

# Construction Information Management: The Role of Fourth Industrial Revolution Tools

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## ABSTRACT

Construction Information management is the act of collecting, storing, distributing, archiving and deleting or destroying information to facilitate smooth running of construction projects. This information is important for planning, budgeting and completion of construction projects. In construction, managing of information is a vital part of decision-making procedure and it helps to guarantee that the accurate decisions are made by stakeholders at the appropriate time. 4th industrial revolution is poised to fundamentally alter the way construction activities are carried out. It represents a new era of innovation in technology, which will boost man-machine relation and catalyze effective and efficient information management in construction. Construction industry continues to encounter challenges in information management, but it is expected that the advent of 4th industrial revolution will assist in resolving these challenges. This research aims to evaluate the role of 4th industrial revolution tools in improving the management of construction information. Data from extensive review of literature were extracted to demonstrate the level of activities of 4IR tools in construction information management. The paper finds out that due to the heavy quantities of information generated, processed, and stored prior to, during and post construction, 4IR tools can assist in managing this information. The findings also provide new knowledge about the management of construction information. The study concluded that adoption of 4IR tools will enhance effective and efficient information management in the construction industry.

**Keywords:** Construction industry, Information management, 4IR tools, Industrial revolution

## INTRODUCTION

Construction Information Management (CIM) has turned into a set up worldview for the improvement of upgraded project performance practices (Guo, 2016). It is evident that appropriately created and managed construction information enables effective and efficient project performance; mathematically and pointly precise project cost management; and particularly

recognizable building component information (Andersson & Widstrand, 2020). Construction project scheduling depends on precise and ideal data and information for professionals and shareholders to make informed decisions and achieve their tasks in a cost-effective and compelling way (Kaur, 2012). When there is efficiency in construction information administration, the resulting effect empowers project teams to utilise their time, assets and mastery viably to simply decide and to accomplish the project (Edmondson & Nembhard, 2009). The procedural stages of construction information management incorporates five significant stages (Volkov et al., 2016). The first is assortment of project data can take many structures, for example, composed, video, oral, sound or electronic. Gather just as much data as sensibly required and guarantee its quality, for example data that can be relied on (Daswani et al., 2003). The second step which is capacity is significant for a scope of purposes including: investigation, recognizing chronicled patterns, creating examples mastered, fulfilling authoritative necessities and so on (Solihin & Eastman, 2015). Proper controls including client access, send out controls, forming, change control, review, and back-ups should be set up. The following stage which is curation incorporates the method involved with social occasion and coordinating data applicable so it can add significance (Girard & Girard, 2015). After curation, the following stage is dispersal (Morales-del-Castillo et al., 2009). It includes thought of inquiries, for example, what data is to be circulated, to whom, in what design, how frequently, under what conditions and utilising what security conventions? The last advance is chronicling which happens after a timeframe, generally controlled by a blend of organisation strategy and judgment (Kinder-Kurlanda et al., 2017). This is along these lines, is as a result of the enormous volumes of data filed. This then necessitate a compelling characterisation framework that augment future uses fundamental.

This multitude of steps have been made simple, viable and proficient through the development of 4IR devices. The advantages and possibilities of the reception of 4IR devices to the construction industry are broad, from simplicity of obtainment and expanded joint effort to diminished overheads and helping financial turn of events (Tempest, 2020). Despite the fact that achieving this potential will require a submitted and community-oriented exertion by the construction industry, it will likewise more urgently depend on the public authority to establish a ripe climate for the digitalisation of the industry. Due to these advantages and possibilities of 4IR, it is imperative that strategic policy makers and regulators, in cohesion with key project proprietor and the public authority of the day build up a halfway financed framework research support stage, joint industry and scholastic assets, charge motivations, and plans for future challenges that could be incurred through innovative works (Plantin et al., 2018). This sort of framework would take into account effective oversight and facilitate public area interest, subsequently driving industry complete use of 4IR devices. The utilisation of 4IR instruments in construction data management is targeted towards upgrading the standard of structures, further develop wellbeing and security, working conditions, supportability, as well as enhancing construction output, and mitigate project's abandonment or delay in delivery (Begić & Galić, 2021).

Existing studies shows the utilisation of 4IR tools in numerous viewpoints like conducting energy, security, agricultural intervention, and project control. Nonetheless, appraisal of 4IR tools usage is as yet in arising stages where most investigations are hypothetically and theoretically proposed. The majority of the appraisals must be considered as the consolidation of 4IR devices in a developmental set-up that needs information sharing across the web through an incorporated system. The applications 4IR devices coupling mechanics are dissipated, it is adequately developed that data blueprints, issues, and enactment can be distinguished.

While the 4IR devices fusing into use for information management in construction is at the evolving stage, there is a need to comprehend the current circumstance of 4IR instruments through the research question of this review which are:

- What are the 4IR tools used in construction information management?
- What are the roles of 4IR tools in construction information management?

## **METHODOLOGY**

To guarantee a thorough and comprehensive audit of construction information management and 4IR tools, 4IR related articles from top-rated journals; computer programming related publications; electrical and electronic designing and software engineering databases were examined for the survey. The exploration was instated by deciding the primary catchphrases (i.e., “fourth industrial revolution (4IR), industry 4.0, development 4.0, 4IR tools, augmented and virtual reality, data management”), which were utilised in different context in each section of the paper. To procure state-of-the-art and high-impact papers, the obligatory precautions were taken: extensive search from google scholar; setting article choice criteria and select high significant articles; paper search in institutional data sets and libraries; erasure of duplication and insignificant articles; and afterward cross-checking articles to ensure that the article contents are distinct but being in correlation with the subject matter.

## **ROLES OF 4IR TOOLS IN CONSTRUCTION INFORMATION MANAGEMENT**

The fourth Industrial Revolution rethinks being human and how we draw in with each other and the planet (Manda & Dhaou, 2019). The construction area can utilize innovation to find and interface with more individuals who need their administrations, comprehend their networks on a more profound level, and supply better administrations to accomplish more objectives (Porter & Kramer, 2019). Simultaneously, the capacities and capability of construction information management framework will all advance alongside the innovations (Trimble et al., 2006). The significant jobs of 4IR devices in construction information management are recorded in following subsections.

### **Improved Services and Productivity**

Firstly, 4IR tools propose the prospect for additional modified service by freeing up construction sector workforces to engage in more client's satisfaction-oriented roles and much lesser percentage of the grunt work (Agbehadji et al., 2021). These tools will enhance communication among the project team, interaction between the construction firm and the clients. This will make communication more efficient and effective. Secondly, services will become timelier, and even predictable (because final output will align with the projected output) (Mpofu & Nicolaides, 2019). Over the years, one the major challenges in the construction industry is delay in completion of construction projects, but with the incorporation of 4IR tools there will be a drastic reduction in delay of project completion and also a drastic reduction in abandoned projects (Petrillo et al., 2018).

### **Rapid Expansion**

Growth is a factor for which higher percentage of construction firms strive for, regardless of their size. Lesser firms intends to get bigger, bigger firms intends to get greater (Elazab et al., 2019). Large volume of information is being shared during construction process, therefore there is a need for advance information management system to accommodate this information (Fox & Signé, 2021). Incorporation of 4IR tools for construction information management has the potential to provide small and medium construction firms with an innumerable benefits, comprising things like superior proficiencies after economies of scale, better power, a superior capacity to resist market fluctuations, an enhanced persistence rate, more profits, and amplified reputation for organisational staffs (Oosthuizen, 2017). Construction firms yearns for growth due to the reason that it is observed largely as an emblem of achievement and progress. Organisational growth is normally used as a pointer of efficacy for construction firms and is a vital consideration of many construction managers (Karr et al., 2020). Ultimately, achievement and progress will be assessed by how good a firm performs relative to the goals set aside to achieve, which for this scenario usage of 4IR tools for information management has helped construction firms to achieve its goals (Oosthuizen, 2016).

### **Competitive and Sustained Competitive Advantage**

Construction firm that incorporates 4IR tools is believed to possess a competitive advantage because it implements a significance generating strategy not concurrently being applied by any existing or prospective competitors (Bosch & Rossouw, 2021). So therefore, a firm that relishes "a competitive advantage or a sustained competitive advantage" is executing a strategy not concurrently being applied by any existing or prospective competitors (Asoba et al., 2021). A competitive advantage indicates feature that empowers a construction firm to outclass its competitors. This permits a firm to accomplish greater success compared to its competition and creates value for the establishment, its bondholders and its client. The more sustainable the competitive

advantage, the more difficult it is for competitors to neutralize the advantage (Malik et al., 2020).

## LESSONS LEARNT

The review of literature explained in this research emerged from a total of 121 examined bibliographic sources. The vital words were mined from the abstract and designated field of the references. 4IR varies from the preceding industrial revolutions ordinarily by offering integrative polyvalent innovations. Hence, 4IR already possess and will possess a much broader scope than the preceding industrial revolutions. In as much as 4IR has already taken place in several countries, developed countries of the world are already operating in 4IR, developing and under-developed countries are encouraged to toe the line. The expansion of 4IR technologies has stirred numerous changes in all categories of industries, which includes the construction industry. Throughout this all-encompassing research review, it is evident that the 4IR is being acknowledged in the construction industry ever since the number of publications and the number of presented utilisation of 4IR innovations in the construction industry is continuously growing. Thus, the motivators of the 4IR are discovered to be the motivators of Construction 4.0. The paper showed that the use of 4IR tools enhances growth and advancement through it possession of efficient capacity as demonstrated in the reviewed literatures.

With the aim of answering research question (RQ) 1, the study presented an enlightenment on the 4IR tools used for information management in construction. There are lots of tools used, but this research focused on Mobile device, Autonomous vehicle, Artificial Intelligence, Augmented Reality and Robots. These tools were selected because they got lots of mention in the reviewed literature. Most of these innovations did exist for general purposes, but it was the conception of 4IR that opened them into broader application and provided them more popularity by growing awareness in the whole conception. It was discovered that due to the heavy quantities of information generated, processed, and stored prior to, during and post construction, 4IR tools can assist in managing this enormous information.

For RQ2, the roles of 4IR tools in construction information management was answered. It is understandable that 4IR tools improves services and productivity; and aids rapid expansion of a construction firm. They also give a firm competitive advantage over rivalry firms. Communication in the construction industry is usually entangled in challenges such as misinterpretation of information, loss of information due to the vastness and other challenges. Adaptation of 4IR tools proffer numerous means to mitigate these challenges. The study further showed that it is uncertain whether there will be rapid incorporation of 4IR tools despite the numerous roles and advantage that 4IR tools proffers since the construction industry is resilient to revolution and does not effortlessly give up conventional traditional practices (especially in under-developed and developing countries). However, the study conveyed that construction firms are adopting 4IR tools for managing their data.

## CONCLUSION

This paper adds to the body of knowledge by introducing a top to bottom survey of construction information management and 4IR tools. The roles of 4IR and its devices which have the possibility to work with arranging, checking, and controlling of different angles identified construction information management should be invited and presented in the built environs and on projects. This will improve proficient and compelling execution of laborers when doing projects. The degree of mindfulness comparative with the expected execution of 4IR ought to be raised by legal bodies, and expert and business affiliations, which will prompt the advancement and assistance of associated continuing professional development (CPD). Contextual investigations involving the organisation of 4IR innovations for data management, ought to be recorded, and the discoveries shared, which are probably going to impact the positive discernments regarding the capability of such 4IR instruments. Potential modules of 4IR apparatuses ought to be coordinated into the prospectus of tertiary fabricated climate instructive framework for wide mindfulness and early acclimation with development understudies. Further likely jobs of 4IR incorporate simple linkage of “progress of work” to data required, which will work with opportune arrangement of such data, along these lines advancing usefulness and the gathering of customized prerequisites (staying away from delay in project conveyance).

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