FOCUS

Quarterly E-Magazine of the
Institute of Quantity Surveyors, Sri Lanka
Volume 16: Issue 02, May 2023

Magazine Highlights

Why and Why Not Innovative **Technologies** are Accepted

The **Work-Life Balance** of Employees in the Construction Industry

The **Decarbonising** Challenge in the Construction Industry

Will **Cyber Physical Systems Takeover** Quantity Surveyors?

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Published by:
Institute of Quantity Surveyors Sri Lanka (IQSSL)

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Technology Acceptance Model: Part 1

Why and Why Not Innovative Technologies are Accepted

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The construction industry is generally known to be poor in the adoption of innovations, and this is considered to be a major challenge for improved productivity and environmental sustainability (Ofori, 2016). Innovations are not limited to advanced equipment, modern construction methods, or information technology solutions; rather, they may include using new practices such as different procurement methods, new conditions of contracts, or even a new Bills of Quantities template. Innovations are different from inventions. Inventions are objectively new advancements, whereas innovations are subjective. In fact, anything that is new to its adopter is an innovation for that adopter (Rogers, 2003).

Innovations related to Building Information Modelling (BIM) are the most talked about innovations in the construction industry in recent times (Zhong et al., 2019). Considering the adverse effects of the current economic condition on the construction industry, making use of such innovation has become more important than ever. Significant reluctance to adopt BIM is continuing to be observed in the Sri Lankan construction industry (Jayasena et al., 2019). Understanding why or why not such innovations are implemented by potential users is useful to offer the necessary motivation and support and to devise strategies for promoting BIM in the industry. This paper introduces and relates the Technology Acceptance Model (TAM) that would help to make a theoretical understanding of these contexts.

There are many models and theories that explain innovation acceptance and adoption. The TAM is one of the more popular models among them. It is found in information systems theory. Introducing the model, Davis (1989) developed and validated new scales for two specific variables, perceived usefulness and perceived ease of use, which he hypothesised to be fundamental determinants of user acceptance. While the scale may have limited practical use for the industry, the fact that two variables are the fundamental determinants is interesting knowledge for practice.

It is quite important to note that perception—the way someone understands or interprets something—is more important than what it really is. This means that it is less useful, no matter how good the new technology is, if it is not understood by the adopter. Therefore, effective communication about the new technology or other innovation becomes important (Rogers, 2003). This is an area where change agents and other supporters of technology adoption can make a good contribution.

Perceived usefulness is defined as the "degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). No matter how impressive the new technology is, if the potential adopters do not see how it can enhance their performance, there will be poor acceptance of that technology. This can often be observed with BIM promotion activities. Many impressive advancements are demonstrated in BIM seminars.

At the early introduction stage of BIM, a Quantity Surveyor attended a BIM seminar where they demonstrated modelling a house in 30 minutes. While it definitely had a "wow" effect, the Quantity Surveyor did not consider adopting BIM technology. Even a Draughtsperson who attended this seminar did not consider adopting the BIM technology because he did not find it helpful for his own job role, i.e., draughting of drawings. It was found that the demonstrators only emphasised the 3D model but did not talk about the exporting of drawings or quantity schedules. However, another Quantity Surveyor attended considered exploring the technology because she felt that it would help her to visualise how the building will look when it is completed, which would help her to improve the accuracy of her work. This shows that the same communication could cause different perceptions. The perceptions are made by making sense of what is communicated with the user's prior knowledge, beliefs, experiences, and expectations (Selwyn, 2003). Therefore, to support effective adoption, it is important to customise the communication by first understanding the characteristics of the particular adopter.

Perceived ease of use is defined as the "degree to which a person believes that using a particular technology would be free of effort" (Davis, 1989, p. 320). This does not mean that the new technology needs to be effort-free. It means that how easy or difficult the adopter sees the use of new technology has an impact on the adoption decision.

An Architect perceived the usefulness of BIM in that he could communicate his design changes "on the fly" to all other parties. But he did not want to use the BIM software because he believed that using the software itself would be "significantly more work".

However, another architect started using the technology because her Draughtsperson was also good at BIM modelling software, giving the Architect a higher perceived ease of use. Perceived ease can therefore be changed by improving facilitating conditions such as added support and training.

TAM is graphically presented in Figure 1. The model in fact identifies the effects of perceived usefulness and perceived ease of use on the attitude toward the behaviour. And then the attitude affects the behavioural intention, i.e., whether to accept the new technology or not. That in turn is supposed to cause the acceptance or rejection, i.e., the actual behaviour. While this flow of impact is present, it also identifies the continued lateral impact of perceived usefulness at all stages of the process. The same influence is not there for perceived ease of use (Teo & Pok, 2003). While this may not be seen as an aspect of concern, it should be interpreted with the dynamic nature of perception to learn the gravity of it. Perceptions are not static; they tend to change with the communication users receive and the experiences they have through the use of new technology. Therefore, supporting the maintenance of a positive perception of usefulness is important to enable acceptance of the technology.

While recalling that TAM is not the only model that explains technology acceptance, it is also noted that TAM was later developed by Venkatesh and Davis (2000) by incorporating subjective norm, image, job relevance, output quality, and result demonstrability and was recognised as TAM2. As the next step, TAM3 has been proposed, adding emotions theory, such as anxiety and enjoyment, and perceived risks of adoption as technology acceptance predictors (Venkatesh & Bala, 2008). These are to be discussed in part 2 of this article.

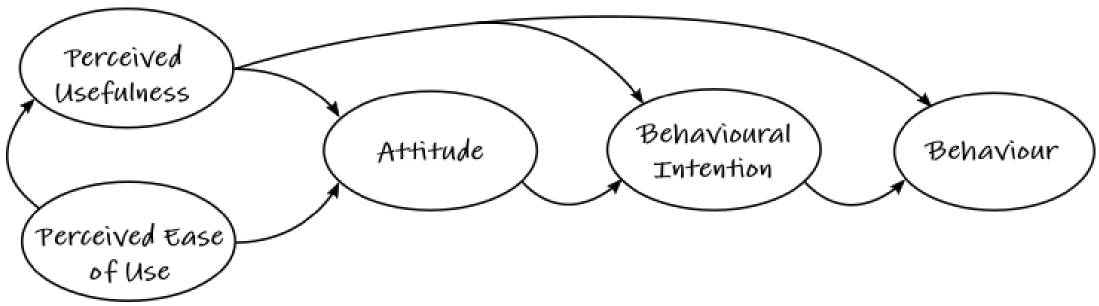

Figure 1: Technology Acceptance Model

Note: Adapted from Teo & Pok (2003)

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Research Article

The Work-Life Balance of Employees in the Construction Industry

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Introduction

Work-life balance is a critical issue for employees in modern workplaces. It refers to the balance between work demands and personal life responsibilities, including family, hobbies, and other interests (Prakash, 2018). In the construction industry, employees often work long hours, and the work is physically demanding (Peng & Chan, 2020). Thus, work-life balance is essential to maintaining the overall health and well-being of employees (Mwangi et al., 2016).

The employees in the construction industry in Sri Lanka face significant challenges in achieving work-life balance (Panojan, Perera, & Dilakshan, 2022). In Sri Lanka eighty-five percent of construction industry employees reported that they work more than 8 hours per day, with 68% working more than 10 hours (Marambage & Maduwansha, 2021). Moreover, Marambage and Maduwansha (2021) discussed 64% of the respondents stated that they work on weekends.

However, proper discussion and implementable actions have not been taken to address the work-life balance of the employees in the construction industry, including at the managerial level and lower levels. Hence, in this study, the secondary data-based articles were analysed to examine the work-life balance of employees in the construction industry, and finally, it provides recommendations to improve work-life balance.

Work-life balance

The construction industry is usually known for its demanding and time-consuming work, often requiring long hours and physical labour. Rajgopal (2010) stated that these demands can lead to stress and burnout among employees, affecting their overall health and well-being. Therefore, construction companies need to ensure that their employees have a good work-life balance. Watts (2009) discussed one of the main challenges that workers in the construction industry face, which is managing their personal and family commitments alongside work.

In the global context, employees work far from their homes and visit their homes occasionally (Kim, 2014). Similarly, workers in the Sri Lankan construction industry often have to work far from their homes, which can create significant challenges in balancing their work and personal lives (Pace & Sciotto, 2021). However, Tamunomiebi and Oyibo (2020) explained that in some cases, flexi-time schedules are followed based on the understanding between employer and employee, allowing the construction workers to enjoy family time. They may also be required to work on weekends or holidays, which can make it difficult to spend time with their families and friends.

In summary, the construction industry is mostly not providing a flexible working environment in the global context. Therefore, this affects the work-life balance of the employees and their families.

Challenges for work-life balance

One of the challenges in achieving work-life balance in the construction industry is the unpredictable nature of the work (Raun, et al., 2019). As per the demonstration of Lingard & Turner (2022), construction projects often have tight deadlines and unexpected delays, leading to long work hours and last-minute changes to schedules. This can make it difficult for employees to plan their personal lives around their work schedules. Another challenge is the physical demands of the work. Construction work can be physically demanding, requiring employees to work in hot and dusty conditions, often lifting heavy equipment and materials. This can lead to physical fatigue and exhaustion, making it difficult for employees to engage in personal activities outside of work (Bhole, 2016). In addition to these challenges, Darshana, (2017); Devadas and Wijesooriya (2021) stated that workers in the construction industry in Sri Lanka also face significant health and safety risks. Construction work is often physically demanding, and workers may be exposed to hazardous materials, dangerous equipment, and other workplace hazards. This can lead to work-related injuries and illnesses, which can further disrupt their work-life balance (Caesar & Fei, 2018).

In a study conducted by Marambage & Maduwansha (2021), 68.4% of the surveyed construction employees in Sri Lanka reported that they face difficulties balancing their work and personal lives. According to the same study, 55.6% of the surveyed employees work more than 10 hours a day, and 38.1% of them work on weekends. In a study by Gerding, Davis, & Wang (2023), 57.1% of the surveyed American construction employees reported that they do not have enough time to spend with their family and friends.

Another study found that 61.9% of the surveyed employees reported that they experience work-related stress, and 52.4% reported that they have a high workload (Mkumbo, 2014). In a study by Nanayakkara et al. (2019), it was found that work demands, supervisor support, and work-life policies significantly influence work-life balance of the Sri Lankan employees. Sri Lankan employees who reported high work demands and low supervisor support were more likely to have a lower work-life balance. On the other hand, employees who reported that work-life policies were available had a better work-life balance. According to the same study, only 28.4% of the surveyed construction employees reported that their company provides flexible work arrangements.

Strategies to implement work-life balance

It is important to provide a comprehensive guideline for the construction industry to improve the work-life balance of the employees. It supports the continuous development of the industry and the improvement of employee well-being. Panojan, Perera, & Dilakshan (2022) manifested that this can be especially helpful for employees with families, allowing them to spend more time with their children and participate in family activities. Some companies are providing on-site amenities such as gyms and recreational facilities, allowing employees to stay active and engaged outside of work hours. These amenities can also help reduce stress and improve the mental health of employees (Arunashantha, 2019). In addition, some companies are providing employee support programs, including counselling and mental health services (Joseph, Walker, & Fuller-Tyszkiewicz, 2018). This can be especially helpful for employees who are experiencing stress or burnout due to their work demands.

Conclusions and recommendations

Work-life balance is one of the top factors affecting employee retention in the construction industry. The study concludes that workers in the construction industry often experience high levels of stress and fatigue, which can lead to burnout and turnover. Furthermore, workers in the construction industry who reported better work-life balance were found to have lower levels of stress, better mental health, and higher job satisfaction. Long working hours and a lack of rest days were significant factors affecting the work-life balance for workers in the construction industry. It was found that work-life balance is a critical issue in Sri Lanka's construction industry too. Workers in the construction industry irrespective of the country face significant challenges in managing their personal and family commitments alongside work.

To address these challenges, employers must recognise the importance of work-life balance and take steps to promote it. By doing so, they can improve workers' well-being and productivity, which will ultimately benefit the industry as a whole. The study found that employers in the UK construction industry provide workers with more flexible working arrangements to help workers balance their personal and professional commitments and other benefits to promote work-life balance. Furthermore, it is recommended to revise the contract documents in Sri Lanka while allocating reasonable time for the holidays. Increasing awareness among the construction stakeholders regarding the importance of the work-life balance of the employees helps the construction sector for its sustainable future.

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Research Article

The Decarbonising Challenge in the Construction Industry: Are We Ready? (Part I of II)

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Introduction

The built environment is responsible for 37% of global energy-related emissions (United Nations Environment Program, 2021). Consequently, as many research experts and expert practitioners suggest, there is an urgent need to achieve net zero carbon performance in the built environment and construction industry to decarbonise construction. As the first of two related articles, this article introduces the need for decarbonising the built environment and how to decarbonise the built environment, while the second article will discuss the decarbonising challenge faced by the construction industry, the approaches for life cycle thinking for decarbonising, conducting building life cycle assessments, and the role of quantity surveyors in them. The implications for global citizens due to carbon emissions from the built environment are discussed within this article, while life-cycle thinking is proposed as the pathway for decarbonisation.

Greenhouse gas (GHG) emissions

Greenhouse gas (GHG) emissions refer to the release of gases into the Earth's atmosphere that trap heat and contribute to climate change. Trapping heat refers to the process of preventing heat energy from escaping a system. The main GHGs are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases (HFCs, PFCs, and SF6).

It is necessary for the atmosphere to trap some heat to keep the earth warm. However, there is an optimal limit for this trapping. When the desired level is exceeded due to GHG emissions, the Earth starts to warm beyond what is necessary, which leads to an increase in global temperatures. It is known as global warming. In other words, the accumulation of these gases in the atmosphere causes the Earth's temperature to rise, leading to changes in weather patterns, rising sea levels, and other harmful effects.

According to the Intergovernmental Panel on Climate Change (IPCC) (2014), global GHG emissions have increased by over 70% between 1970 and 2004. Figure 1 below shows statistics of global GHG emissions by type of gas:

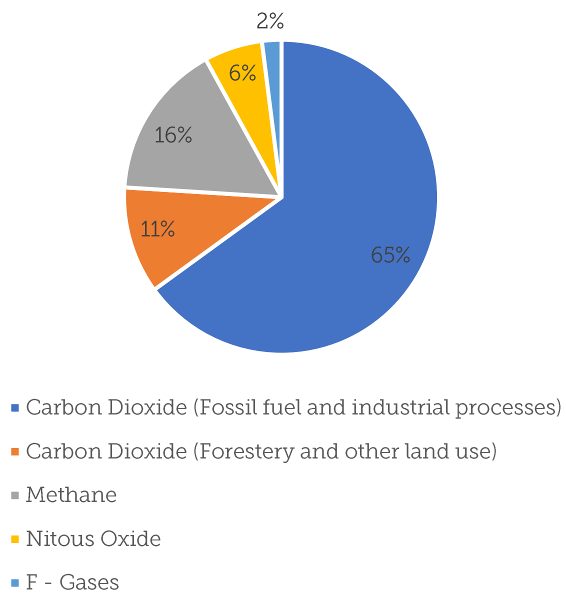

Figure 1: Global GHG emissions by type of gas
Source: IPCC (2014)

GHG emissions are primarily caused by human activities, such as burning fossil fuels for energy, deforestation, and agriculture. The majority of these emissions come from the burning of fossil fuels for energy, which accounted for approximately 72% of global GHG emissions in 2014. Other sources of GHG emissions include land use changes, such as deforestation, and agriculture, which produces methane and nitrous oxide.

According to the IPCC (2014), the main economic sectors that contribute to global GHG emissions are as follows, which are depicted in Figure 2 as well:

- Energy - this includes the production and consumption of energy, such as electricity and heat, and is responsible for approximately 25% of global GHG emissions.
- Agriculture, forestry, and other land use - 24% of global GHG emissions.
- Industry (this includes manufacturing, construction, and mining - 21% of global GHG emissions.
- Transportation - 14% of global GHG emissions.

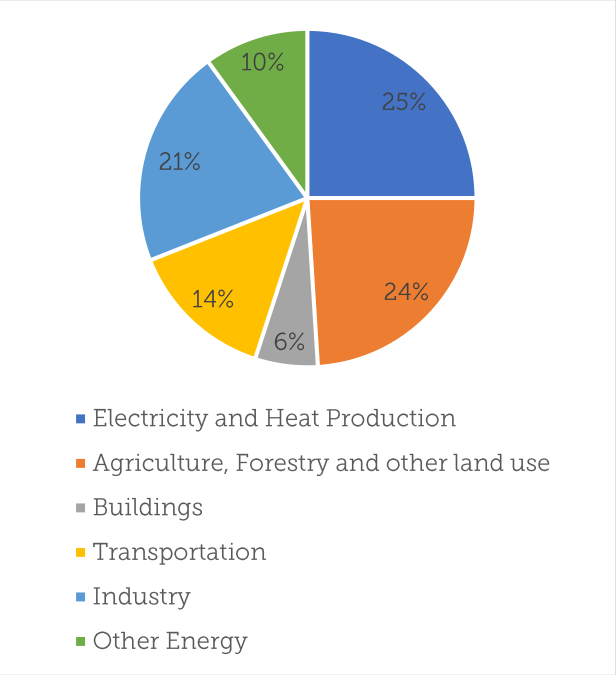

Figure 2: Global GHG Emissions
by Economic Sectors
Source: IPCC (2014)

- Buildings (this includes the construction and operation of residential, commercial, and institutional buildings) - 6% of global GHG emissions.

GWP (Global Warming Potential) (CO2 equivalents)

It is known that different greenhouse gases have different abilities to trap heat in the atmosphere, and therefore have different impacts on climate change. Global Warming Potential (GWP) is a measure based on the notion that a given amount of greenhouse gas contributes to global warming over a specific time period, usually 100 years. The GWP of a greenhouse gas is calculated by comparing its heat-trapping ability to that of carbon dioxide (CO2), which is assigned a GWP of 1. For example, methane (CH4) has a GWP of 27-30, depending on the time period considered, which means that it is estimated to have 27-30 times the warming potential of an equivalent amount of CO2 over a 100-year time horizon. Accordingly, even though CH4 is released in small quantities, its impact is considered to be high compared to CO2 and thus, compared to CO2, CH4 is nearly 30 times more potent and N2O is nearly 273 times more potent.

GWP is used to compare the relative impacts of different greenhouse gases on the climate system, and is often used in the context of policy and

Table 01: GWP and atmospheric life of various GHGs

GHG	GWP (Global Warming Potential) (CO_2 equivalents)	Atmospheric life (years)*
Carbon Dioxide (CO_2)	1	> 1000s
Methane (CH_4)	27-30 for a 100 year timescale	>10
Nitrous Oxide (N_2O)	273 for a 100 year timescale	>100
Fluorinated Gases (F- gases)	1000-10000	
Chlorofluorocarbons (CFCs)		
Hydrofluorocarbons (HFCs)		
Hydrochlorofluorocarbons (HCFCs)	100 year GWP is based on the energy absorbed by a gas over 100 years	
Perfluorocarbons (PFCs)		
Sulphur hexafluoride (SF_6)		

* The atmospheric life of a substance refers to the amount of time that it remains in the Earth's atmosphere before being removed by natural processes such as chemical reactions, deposition, or uptake by living organisms.

Greenhouse gas (GHG) emissions from the construction sector and the need for decarbonising

Emissions from the building sector arise from onsite energy generation by the burning of fuels for various heating requirements in buildings. Emissions from electricity used in buildings are usually excluded and are instead covered in the Electricity and Heat Production sector (see Figure 2 above). In Sri Lanka, more than 30% of the electricity generated is used by the building sector. In this setting, it is obvious that buildings make a significant contribution to global GHG emissions because GHG emissions from the building sector have indirect relationships with other sectors as well.

For example, GHG emissions arising from building material manufacturing are covered under the industry sector.

In 2017, global GHG emissions were 4.8 tons per capita, and they were 0.95 tons in Sri Lanka. In 2019, the global GHG emissions were 50 billion tons of CO2 – e and in Sri Lanka, it was about 20 million tons. Even though the Sri Lankan contribution to global GHG emissions is not that significant, which is only around 0.04%, Sri Lanka cannot remain silent anymore because its Climate Vulnerability Index is anyway as high as 104, which places Sri Lanka among the top 5 vulnerable countries in the world. The sector-wise spread of greenhouse gas emissions in Sri Lanka in 2019 is depicted in Figure 3 (presented in the next page).

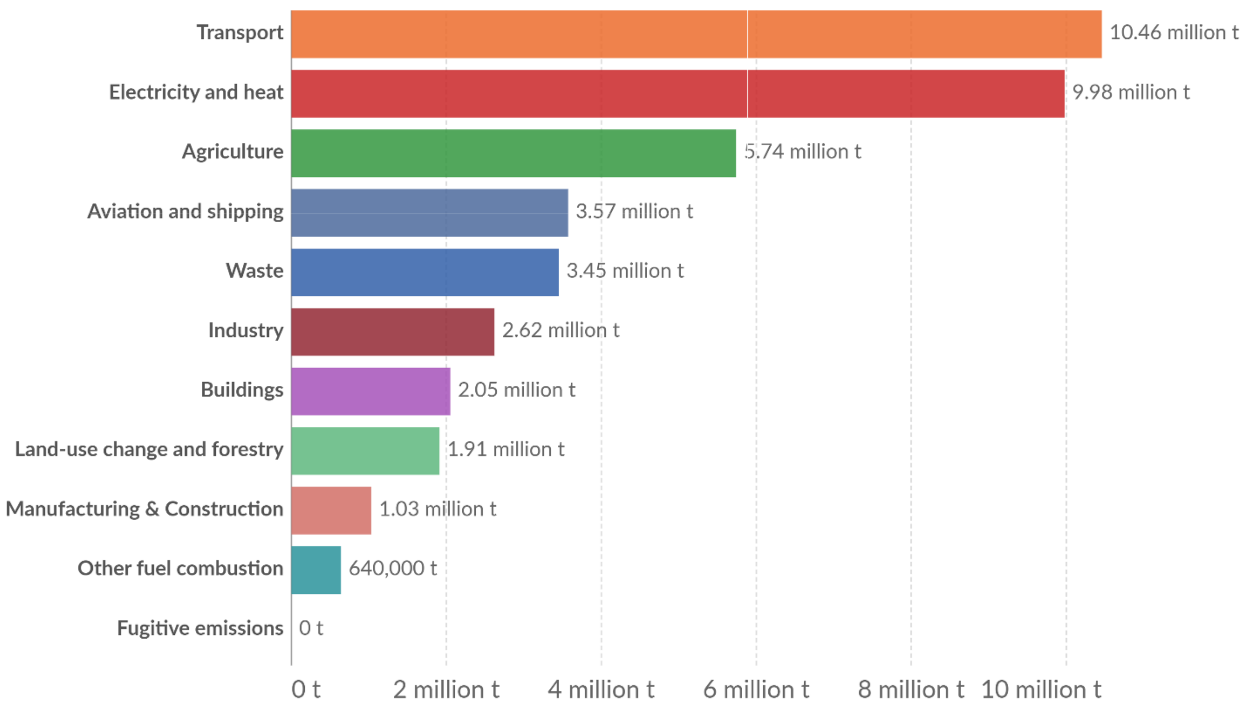

Figure 3: Greenhouse gas emissions by sector, Sri Lanka, 2019
Source: Ritchie, Roser, and Rosado (2020)

Though the building sector is not very significant in greenhouse gas emissions as per Figure 3 above, when the transport, electricity and heat, buildings, and manufacturing and construction sectors are considered together, it is apparent that the building sector plays a significant role in GHG emissions in Sri Lanka.

It has been found that the built environment generates 40% of annual global CO2 emissions, and it is expected that the global building stock will double in area by 2060 (Architecture 2030, 2023). Concrete, one of the main materials used in construction, is recognised as the second most widely used substance on the planet after water.

For example, the tallest concrete building in the world, the Burj Khalifa in the UAE, has used 330,000 m3 of concrete and 390,000 tons of steel, whereas the largest concrete structure in the world, the Three Gorges Dam in China, has used 28 million m3 of concrete and 463,000 tons of steel during construction.

The carbon intensity of concrete production has been of major concern because, to manufacture 1 ton of cement, 1 ton of CO2 has to be emitted. Cement production alone accounts for as much as 7 percent of global CO2 emissions (Isabel Malsang, 2021). Thus, concrete production is one of the largest emitters of greenhouse gases on Earth (Isabel Malsang, 2021).

How to decarbonise the built environment

Reducing GHG emissions is crucial to mitigating the impacts of climate change and meeting global climate goals. The Paris Agreement, adopted by 196 parties in 2015, aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels, with a target of limiting warming to 1.5 degrees Celsius. To achieve this, countries have pledged to reduce their GHG emissions and transition to a low-carbon economy.

There is a significant opportunity to achieve carbon neutrality in the built environment. Decarbonising construction refers to reducing or eliminating the greenhouse gas emissions associated with the construction and operation of buildings and infrastructure. There are several ways to decarbonise construction, including:

- Improving energy efficiency: Buildings can be designed and constructed to minimise energy consumption and reduce the need for heating, cooling, and lighting.
- Using low-carbon materials: Construction materials such as concrete and steel have a high carbon footprint. Using low-carbon alternatives such as timber, bamboo, or recycled materials can significantly reduce emissions.
- Utilising renewable energy: Buildings can be designed to incorporate renewable energy sources such as solar panels, wind turbines, or geothermal energy.
- Implementing circular economy principles: This involves designing buildings with the aim of minimising waste and maximising the reuse and recycling of materials and resources.
- Reducing embodied carbon: Embodied carbon refers to the emissions associated with the production, transportation, and disposal of building materials. Minimising embodied carbon can be achieved through the use of low-carbon materials and practices such as local sourcing of materials.
- Purposeful deconstruction.

By adopting these measures, the construction sector can significantly reduce its greenhouse gas emissions and contribute to the global effort to mitigate climate change. In order to enhance the building's life cycle performance, changes in the whole life cycle are needed. Generally, the main concentration of buildings and infrastructure is in the design and construction stages. However, in the life cycle, these two stages are the shortest. On the other hand, decisions made in the design and construction stages determine end-of-life behaviour. Therefore, professionals need to be aware of the whole life cycle, and overall, life-cycle thinking is proposed as the pathway for decarbonisation..

Most of the countries that started their journey towards net zero have the right policies in place. Research and development on materials and energy are essential, especially the development of local materials. However, it is not possible to wait until all the requirements are fulfilled. The easiest thing we can do is start quantifying the problem. Under that, the main focus is on quantifying environmental impacts. Quantification will allow us to benchmark where we stand.

Among the changes required in the construction industry to achieve decarbonising targets, changes in product outcomes, design and specifications, construction and reuse, and procurement are the most important.

Changes in procurement are where most of the experts are interested, and it is the most important area where Quantity Surveyors can also play a major role. Changes to the procurement of goods, services, and works, as well as the business models and supply chains involved, cover almost all aspects of procurement with respect to the construction industry. Procurers, such as the government, must change their approach to procurement to reflect whole-life carbon performance. Furthermore, procurers can use their purchasing power to stipulate carbon performance through specifications and the requirements that are set out in both public and private contracts. Thus, procurement practices have been a key driver of carbon performance within the construction sector.

Acknowledgement

The authors would like to express their sincere gratitude to Professor Shiromi Karunaratne at the Sri Lanka Institute of Information Technology for the online session she delivered on the topic of "Decarbonising Challenge: Are We Ready?" for the Continuing Professional Development (CPD) programme of the Institute of Quantity Surveyors Sri Lanka (IQSSL) on the 16th of December, 2022. This article was prepared based on the key concepts, facts, and figures presented at this CPD session with the intention of further elaborating, clarifying, and disseminating the knowledge on the decarbonising needs in the Sri Lankan construction industry with a wider community. Our thanks also go to the organisers of the IQSSL's CPD programme as well as the participants of this specific CPD session, who generously shared their knowledge and perspectives with everybody.

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Research Article

Will Cyber Physical Systems Takeover Quantity Surveyors?

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Technological innovation is one of the key features that is currently affecting design, construction, and facility management (Codinhoto et al., 2023). As a result, the industry of architecture, engineering, and construction is also undergoing a transformation of its conventional business processes through the adoption of innovative technologies (Schiavi et al., 2022). These applications include automation of manual processes and knowledge management, document classification, digital engineering for labour productivity, construction management, and data visualisation with the industrial revolution (Pan et al., 2022; Zhu et al., 2022). Although each industrial revolution is often considered a separate event, together they can be better understood as a series of events building upon the innovations of the previous revolution and leading to more advanced forms of production. Figure 1 shows the history of the industrial revolution up to the fourth industrial revolution (IR 4.0).

The speed and measure of the changes coming due to the fourth industrial revolution are not to be ignored. These changes will bring about shifts in power, wealth, and knowledge. Hence, IR 4.0 has a spillover effect on the construction industry, which includes smart production (Lee & Park, 2022). Therefore, smart construction will be a growing trend for the future of construction as innovative technologies are increasingly being used in construction, such as Building Information Modelling (BIM), cloud computing, the Internet of Things (IoT), big data, Cyber Physical System (CPS), Internet of Services (IoS), Artificial Intelligence (AI), Mobile Internet, automation, all of which are united by the concept of Industry 4.0 (Manogaran et al., 2023; Sawhney et al., 2020).

The construction industry is transitioning to the widespread use of Cyber-Physical Systems (CPS) due to the implementation of these innovative technologies (Akanmu et al. 2021).

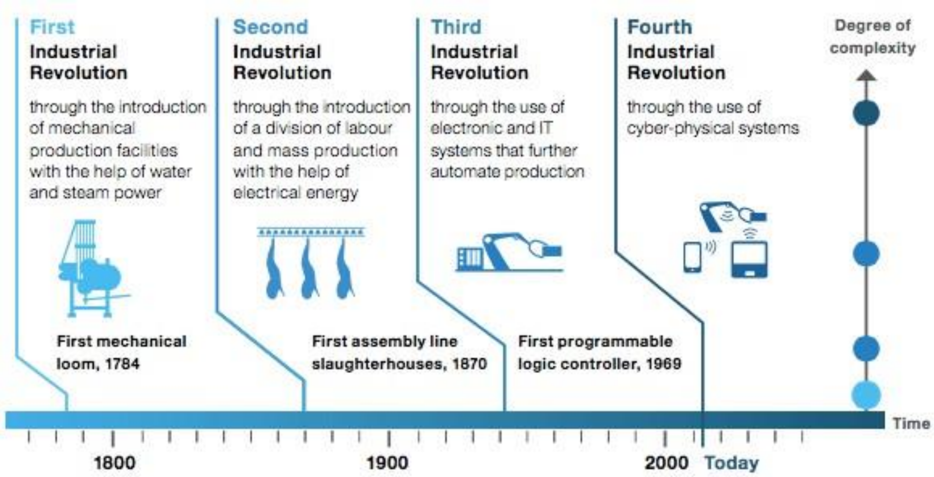

Figure 1: Evolvement of Industrial Revolution
Source: (Savić, 2020)

Nowadays, CPSs could be considered a game changer in a wide range of industries that integrate both the cyber and physical worlds. Figure 2 shows the mapping between the physical and cyber worlds. Wireless sensors, visualization devices, real-time monitoring, and data fusion devices are critical components for bi-directional communication between the physical world and its virtual representation (Kan et al. 2017).

The physical component consists of different resources such as human, machine, material, environment, and execution. The cyber part has several applications and services, which include smart data management, analytics, and computing technologies, as shown in Figure 2.

Figure 2: Mapping between physical and cyber
Source: (Tao et al., 2019)

CPS continuously expands its application to various areas such as robots, smart devices, transportation, and critical infrastructure, among others (Ramasamy et al. 2022). The rapid developments in information and communication technology have made the exploration of the CPS approach in the construction industry possible.

Based on the current practices of the construction industry around the world, CPS could be seen as a far-fetched technology to solve the recurrent problems seen in the construction industry.

Improvements in progress monitoring, construction process control, as-built documentation, and sustainable building practices are some potential uses of CPS in construction (Alzubi et al., 2022; Tetik et al., 2019). Other than that, many researchers identified the usage of CPS and its supportive applications in construction: building efficiency monitoring (Bonchi et al., 2019), integration of building information models and physical construction (Akanmu & Anumba, 2015), planning and operation of mobile cranes on construction sites (Kan et al., 2017), tracking of scaffolding in construction projects (Sutrisna et al., 2018), computer-aided design (Chelyshkov, 2019), and materials management in construction projects (Kasim et al., 2013). Having everything attached to everything else in the CPS is going to monumentally increase the vulnerabilities present in any construction project. Consequently, the implementation of CPS will impact professionals in the construction industry.

As professionals in the industry, Quantity surveyors perform a wide variety of tasks throughout the life cycle of a construction project. Further, Quantity Surveyors are more involved in project financing than any other professionals. Hence, Quantity Surveyors face numerous challenges, which often arise during the design stage. Design drawings and specifications were in conflict, containing errors and lacking sufficient details to provide accurate cost advice. Buildability issues also arise from designs that are too complex, which may lead to constructability problems. This is mainly due to the lack of understanding by designers regarding the way in which buildings are constructed in practice. Another issue is the time-consuming process of executing quantity take-offs.

This becomes more challenging on projects where large amounts of drawings need observing and analysing, especially when frequent changes are required, resulting in inaccuracies in estimates. In many instances, manual take-off may result in human error. Therefore, there is an increasing trend in the use of CPS and related applications by Quantity Surveyors to minimise these challenges.

BIM provides an IT-enabled approach where all disciplines can collaborate, share, and work effectively (Pittard & Sell, 2017). It supports providing a smooth flow of information throughout the phases of a construction project; equally, the improved collaboration between stakeholders enables quick and easy information transfer by combining the work of different disciplines within a centralised model (Grillo & Jardi-Goncalves, 2010). According to Smith (2016), BIM allows Quantity Surveyors to spend more time providing knowledge and expertise to the project team as the time taken to generate quantities is significantly reduced. Muzvimwe (2011) stated that BIM raises the value of Quantity Surveyors' services by offering the ability to envision, simulate, and explore the impact of different design and construction scenarios through the integration of cost data, quantities, and project programmes within a BIM model. BIM offers the ability for Quantity Surveyors to take-off, count, and measure directly from a regularly updated model through 5D BIM applications by linking the model to estimating software (Haque & Mishra, 2007). With the tedious task of quantification in some sense being automated and effortless, it allows Quantity Surveyors to pay attention to and provide expertise on other project-specific factors (Mayouf et al., 2019).

Previous studies highlighted that due to innovations and advanced IT applications related to the construction industry, the employment model of Quantity Surveyor has also been completely redefined. Professional bodies such as RICS also mentioned that Artificial Intelligence (AI) and the Internet of Things (IoT) have now become core parts of industry operations. Currently, Quantity Surveyors use various software that can update, maintain, store, and share data in multiple dimensions. Therefore, CPS will help Quantity Surveyors increase the viability of construction projects by reducing costs, time, and management effort. However, Quantity Surveyors or organisations that have adopted CPS have not gotten the full benefits of the system. For instance, there is a lack of coordination and consistency between virtual models and physical construction. Developed virtual models at the design stages are not effectively used during the construction stage. By providing a connection between computational models and the physical environment, CPS offers an appropriate mechanism for Quantity Surveyors to fill that gap.

Nevertheless, some construction firms may not be able to financially fund the CPS implementation within their firms as it involves the education and training of their staff members, which requires substantial time and cost commitments. The education aspect of CPS may be assisted by universities teaching graduates the foundation knowledge required before entering the industry (Terik et al., 2019). Despite CPS having its benefits, improvements and developments are still required for better implementation. It can be argued that, with the implementation of CPS, designers should now design to cost.

Therefore, rather taking over the role of Quantity Surveyors, CPS will facilitate a rich data model to form accurate estimates through collaboration and a smooth flow of data/information from an early stage.

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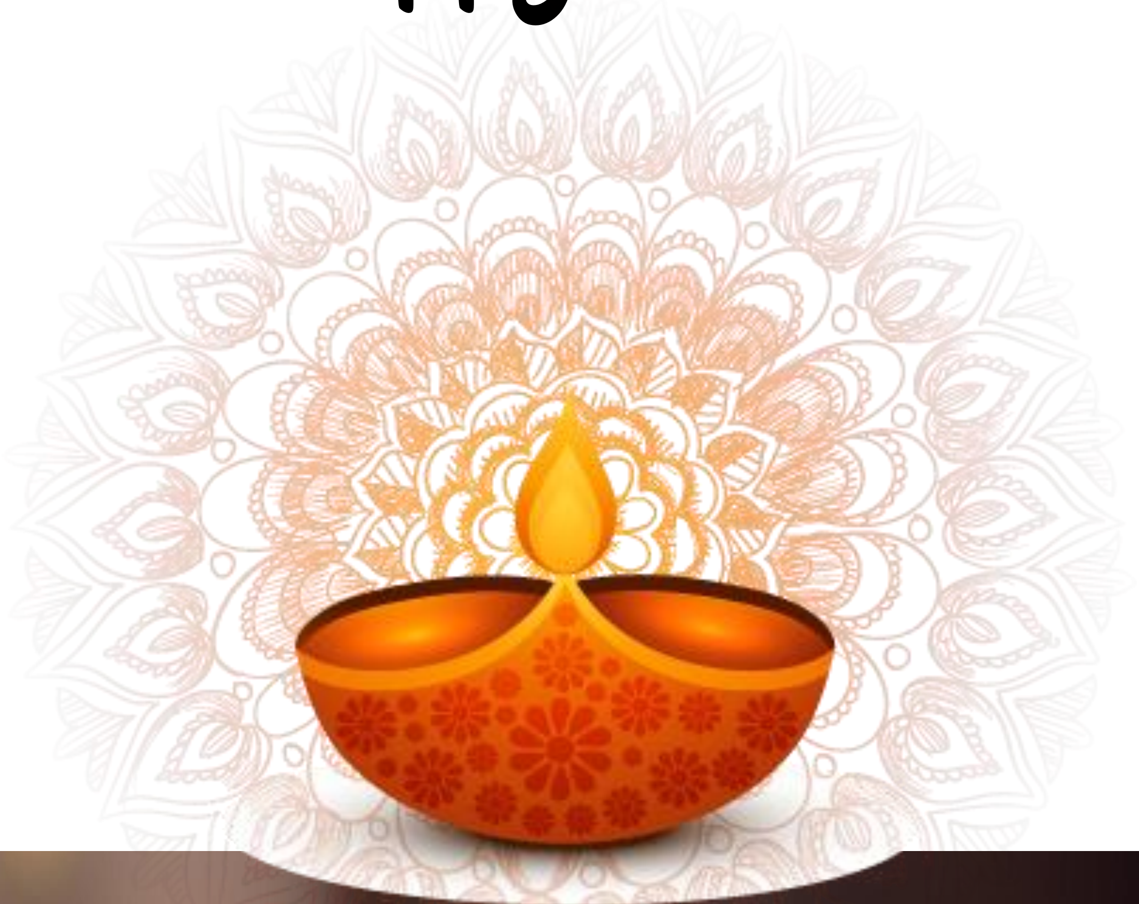
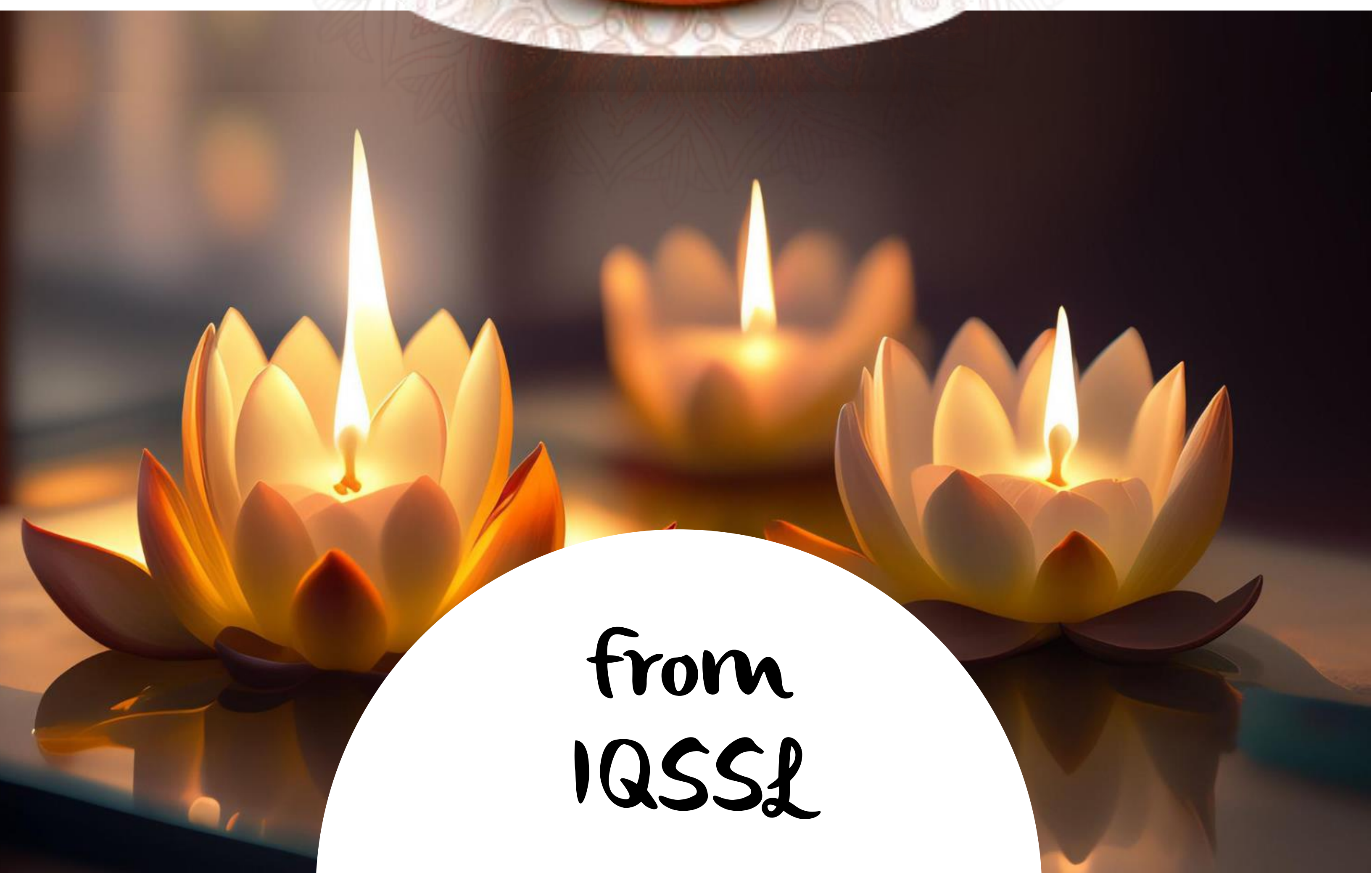
Happy Vesak





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CPD No.	Title	Resource Person	Date	Venue
CPD 05 - 2022/2023	Dispute avoidance mechanisms in construction industry	Ch.QS Tilak Kolonne	23rd March 2023	Online
CPD 04 - 2022/2023	Uses of blockchain technology in the construction industry	Dr. Navodana Rodrigo	20th January 2023	Online
CPD 03 - 2022/2023	Moving to New Zealand as a QS – matters to ponder	Ch.QS Nilmini Thilakarathna, Ch.QS Dr. Inoka W. Gamage	6th January 2023	Online
Round Table Discussion 01 - 2022/2023	Meeting the decarbonising challenge: A software tool to facilitate carbon calculations	Prof. Shiromi Karunarathne	10th February 2023	RCU Skills Centre, Rajakeeya Mawatha, Colombo 07

The PAQS-Iwata Foundation 2023 Travelling Scholarship Competition

The Pacific Association of Quantity Surveyors established the PAQS-Iwata Foundation in 2008 for the purpose of promoting the QS profession and the professional development of young quantity surveyors in the PAQS region. The Foundation is now sponsoring an international essay competition for young members from PAQS member countries.

The competition winner will receive travel airfares, 3 nights' accommodation and full registration for their attendance at the next PAQS Annual Congress which will be held from 25th - 26th September 2023 in Kuala Lumpur, Malaysia

Entries for the competition are now being accepted and will close on Friday, 28th July 2023. Properly completed essays should be emailed to the PAQS Secretariat at secretariat@rism.org.my

Entries will be judged by an international PAQS-Iwata Foundation panel who will announce the result by 15th August 2023. The panel's decision is final.

The topic for the essay competition for 2023 is

"THE QS ROLE IN DECARBONISING THE FUTURE"

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