

The Role of Systems Thinking in Integrating Innovation in Construction with a Journey Towards Sustainable Development

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Abstract

The economic environment has altered due to globalisation. It establishes new links across national economies and denationalises access to data, technology, expertise, markets, and financial resources. A national sector or economy now has two distinct ways to compete in global markets: By developing more advanced technology, which may or may not be introduced first in niche markets and by implementing cost-cutting strategies that entail increased economies of scale, the elimination of labour and frequently ignoring health, safety and environmental risks. Others have warned about a "race to the bottom" and an ever-increasing desire to trade on environmental (and labour) externalities, while some have claimed that globalisation also raises the need for stronger protective environmental and labour policies globally

Keywords: Sustainable development • Thinking • Innovation • Integrating

Introduction

Understanding how systems are connected, and more so how they will change, is an important factor to consider in our collective journey to meet the sustainable development goals. The role of construction in delivering infrastructure for sustainable cities and communities is a critical part. This perspective explores examples of innovations within the construction sector that demonstrate the need for considering a systems approach.

This year as 2020 gives a strong bell toll that the 2030 path for the Sustainable Development Goals (SDG), there are opportunities to strengthen the ways in which we are tackling them. With a background in infrastructure and sustainable cities, my interest began first working in public health in Rwanda that led to projects in Cameroun, Colombia, Myanmar and Morocco. After being 'underwater' in places that lacked access to critical infrastructure; reliable, affordable 24/7 access to water, roads and/or lights, I shifted to work on infrastructure and investigating its many linkages with Sustainable Development Goals, specifically SDG: Industry, Innovation and Infrastructure, SDG 11: Sustainable cities and communities as well as SDG 12: Responsible consumption and production. Having spent the last couple of years zeroing in on sustainable cities and communities, construction cuts across several different systems involved in the delivering of infrastructure [1]. Understanding how these systems are connected, and more so how they will change, is an important factor to consider in our collective journey to meet the SDGs.

Understanding how these systems are connected and how they will change large in part a continuation of an understanding of how we have arrived at this juncture in human history. This is best illustrated in our journey across the four main industrial revolutions. Prior to the first industrial revolution, there was our shift as a species from hunter-gatherer societies to agricultural ones. As humans built shelters and moved from more nomadic societies towards societies of mechanization, the first industrial revolution (1765) emerged. This was marked by the early days of automation led to innovations in transport and scaling supply chains. This first industrial revolution gave way to the second industrial revolution (1870) with large scale advancements in transforming energy [2]. The division of labour, mass production and harnessing the power of steam, not only could goods be made quicker and cheaper, but the construction buildings became critical for delivering central places for living and working. For homes, this meant heating and cooling networks could be expanded and large developments could be rolled out at scale. It would be nearly 100 years until the Third Industrial Revolution which witnesses advancements in Information, Communication and Technology (ICT) from approximately 1969 onward. We are currently in the 4th industrial revolution with the internet at the helm. There are debates of the markers of the 5th Industrial Revolution, with some arguing that it has already arrived with artificial intelligence as innovations in machine learning and robotics become more central to the functioning of core to the operation of society.

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Literature Review

Returning to the theme of how to understand how systems are interconnected, particularly with regards to sustainable cities and communities as we tackle the SDGs, what will the next revolution will mean for how places are being designed and built? Are we considering the wider system in which these changes are taking place? The innovations in technology of this 4th industrial revolution suggest that the internet-of-things and 'smart home' technology will create 'super homes' which are 'intelligent' and tailored to individual needs. Will these trends continue through the 5th industrial revolution? As an example, will the trend towards using more Modern Methods of Construction (MMC) continue as an opportunity to create low-carbon buildings, inspire a shift towards more low-carbon living through the use of smart materials and more vertical supply chains? Among the several arguments for its widespread use, is that it can enable mass production with sustainable materials in some cases without the challenges of long construction times that result from a decentralised supply chain [3]. However, an immediate question emerges as to how the systems beyond house building and construction being considered in the widespread support for MMC? Research in academic circles and policy are attuned to these questions and the need for a systems approach is gaining traction, yet translating this knowledge and understanding of systems into actionable steps for delivering on the SDGs requires further development. Sustainable Cities and Communities needs a futures lens that is interdisciplinary and across systems to inform decision-making in policy, inspire cross-sectoral thinking and generate solutions that account for unintended consequences as well as benefits.

There are some policy areas where unintended consequences of rolling out MMC are being explored such as disruption to local labour markets. This includes markets supplying the construction sector as well as building insurance and logistics which are connected to it. Other broader policy agendas such as the contributions to a net-zero carbon agenda may require understanding of other environmental risks that emerge as a result of a shift towards greater MMC (water use across the supply chain, carbon footprint of transporting materials and biodegradability of waste) [4]. With regards to current building regulations developed in relation to traditional methods of construction, these vary widely by country and even within countries at regional and local levels. As these are country or even regionally dependent in some cases, these will need to adapt as MMC technology, materials and supplies continue to be developed traded across countries. With regards to policy around skills, how will the current labour force supplying the construction sector adapt? Will there be a shift towards upskilling and transitioning or is the leap currently too great and requires innovative alternatives?

Each of these unintended consequences should be taken into consideration through drawing upon the perspectives of stakeholders operating in this arena. However, what if the sector transformation is not led by MMC alone and what if it requires thinking through the lens of an innovation that could be more disruptive than MMC? Taking a lesson from the 4th revolution, the internet laid the groundwork for not just consuming and transmitting information, but also for sharing information which led to a variety of disruptive technologies related to the sharing economy. The sharing economy concept of 'hiring' or 'renting' goods (bike share), services (Uber)

and or spaces (Airbnb) transformed and is continuing to transform models of ownership in cities and communities globally [5]. What was relatively localised through sharing practices that predate these tech disruptors, became global parlance within a span of a decade.

Discussion

This is not to suggest that the sharing economy will upstage MMC however, it does beg the question as to which other systems might have an influence on MMC. To explore this, there are several approaches that draw upon systems thinking and its utility in crafting understanding in its wider context. A systems approach allows us to explore how different systems are connected to delivering sustainable living places, the dynamics between them and how they influence one another. A systems view is important because it "tries to take into account the interactions between different parts of a system and understand how together they are affecting change rather than simply trying to understand specific components in isolation". Donella Meadows defines systems as providing a means of bringing perspectives together to generate a shared understanding and a process for identifying aspects of the system that can be leveraged.

To design an approach that would explore this question, the Acumen systems' lens is one that offers an innovative approach to this exploration. This approach applied to MMC in the wider systemic context would involve identifying the key enablers and inhibitors around the role of MMC in today's current context [6]. Drawing upon stakeholder perspectives and priorities, the approach curates an analysis of the main processes, institutions, stakeholders (structural elements), perceptions (attitudes) and transactions (relationships). With these inputs, identifying the forces that influence the system upstream and downstream can be investigated to identify causal relationships drawing upon the work of Jay Forrester (system dynamics) and Sterman (causal loops) [7]. From here, dynamics within the system (tensions, leverage points) can be explored and mapped. The benefits are that a big picture view of the system can be distilled into leverage points and inform where interventions are made. As it requires stakeholders to co-create, it also provides a process for an integrated approach to iterative working with stakeholders. There are some limitations in that it captures a given point in time, can be time consuming and will rarely provide a silver bullet solution [8].

Conclusion

In considering this process to tackle a complex systems problem, the first question would be what are the merits of doing it? The main question should be: what are the consequences of not doing it? A key concept underlying the sustainable development goals is that they are integrated, in that none are to be understood in isolation from one another. Identifying a solution that seems to have the support from key stakeholders is a step in a process of understanding how it may affect other areas of the system in beneficial or harmful ways. As we move closer in our journey towards a 2030, we have time and the expertise to ensure that our solutions, activities and partnerships are fit to create lasting change and do no harm. A systems approach, with all of its merits and limitations, is one way to lead that process.

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