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A CALL FOR ACTION: CONSTRUCTING SOLUTIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS

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The Sustainable Development Goals (SDGs) are the current, global call for action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The built environment, hereunder the construction management community, plays a central role in developing solution to meet the SDGs. This paper reports on the findings from a workshop organised as part of ARCOM 2017 conference, where the participants explored "what the academic community around construction management can do to address the SDGs?" The results reveal a consensus that the SDGs are important and that researchers and educators have a pivotal role in addressing them. However, this requires connecting research and education with other domains like policy, industry, technology and civil society. In addition, the suggested strategies all includes social and technological components, including winning the hearts and minds of the wider public and creating international mind-sets, and bridging developing and developed countries. Based on the findings from the workshop, a research agenda informed by the SDGs is suggested. The agenda should cover activities like (1) understanding the complex relationships between different goals, solutions and stakeholders, (2) establishing measures for evaluating progress and impact, (3) formulating specific projects for addressing targets of the goals globally and locally and (4) facilitating knowledge transfer between developed and developing countries.

Keywords: SDGs, sustainability, innovation, construction management

INTRODUCTION

In 2015, the United Nations conceptualized the crucial problems of the world in the form of the Sustainable Development Goals (SDGs). The SDGs are the global call to action in the period from 2016-2030 to end poverty, protect the planet and ensure that all people enjoy peace and prosperity (United Nations, 2015).

The SDGs is a continuation and extension of the Millennium Development Goals (MDGs) from 2010-2015, now covering both developing and developed countries. The SDGs go much further than the MDGs, addressing the root causes of poverty and the universal need for development that works for all people. While the goals were initially well-received, critical voices emerged, questioning the underlying economic model (e.g. Hickel, 2015) and the overall complexity and inconsistency (e.g. Economist, 2015). However, recent development suggests a raising popularity of the goals, exemplified by the editor's comment from the World Economic Forum in Davos: "The SDGs may not be perfect, but the fact that these Global Goals exist is important and valuable. And if this

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year's event in Davos was any indication - and it's just the second year since the Global Goals were approved — they are making a meaningful difference in the way leaders understand the challenges facing the world and recognize their own responsibility in addressing them" (Kumar 2018).

Today, the goals are adopted by all 193 UN member states and explicitly addressed by more than 9,600 companies in 170 countries, representing nearly every sector and size (Global Compact, 2018). A quick review of the Global Compact database of member organisations reveals that more than 2,400 construction companies have made specific commitments for addressing the SDGs. While industry support is of outmost importance, realising the SDGs also requires a mobilization of resources within the academic community on construction management (Leal *et al.*, 2018). Higher Education Institutions (HEIs) can play an important role in achieving the sustainable development goals through research, innovation and leadership. The academic community must equip graduates with the sustainability knowledge, skills and experience needed to solve the sustainability challenges faced by the global community through a higher education curriculum embedded with sustainability literacy (Opoku and Guthrie, 2018).

Opoku (2016) argues that the built environment could drive the agenda towards achieving the SDGs; a sustainable built environment (SBE) could highly influence the realisation of the sustainable developments. Qualitative data from expert interviews with central researchers and practitioners revealed that developing smart cities and sustainable communities, sustainable procurement, design and construction of infrastructure, and the provision of renewable energy technology such as solar on built assets are some of the roles a SBE can play in achieving the SDGs. The built environment has more impact on some of the goals than others. For example, a SBE could highly influence the realisation of goal #11 (Sustainable cities and communities), #9 (Infrastructure and Innovation) and #7 (Affordable and clean energy) (Opoku, 2016).

According to Opoku (2016) and Dixon *et al.*, (2018) the construction industry is a key partner in the global effort to achieve sustainable development. Therefore, the built environment can act as a driver for realising the SDGs, supported by the right government policies and strategies. However, this requires the involvement of the Construction Management (CM) community.

This leads us to the following research question: "What can the academic community around construction management do to address the SDGs?"

METHODOLOGY

The paper adopts a qualitative research approach using Participatory Action Research (PAR) methodology. The methodology involves the research stakeholders in the process of generating the research knowledge. The PAR captures the individual participant feelings, views, and patterns and also encourages a culture of collaboration among research participants and the researchers (MacDonald, 2012). The PAR methodology provides the research participants perspective in terms of the views, concerns, feelings and experiences round the subject under investigation (Swain and French, 2004). A workshop was organised as part of the 33rd Annual ARCOM Conference in 2017. The workshop participants explored the role of the construction management research community in addressing five of the 17 SDGs, namely; #4: Quality education, #7: Affordable and clean energy, #9: Industry, innovation and infrastructure, #11: Sustainable cities and communities, #13: Climate Action.

The selected SDGs were based on Opoku's (2016) initial investigation into the role of the built environment in achieving the SDGs (goal #7, #9 and #11). The workshop extended the list with goal #4 to acknowledge the educational component of the academic community, and further included goal #13 to denote the importance of tackling climate change. However, goals #7, #9 and #11 are here in this paper assessed as the core goals, i.e. the goals most relevant for the construction community to address.

Instead of employing traditional workshop methods such as panel discussions, participants were engaged in exploring the complex areas and thus adapted the 'Knowledge Café' approach designed by Gurteen (2008) with inspiration from "the world café" (Brown and Isaacs, 2005). Both concepts build on the "café" as an archetype - a familiar cultural form around the world - that evoke immediate intimacy and collective engagement through conversation around a certain topic. According to Brown and Isaacs (2005:19) conversation "is the core process by which humans think and coordinate our actions together. The living process of conversations lies at the heart of collective learning and co-evolution in human affairs. Conversation is our human way of creating and sustaining - or transforming the realities in the society". Bringing a diversity of people together for a conversation in a Knowledge or World Café is a useful way of making sense of a challenge, create better decisions and secure commitment from central stakeholders. Thus, it represents a promising method for involving people in addressing the SDGs.

More than 30 people including PhD students, junior and senior researches, lectures and professors as well as a few of practitioners participated in the "Knowledge Café".

The workshop was organized in three parts covering (1) a brief introduction to the SDGs and the built environment, and to the structure of the knowledge café, (2) the actual "Knowledge Café", and (3) a final presentation and open discussion.

In the Knowledge Café, the participants were divided into five smaller groups. Each group was placed at one of five 'tables', where each table was devoted to one of the selected SDGs as shown in figure 1:



Figure 1: Structure and process of the Knowledge Café

At each table, participants investigated the potential role of the CM community in addressing a particular SDG by answering the central questions of What? How? and Who?

- What: What are the challenges and what is the current state-of-play in different countries?
- How: How can the CM community contribute?

Theoretically - What are the research issues and opportunities; what concepts should be useful?

Educationally - How should our teaching be modified?

Practically - What impact should - be aiming for?

- Who/Contributors: Who would like to join us; whom should be talking to?
 - Researchers - Above and beyond, as well as in, the academic communities
 - Governments - National, local and supra (e.g. the UN)
 - The professions - National, and other disciplines and countries
 - Funding bodies
 - Thinking shapers
 - Practitioners

After 10 minutes, each group rotated to the next table and the process continued until the groups were back to their initial tables. Each group then consolidated their 'collective findings' for the selected SDG and presented it to the rest of the café.

The café was finalized by an open discussion on future actions for the CM community.

FINDINGS

This section highlights the main findings from the workshop on the three core SDGs (#7, #9 and #11). Each goal is presented by an introductory text followed by the workshop result.

Goal 7: Affordable and Clean Energy

Renewable energy solutions are becoming cheaper, more reliable and more efficient every day. Our current reliance on fossil fuels is unsustainable and harmful to the planet, this should change the way energy is produced and consumed. Implementing these new energy solutions as fast as possible is essential to counter climate change, one of the biggest threats to society's survival (globalgoals.org, 2018)

What?

The participants associated the main challenges in ensuring access to affordable and clean energy with four dimensions: Social, economic, sectorial and political. The social dimension includes a general awareness in the public of the importance of energy to society and its implication for sustainable development like climate change. This also addresses the current resistance in converting to green energy. Furthermore, the energy provided should be easily accessible, in a stable supply and affordable. This overlaps with the economical dimension where affordability is a key challenge, minimizing fuel poverty in developing and developed countries. This is impacted by the speed of the technological development that is radically reducing the costs of renewable energy e.g. from solar and wind. The sectorial dimension highlights challenges on a systems level including inappropriate use of energy, balancing energy production, grid storage, and a reduction of consumption based on energy efficiency. Also, it is important to address the residual of the energy production in the environmental impacts of greenhouse gas emissions and nuclear waste. Finally, it includes a political dimension where interest organisations for fossil fuel influence governments to favour old polluting technologies.

Table 1: Summary of workshop results for selected SDGs

SDG	#7: Affordable and clean energy	#9: Industry, innovation and infrastructure	#11: Sustainable cities and communities
What?	<p>Awareness of energy production, distribution and consumptions</p> <p>Easy accessible, stable and affordable</p> <p>Balancing energy production and use</p> <p>Lobbyism</p>	<p>Developing and renewing infrastructures</p> <p>Physical infrastructures (Buildings, schools, smart cities, transport)</p> <p>Trends (digitalization, communication and broadband)</p> <p>Resistance to change</p>	<p>Urbanisation (heat island, densification, migration)</p> <p>Community (social & equity)</p> <p>Pollution / air quality</p> <p>Land use</p> <p>Infrastructure services</p> <p>Health and well-being</p>
How?	<p>Technologies (solar, wind, smart grids)</p> <p>Unsophisticated technologies and simple solutions</p> <p>Transparency</p> <p>Policy (tax incentives subsidies)</p> <p>Research (maturing technologies, systems perspective, research based advice)</p>	<p>Create spaces and places for (inter-disciplinary) collaboration and co-creation</p> <p>Open-source collaboration and technology transfer and standardization</p> <p>Policies (funding and investments)</p> <p>Competence development</p> <p>Transparency</p> <p>Research (systems thinking, COPS, road mapping and measurement)</p>	<p>Practical (smart cities built, local grids, evaluation, green building, electric cars)</p> <p>Educational (community involvement, learn community involvement, better life by education, increase awareness)</p> <p>Research (systems thinking, data analysis, case studies)</p>
Who?	<p>Industry (companies, start-ups and landowners)</p> <p>Government (ministries, regulators, funding bodies for research & development)</p> <p>Academia (researchers, institution for higher education and schools)</p> <p>Civil society (local communities, kids, celebrities)</p> <p>Developed and developing countries</p>	<p>Industry professionals as consultant engineers, planners, contractors and suppliers</p> <p>Government (politicians, public sector)</p> <p>Academia (researchers, universities and communities)</p> <p>Civil society (expert and user communities, local communities, science fiction writers)</p>	<p>Industry (professional bodies, architects, engineers, contractors, planners)</p> <p>Government (local government, regulators and policy makers, municipalities)</p> <p>Academia (universities and researchers)</p> <p>Civil society (NGO's and social enterprises, citizens, celebrities)</p> <p>Health professionals</p>

How?

The solutions to the challenges have very strong technological elements. This includes different forms of renewable energy production (solar, wind-power) combined with smarter grids to even out the energy production and consumption from green buildings. However, it is also suggested that the solutions should be based on unsophisticated technology and simple solutions favouring local production and consumption of energy. It is specifically suggested to take the geographical location into consideration when developing renewable energy, as different locations have different potentials. Finally, the technologies should be transparent for the consumers and decision makers, e.g. enabled by a stronger emphasis on circular economy. A key driver in the development and implementation of these technologies is a strong policy agency. This includes development of tax incentives, feed-in tariffs, and subsidies for renewable energy solutions while decreasing it for fossil fuel and nuclear energy sources. The CM community can play a central role in this development through initiating R&D activities for developing, maturing and implementing technologies. This includes extending the understanding of a building to include the wider energy systems. Finally, the participants identified research-based advice as a corner stone in the development.

Who?

Based on the participant's identification, the key stakeholders can be categorized as industry, government, academia and civil society. The industry included companies, start-ups with a specific emphasis of property owners, and landlords. The main governance stakeholders are ministries, energy regulators mainly, funding bodies like the World Bank, and research councils. The later overlaps with the academia and educational actors, which also include researchers, schools and institutions of higher education. The civil society includes the kids, local communities (for local energy production), and celebrities. Finally, it was argued that a categorization of stakeholders between developed and developing countries are important.

Goal 9: Industry, Innovation and Infrastructure

A functioning and resilient infrastructure is the foundation of every successful community. To meet future challenges, our industries and infrastructure must be upgraded. For this, there is the need to promote innovative sustainable technologies and ensure equal and universal access to information and financial markets. This will bring prosperity, create jobs and ensure that stable and prosperous societies across the globe are built (Globalgoals.org, 2018).

What?

The participants identified a wide range of physical infrastructures that are central in promoting inclusive and sustainable industrialization and innovation. This includes housing, schools and smart cities, as well as transport infrastructure such as high-speed railways and bridges. Furthermore, it was highlighted that infrastructure should include local requirements as infrastructure often disregards the local communities in addressing needs of the wider public. The development is influenced by a wide range of technological trends like digitalization, cheaper broadband, data, Wi-Fi, block chain technology and web services. The need for resilient infrastructures create managerial challenges like uncertainties of scenario planning, addressing resistance to change and insuring effective coordination and communication in interdisciplinary settings.

How?

The solutions to these challenges should be based on a stronger emphasis on innovation creating spaces and places for (inter-disciplinary) collaboration and co-creation. This includes promoting mature technology to low income areas, open source collaboration practices, and “proper” regulation through standardization and building codes. However, it should also cover technical features integrating BIM and GIS as technologies for improving design. Finally, it should be acknowledge that innovation takes time especially concerning physical infrastructures. Developing and maintaining infrastructures requires access to resources e.g. in terms of finance. Thus, it is important to create policies that develop incentives for investments and development as well as allowing for risk-taking. Developing resilient infrastructures is, however, not only about technologies and regulations, but also about people. It requires a development and mobilization of competences and resources through training, workshops and educational programmes but also transparency and community-led development and collaboration. From an academic managerial perspective, this requires more research into highly integrated complex systems like COPS (complex product systems) within a general framework of systems thinking. In addition, methodology and practices for road mapping and monitoring of environmental conditions should be included.

Who?

The central industry stakeholders are; Industrial professionals such as consultant's engineers, planners, contractors and suppliers, as well as pension funds, long tail capital actors and think tanks; Governance stakeholders including politicians and governments with a special role of public sector government; Academic stakeholders including researchers, universities and communities like mainstream management science and construction management (e.g. ARCOM). Central to the academic actors is a requirement for interdisciplinary organisation and collaboration. Finally, the wider public is important, e.g. communities around experts and users, connecting expert-push and user-demands. This further includes involvement and engagement of local communities as well as science fiction writers for portraying the possible futures of societal development.

Goal 11: Sustainable Cities and Communities

The world's population is constantly increasing and to accommodate this increase there is the need to build modern, sustainable cities. For society to survive and prosper, the global community need new, intelligent urban planning that creates safe, affordable and resilient cities with green and culturally inspiring living conditions (globalgoals.org, 2018).

What?

The participants conceptualized a wide range of challenges related to cities and human settlements. The continuing urbanisation in developed and developing countries stresses land use, enforces densification and creates heat island. At the same time, the cities are challenged by social exclusion of citizen-groups, segregation, ghettos, economic disparity, inequality and crime. Furthermore, the intensified use of infrastructure creates traffic congestion and pollution that influence the air quality and the general health and wellbeing of the citizens. Finally, the cities are challenged by the effects of climate change in terms of rising sea levels, drought, scarcity of drinking water, and flooding.

How?

The participants suggested several practical solutions: technical components elements like green buildings; smart cities; local grids; electric cars; rainwater harvesting; tunnels; urban farming; systematic waste management; and recycling. Furthermore, the social dimensions should include integrated communities through formal and informal community engagement. The technical and social elements require substantial investments and increased collaboration to handle complex decisions and prioritisation. This must be supported by research activities based on systems thinking and data analysis, and articulate case studies of what works in practice. Furthermore, the educational system should support increased awareness, community involvement and better life by education.

Who?

The central stakeholders are the governance bodies like municipalities, local governments, regulators and policy makers. Furthermore, the built environment professionals and professional bodies like ACD, RIBA, ICS, ICE (associations for architects, engineers, and contractors) are key actors for shaping problems and offering solutions for sustainable cities. In addition, health professionals represent an important resource for creating healthy and liveable cities and communities. Researchers and universities are important for sustaining and developing capabilities and knowledge supporting decision makers and the wider public. Finally, the citizens are of course at the heart of the cities. However, also the wide civil society in form of NGO's and social

enterprises, communities of practice, and mass media are important. Even celebrities like Jennifer Lopez and Leonardo DiCaprio are considered important players.

DISCUSSION AND NEXT STEPS

The results reveal a consensus that the SDGs are important and that researchers and educators have a pivotal role in addressing them. The tasks, however, are highly interdisciplinary - the challenges cannot be solved from a single academic and professional discipline. It requires connecting research and education with other domains like industry, policy, technology and civil society, and thus extending the collaboration to stakeholders that are not usually engaged in academia. Thereby the findings support and extend Lucko and Kaminsky's (2015) formulation of a research agenda bridging academia and industry. It is supporting by the attention on global systems and sustainability, technology and management, and research methods and extending by highlighting the role of the wider society suggesting quadruple helix development connecting state and government; industry and business; academia and universities; and media, public and civil society.

Comparing the results, it becomes apparent that the challenges of the developing and developed countries are fundamentally different (see also Jain *et al.*, 2017). While the developed countries already have well-functioning infrastructures, developing countries lack fundamental societal infrastructures. Thus, the challenge is to create new infrastructures for developing countries while refurbishing and renewing the infrastructures of developed countries. This highlights, as previously identified by Plessis (1999), the importance of capacity building and knowledge transfer from developed to developing countries.

Given the diversity of the challenges, the specific technologies and actors vary greatly from goal to goal. However, the strategies suggested all include social and technological components. Thus, the ability to connect our current socio-technical organization with current and future opportunities is crucial in addressing the goals. This includes leveraging technologies and trends within digitalization, GIS, big data, with existing capabilities. Here classical (research) frameworks and methodologies like systems thinking, stakeholders analysis, scenario planning, road mapping, communication, services, risk and resilience must be combined with policy making, creating funding opportunities, incentivizing investments and procurement, and establishing spaces for innovation. However, it also includes a broad social and global dimension, winning hearts and minds of the wider public and creating an international mind-set for bridging developing and developed countries.

There was a collective agreement on the workshop that the construction management community are interested in a further exploration of the SDGs. The workshop represents an initialisation of a movement that potentially can influence not only the construction management community but also the wider society. Thus, based on the findings from the workshop, the paper suggests the formulation of a research agenda informed by the SDGs. This should cover activities like:

- Understanding the complex relationships between different goals, solutions and stakeholders
- Establishing measures for evaluating progress and impact. Contextualizing the goals in various context enabling local relevance while maintaining global comparison.

- Formulating specific projects for addressing targets of the goals globally and locally
- Facilitating knowledge transfer between developed and developing countries.

This agenda needs a critical engagement of the construction management community to make sure that the SDGs are not just used for greenwashing. Stigson (1999) identifies that progressive construction companies understand sustainable development as a source of competitive advantage. However, there might be a discrepancy between the formal strategies / glittered annual reports and the actual practices. While the impressive number from the Global Compact of companies and organisations who target the SDGs shows an interest, it does not say anything about the actual impact of the projects of the engaged companies. Thus, it is important to develop practices for measuring progress that acknowledge the complex interplay between the goals and targets, and is based on actual impacts. This could be a core role for the academic community of construction management.

Unfortunately, the construction management community has historically been reluctant in taking up political challenges (Singh, 2012). The relation - and balance - between science and politics is delicate. There are plenty examples of manipulation of science for political gain (politicization of science), however it should not hold us back from supporting the common good. The SDGs certainly is an outcome of political processes and include a political bias towards liberal societies. Addressing the SDGs would thus be political; however, it would be a conscious choice. It is important to iterate the fact that all research potentially shapes the society whereby it becomes a part of the political agenda. This is not a problem. The problem is that if society does not acknowledge the political dimension of our research, the relevant key stakeholders are blind to the wider impacts of our academic practices.

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