to apply SSM principles. To add more complexity, students were embedded in a role-play-based simulation where they assumed conflicting stakeholder roles. The VSM, which was being taught independently, was integrated with the teaching of SSM by asking students to use it as a governance framework for transformation projects they proposed to address. The name of the course was changed to "Systems Thinking for Managers" as the emphasis on modeling tools was reduced.

Between 2015 and 2018 new strategies were introduced. The Beer Game was replaced with an introduction of Complex Adaptive Systems (CAS) to demonstrate its use to address complex situations. We also sought out project management problems that had significant and societal impacts. The societal issues were introduced by guest management educators that acted as a client that was looking to a systems thinking practitioner to help address a complex problem. For example, students were challenged to address some of the complexity of the National Disability Insurance Scheme in Australia and the changes in the Australian aged care systems to move toward caring-in-place. During this period, we also incorporated a daily learning capture process so students could reflect on their daily learning and use this information in their final reflections and presentations on day 4. Inspired by Rucker (2015), we introduced a Town Hall Meeting. This demonstrated to students how accommodation can be achieved between stakeholders when using SSM. To reach consensus and create collective wisdom, the different stakeholder groups

realized that there needed to be a collective action if they were to help the client with issues. By the end of 2018 the management educators recognized that the students would benefit from more integration between the 4 days and SSM became an overall umbrella for the course with other methodologies applied on the outputs generated during the day 1 application of SSM.

From 2019 to 2023 the course was modified to accommodate an even wider range of students from different schools at the university including those from property development, health services. urban planning, policy development, and information technology. Due to the diversity of the students, the management educators shifted the course output from the development of a high-level project scope to designing an organization to carry out a transformation of selected ideas proposed at the Town Hall Meeting. This decision was based on one of the educator's experiences at a 1-day Systems Thinking workshop that employed TRIZ (Terninko, 1998). Starting in 2019 students were asked to propose innovative ideas at the Town Hall Meeting that could be converted into action through an organization that they designed within the course. Student teams selected items that were voted as high priority to work on organizational design. To assist students with organizational design a systems method to design organization called Idealized Design was introduced (R. L. Ackoff et al., 2006). The types of problems and clients who brought them were selected to tackle a wider variety of challenges with higher levels of complexity than before. Examples of such issues include the death of rare species like koalas during the major fires that cause devastation during summers in Australia, the barriers faced by people with disability to find work in sectors like construction, and issues arising from the increase in informal settlements. As the issues being addressed had elements of coercion, Critical System Heuristics (Ulrich, 1987) was added to the course. From that point forward, we selected either local or global grand challenges for the course (see Figure 1).

Major changes made to the course

Year(s)	Activities/changes	Features/reasoning
2007–2008	Designing the course to meet course change proposal.	Two management educators who were both members of the Australia New Zealand Systems Thinking Group worked together with their ideas and developed a new course required by a Masters' Program on Systems Thinking. Used 4-day intensive pattern used by the program.
2009–2011	Course offered as an elective to teach project managers. Course called Systems Thinking and Modeling.	- Focus on teaching systems concepts and selected approaches from Systems of System Methodologies (Jackson, 2006). - Beer Game developed at MIT in the US to help appreciate a more holistic thinking approach to managing projects. - Used a computer lab to teach "iThink" for modeling with a focus on hard systems thinking.
2012–2014	Soft Systems Methodology modified to teaching three stages based on Hindle's (2011) presentation at a systems conference. Changed the name of the course to Systems Thinking for Managers to attract student from across the university.	- Students struggled with using tools such as stock and flow diagrams in the class in a short time. - Increased interest shown by student using soft systems methodology and drawing rich pictures on a social problem used. - The number of MBA students who enrolled in the course increased.

(continued)

(continued)

Major changes made to the course

Year(s)	Activities/changes	Features/reasoning
2015–2017	Beer Game replaced by teaching CAS. More complex problems introduced each year in the class and students were taught how to combine systems approaches to tackle such problems.	- Increased interest in complexity in projects and management or organizations. - Diversity of students increased.
2018–2019	Started the course with SSM on day 1 and used it as an umbrella to include other approaches. Daily learning capture process was introduced for students to consolidate the learnings to help applying at the workplace. A Town Hall Meeting was introduced to build accommodation between stakeholder groups.	- Diversity of students increased - Students still unclear about how to integrate systems approaches.
2019–2023	Due to the nature of the problems used in the classes (effects of bushfires, political influences on projects, and problems face by people with disability) it became necessary to think of coercive systems. CSH was introduced to consider systems boundaries Ackoff's Idealized Design was introduced to design organizations to carry out. Transformations and VSM was also used to design a viable system to govern the transformations.	- Adopted a Critical Systems Thinking approach to help integrate the application of systems approaches following Jackson's (2019) new book on CST. - Experience gained teaching at a workshop in India on systems thinking using SSM and TRIZ together to find innovative solutions. - Transformations that were discussed on the final day by students designed to develop innovative solutions with the whole class working together.

Challenges Used to Teach Systems Thinking Over the Years

Examples societal and management challenges addressed in the course over the years:

2013	Juvenile Delinquency—Challenges faced by indigenous communities due to repeated imprisonment on indigenous youth in Australia
2014	Waste Not Want Not—Challenges facing a community living in a beautiful regional area faced by the prospect of creating a nuclear waste facility in the neighborhood
2015	National Disability Insurance Scheme—Challenges faced by People with Disability to gain government assistance
2016	Emergency Services in Rural Areas—Challenges faced in developing a rapid response ambulance service management system
2017	Aged Care—Providing Person-Cantered Care to older people due to Government policy changing how aged acre is managed
2018	Sydney Central Station Revamp Project—Stakeholder problems faced by a project owner to carry out construction works in a busy city
2020	Endangered Species—Challenges face by organizations working on saving endangered species affected by a major bushfire
2021	Care Homes—Challenges faced by parents developing strategies to find community homes for their adult children with disability
2022	Decision Making in a complex megaproject (freight railway network) whose cost has blown out

Appendix B: Assignments

Assignment 1—Pre-Course

This assignment asks you to use diagrams to explore a complex situation that will be used as a case study to apply systems tools at the course. Diagrams often help us to have a visual representation of our thoughts that is often used by systems thinkers.

The topic we will be discussing is related to informal settlements (sometimes called slums) that are increasing in size and complexity in several parts of the world. Please work on this assignment using the following steps:

1. Explore listed publications, websites, and media to get a better understanding of the nature and issues related to informal settlements. These are listed at the end of this brief.

2. Read the paper titled "Teaching Diagramming at a Distance" by Lane and Morris (2001) from the Pre-course readings on the LMS.
3. Think about one key question you would like to address on the situation faced by informal settlements. This will help you work on the next step.
4. Draw a "Systems Map" like the one shown in Figure 3 of Lane and Morris (2001) drawing a boundary framing the question you want to address in Step 3. Identify internal and external stakeholders of the system of interest.
5. Watch the video about influence diagrams posted by the Open University https://www.open.edu/openlearn/science-maths-technology/engineering-technology/influence-diagrams
6. Draw an influence diagram using Figure 4 in Lane and Morris (2001) as a guide. Use your own ideas based on what you learned from the video you watched in Step 5 to develop the influence diagram.
7. Write a 500-word brief (using free writing) on your reflections from the influence map you created explaining how and why you created this map.
8. Submit the diagrams you created and the brief into one consolidated file into the drop box on the LMS.

Here are some references provided by the client:

Readings. https://assemblepapers.com.au/2019/09/17/informal-settlements-never-just-a-slum/ by Dr. Ishita Chatterjee who will engage with you at the workshop (also available through Canvas preworkshop readings).

They are not informal settlement—They are habitats made by people:

https://www.thenatureofcities.com/2016/04/26/they-are-not-informal-settlements-they-are-habitats-made-by-people/

Videos: These are long so please skim through to get the essence.

McCloud (2010): Slumming It—Ep1—YouTube

https://www.imdb.com/title/tt3550768/

Read selectively from: Contested urbanism in Dharavi. Writing and project for the resilient city

https://www.ucl.ac.uk/bartlett/publications/2013/jul/contested-urbanism-dharavi-writings-and-projects-resilient-city

Additional readings if you become fascinated by the topic.

Rediscovering Dharavi—https://penguin.co.in/book/rediscovering-dharavi/

Behind the beautiful forevers—https://www.penguinrandomhouse.com/books/16017/behind-the-beautiful-forevers-by-katherine-boo/

Additional resources:

1. They are not informal settlement. They are habitats made by people: https://www.thenatureofcities.com/2016/04/26/they-are-not-informal-settlements-they-are-habitats-made-by-people/
2. Videos: These are long so please skim through to get the essence. McCloud (2010): Slumming It—Ep1—YouTube https://www.imdb.com/title/tt3550768/
3. Read selectively from: Contested urbanism in Dharavi. Writing and project for the resilient city https://www.ucl.ac.uk/bartlett/publications/2013/jul/contested-urbanism-dharavi-writings-and-projects-resilient-city
4. Additional readings if you become fascinated by the topic:
    1. Rediscovering Dharavi—https://penguin.co.in/book/rediscovering-dharavi/
    2. Behind the beautiful forevers—https://www.penguinrandomhouse.com/books/16017/behind-the-beautiful-forevers-by-katherine-boo/

Assignment 2

There are four tasks for Assignment 2.

Assignment 2A

Develop a Causal Loop Diagram (CLD) using one or more of the relationships you identified from the rich pictures drawn by stakeholder groups on day 1. Use Vensim software to draw it and export it as a pdf file for submission. Identify any balancing or reinforcing loops.

Assignment 2B

Develop a Stock and Flow Diagram using one or more relationships you identified from the rich pictures drawn by stakeholder groups on day 1. Use Vensim software to draw it and export it as a pdf file for submission. Identify rates that you will assign to simulate the situation you are proposing.

Assignment 2C

Please submit the following items as a group for this assignment:

1. Rich Pictures of informal settlements from day 1
2. CATWOE for the Transformation you proposed on day 2
3. Root Definition for the Transformation based on your CATWOE day 2

Assignment 2D

Post your final presentations in the LMS Dropbox.

Assignment 3

The course has introduced various tools and models to enable you to apply a systemic thinking approach to practice.

- Causal Loop Diagrams/Stock and Flow Diagrams/System Archetypes
- Soft Systems Methodology
- Viable System Model
- Critical System Heuristics

In this assignment you will demonstrate your ability to apply systems thinking, diagnosis, and modeling tools to address issues arising in organizations (or a project or in your own life) to manage them better.

Task: Apply systems methodologies discussed during the course to analyze a problem:

- At your workplace (or a workplace you are familiar with), choose a project or context related to your discipline, and present a way forward to improve the situation ("preferred"). If this is a problem that you have extracted from a case study, rather than a real-life situation, provide a reference to the case study.
- Feel free to use a problem that has had an impact on your life (health, career etc.). Choose a suitable problem that would benefit from an exploration using systems methodologies.

Limit the submission to 10 pages excluding any cover sheet.

Requirements

Describe the context:

- Provide a brief three-sentence description of the problem you are analyzing.

Structuring the Problem: (about three pages)

- Draw a Behavior over Time graph of the problem and the desired change and then two more for the causes and effects of the problem because of that change.
- Provide either a Causal Loop Diagram or a Rich Picture exploring the dynamics and solution to the problem situation.

Finding a Way Forward: (about three pages)

- Provide a VSM or a description or SSM model that would meet the requirements of dealing with the problem.
- If relevant, ask questions explained under Critical System Heuristics to address any boundary related issues.

Developing Activities to Implement the Solution: (about two pages)

- Provide a Human Activity Systems (HAS) to solve the problem.
- Provide one evaluation criterion for each of efficiency, efficacy, and effectiveness of your HAS.

Personal Learning: (about one page)

- Reflect on what you learned from the course (use reflective questions presented during the class)
- How do you think you can use what you learned in your work or life?

Marks will be allocated to reflect:

- Rigor demonstrated in the analysis (10 marks)
- Ability to apply systems thinking in practice (10 marks)
- Use of relevant literature with appropriate referencing (5 marks)
- Ability to relate to present or experience (10 marks)
- Innovative thinking (5 marks)

Appendix C

Tools/Approaches Selected in Systems Thinking Course

All the systems tools or approach can be used for diagnosing the system depending on the systems of interest. The following table provided some general guidance on why the tools used in 2023 were useful. Please refer to Jackson (2019) for more information on a variety of systems approaches to be used.

Approach	Tools	Use
Systems dynamics	CLD's, SFD's, System Archetypes	Uncover interrelationships between variables in a system to clarify nature of relationships (cause and effect), predict behaviour over time and can be used as means of conversations between stakeholders to develop a better understanding of the situation.
Soft systems methodology	Rich pictures, CATWOE, Root Definition, Human Activity System (HAS)	To understand multiple perspectives of stakeholders in a problematic situation, identifying key parties (CATWOE) to find a way to improve the situation, developing a mission statement for improvement through accommodating stakeholder interests and high-level activities to carry out the transformation.
Critical systems heuristics	Twelve questions	Used to uncover power and politics present in a situation and critically evaluate boundaries that are being drawn to identify the system of interest.
Viable system model	Five subsystems, Communication channels	To develop a viable system that can achieve the transformation and sustain it. Can be used as a model for governance of a transformation project.
Town hall	Collaborative intelligence	Facilitating stakeholders to work together (after knowing each other's perspectives) to develop innovative solutions to address the problematic situation.

Examples of Organizations Students Worked in Professionally

Construction Firms: Lend Lease, John Holland, Buildcorp, Worley Parsons
Property Developers: CBRE, Landcom
Banks: ANZ, Westpac
IT firms: Atlassian
Telecommunication Providers: Telstra, Optus, Vodaphone

Government/Public Sector: Local Government (New South Wales), Department of Defense, Transport for New South Wales, Local Councils (Willoughby, Northern Beaches)

NGOs: Aged care providers

Hospitals: Northern Beaches, Royal North Shore

Insurance Firms: NRMA, Chubb

Typical stakeholder roles played by students in recent instances of the course

Year	Problem addressed	Stakeholder roles
2021	Decision Making in a complex megaproject (freight railway network) whose cost has blown out	Local Government Project Public
2022	Barriers to People with Disability to be employed in the construction sector	Employment agents (to hire people in the construction sector) Construction Firms employing People with Disability Government (who set policies of equity) Empowering Organizations (Helping people with disability to be ready to be employed)
2025	Housing affordability	Property (Developers/Builder) Planners (Urban and Regional) Government (Federal, State, Local Government) Analysts (Economists, Forecasters, Consultants) Finance (Banks/Financial Institutions)

Appendix D: Essential Readings Linked in LMS

Recommended Textbook (Available as e-Book From the Library)

Reynolds and Holwell (2020).

Pre-Course

Chatterjee (2019), Lane and Morris (2001), Lane (2013), and The Open University (2021).

Day 1

Bell (2016), Monk and Howards (1998), Williams and Hummelbrunner (2016), D. Kim (2016a), and Maani and Cavana (2007).

Day 2

D. Kim (2016b), Lyneis and Ford (2007), Winter and Checkland (2003), and Checkland and Tsouvalis (1997).

Day 3

Sankaran (2015), Pourdehnad and Hebb (2002), R. Ackoff (2001), and Ulrich (2006).

Day 4

Schwaninger (2000) and Sankaran et al. (2020).

Post-Course

Pollack (2009), Barton (2009), and Pollack (2006).

Appendix E: Guidance for Rich Pictures, Town Hall, and Final Presentations

Guidelines for Rich Pictures

Why use rich pictures?

- System thinkers try to understand "messy" situations and take some time to do it.
- Rich pictures are important tools to capture everything one or a group knows about a situation and its interconnections.
- The process of drawing is as important as the picture itself and could clarify situations.

Some rules:

- Do not try to structure your rich picture, they are supposed to capture everything you know about a messy situation.
- Avoid using too many words.
- Do not exclude observations about culture, emotions, values.
- Be in the picture but include other points of view.

How can they go wrong?

- Try to represent the situation rather than the problem.
- By not being rich enough.
- The first attempt is rarely complete, so do not consider it to be finished—but rather finished for now!

Some things you could include:

- Interfaces, boundaries.
- Resources.
- People.
- Roles.
- Organizations and their parts.
- Needs.
- Obstacles.
- Conflicts.
- Alliances.
- Tools.
- Objects.
- Targets, goals aspirations.
- Processes.
- Progression.
- Relevant history.
- Issues.
- Thoughts and ideas.
- Concerns, reactions, responses.
- Time.

Guidelines for Town Hall and Voting Instructions

Town Hall Meeting Process Summer 2023:
During this course, you have been exposed to the views of designated stakeholder groups on the Informal Settlements. The client has sought your support to suggest innovative solutions to consider the multiple perspectives of concerned stakeholders.
There will be a Town Hall Meeting to present some innovative ideas to address the problematical situation faced by the client.
Groups will be given 30 min to do the following in preparation for the Town Hall Meeting:
Assign a recorder/reporter/facilitator for your group.
Revisit your rich picture and CATWOE.
As a group, look at the issues listed at the designated area at the front of the room, identify two to three issues which will need some new ideas/initiatives to resolve.
Your goal is to develop three to four innovative ideas for each of the issues you have chosen. Record those ideas on a flipchart.
We will then convene the Town Hall Meeting where each group will explain their innovative ideas to the audience.
There will an opportunity for questions and clarifications where required.
Your flipchart with the innovative ideas will be posted on the back wall of the room for voting.

Voting process.
Voting is an individual process. Each of you will receive three green dots. The dots are used to vote on the flipchart ideas.
You may select any idea proposed by any of the groups, and you may use more than one green dot on the same idea. Once you have placed your green dots, you will be given a red dot.
You will use the red dot to prioritize the one idea that you think should be taken up first. The idea receiving the most red dots will be presented to the client.

Instructions for Final Day Presentation (Assignment 2D)

The presentation should have the following slides. The maximum number of slides is 10.

1. Rich Pictures revised on day 3.
2. CATWOE and Root Definition for Transformation.
3. Human Activity System (High Level Scope) and Evaluation.
4. Group Reflections from the Town Hall Process.
5. A governance model using VSM for the Transformation Project.
6. Reflection from Daily Learning Capture.

Time allowed for presentation—20 min followed by Q&A—5 min

Acknowledgments

Shankar Sankaran would like to acknowledge the late Dr. Tim Haslett's contribution to the development of the subject from the start (Tim passed away before we taught in 2023 but was engaged in discussions with the client). He would like to thank: Dr. Ishita Chatterjee who acted as the client from the Dharavi slum where she was engaged in research on urban planning in Mumbai; Dr. John Barton, a systems thinker and friend of Tim Haslett who filled Tim's place when we taught the course in 2023; Dr. Danon Jalali, whose lecture of his PhD work on the impact of informal settlements on urban planning inspired the students; Dr. Jeffrey Scales who was a student of this course in 2010 and went on to complete a PhD on the impact of systems thinking in projects and guest lectured in the course. Finally, Shankar would like to thank the anonymous students of the course whose work as stakeholder groups helped to explain what we learnt from teaching this course.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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