

Digitalisation of Construction Organisations in South Africa: A Dynamic Capability Theory Approach

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Abstract

Digitalisation is a key driver of the Fourth Industrial Revolution and the digital transformation of construction organisations, for better service delivery, has become a popular clamour among academics and construction professionals alike. However, both the digital world and the construction industry are dynamic in nature. Therefore, a construction organisation that will attain sustained competitive advantage in this ever-changing environment through the digitalisation of its operations, must carefully consider its dynamic capabilities. Based on this knowledge, this study set out to create a direction through which construction organisations in developing countries like South Africa can increase their dynamic capability to attain a competitive advantage through the digitalisation. In achieving this, the dynamic capabilities needed by construction organisations were assessed through a review of the Dynamic Capability Theory. Findings revealed that construction organisations need to grow their dynamic capabilities in the area of sensing of opportunities and threats within their environment, seizing of sensed opportunities, and reconfiguring of their organisational resources to conform with the ever-changing environment. Some notable factors needed towards attaining these feats are investing in research and development, careful selection of digital technologies, tapping into suppliers and complementor's digital innovations, understand changing clients' needs, selecting the right decision-making procedure, controlling challenging assets, and many more. The findings of the study can serve as a starting point for the awakening of construction organisations that seek to gain a competitive advantage over their competitors through digitalisation of their services.

Keywords: Competitive Advantage, Digitalisation, Digital transformation, Digital technologies, Dynamic Capability Theory

1. Introduction

All over the world, the construction industry is dynamic, and its activities are not static. This uncertain nature of the industry can be attributed to the clients' growing demand, the complexity of construction projects, advancement in technology and the introduction of digital innovations (Navon, 2005; Oke and Ogunsemi, 2011). Clients' taste and demand are not static, and construction participants are saddled with the responsibility of meeting these demands through every available method. This situation has placed stiff competition among construction organisations, who take up the responsibility of delivering construction projects in return for a particular financial reward. For these organisations to survive this obviously competitive environment, strategic planning and adoption of innovative ideas are important (Aghimien *et al.*, 2018a). One such approach is the adoption of digital technologies (DTs) which are key instruments geared towards attaining digitalisation.

It has been stated that digitalisation is the application of DTs in the operations of an organisation (Kalavendi, 2017). Ochs and Riemann (2018) described it as the use of DTs in everyday life, through digitising anything that is capable of being digitised. According to Crampton (2017), digitalisation is the use of DTs to transform the business model of an organisation, while at the same time providing new revenue streams and value-producing opportunities. Based on the aforementioned descriptions, in the context of this study, the term digitalisation is conceptualised as the "innovative use of DTs in the

delivery of tangible and intangible services within a construction organisation with a view towards gaining a competitive advantage over other competitors, and providing better service delivery”.

It is interesting to note that while the construction industry is ever-changing, the digital world is also dynamic in nature (Solis, 2016). Therefore, a construction organisation that will attain sustained competitive advantage in this uncertain environment through digitalisation, must carefully consider its dynamic capabilities. These dynamic capabilities are believed to be responsible for the adjustment in the usual routines of an organisation (Winter, 2003). It has been seen as an organisations ability to utilise its internal and external resources to address rapidly changing environment (Tecee *et al.*, 1997), organisational routines used in achieving new resources that brings about market change (Eisenhardt and Martin, 2000), as well as a learned pattern of collective activities used by an organisation to generate and modify its operations in order to attain improved effectiveness (Zollo and Winter, 2002). Khin and Ho (2018) have noted that the ability to implement the DTs in the operations of an organisation is the first step towards attaining competitive advantage. Similarly, studies have observed that if DTs can be implemented in a manner that promotes the main strategic and operational objectives of an organisation, then significant benefits can be derived in the area of organisational performance (Chen *et al.*, 2014; McLaughlin, 2017) and significant competitive advantage can be attained (Teece, 2007). It is based on this knowledge that this study set out to create a roadmap with which construction organisations in developing countries like South Africa can increase their dynamic capabilities to attain competitive advantage through the digitalisation of their operations. This was done through the review of the extant literature on dynamic capability theory.

2. Digitalisation of the construction industry

There have been four industrial revolutions that have altered mankind’s way of existence. First is the human’s transitioning from being a hunter-gatherer society to agrarian society, and from then on to becoming an industrialised society. From the industrial transformation came the advancement in information, and this saw human society becoming more information-oriented with the use of information technologies (Ozlu, 2017). Currently, the fourth phase of the industrial revolution known as the Fourth Industrial Revolution (4IR) is upon us. The 4IR is essentially the application of diverse technologies in an organisation or industry’s activities. It is believed that digitalisation is a key driver of the 4IR as most of the technologies and processes that characterise the revolution is digital in nature (Bienhaus and Haddud, 2017). Crampton (2017) defined it as “the use of DTs to change the business model, provide new revenue streams and value-producing opportunities”. Dimick (2014) viewed DTs from three facets and these are software, information technology equipment (computers and related hardware), and communications equipment. Example of these DTs include the building information modeling (BIM) which according to Ashcraft (2007) “utilises cutting-edge digital technology to establish a computable representation of all the physical and functional characteristics of a facility and its related project life-cycle information, and it is intended to be a repository of information for the facility owner/operator to use and maintain throughout the life-cycle of a facility”. Iben and Laryea (2014) described BIM as one of the most popular technologies that have gained significant recognition within the construction industry in recent time. There is also augmented reality, which is an innovation that gives an augmented view of objects or designs using specific gadgets (Celaschi, 2017); Internet of Things (IoT) which implies an overall system of network which are linked to each other and uniformly addressed objects by means of standard conventions (Vaidya *et al.*, 2018); and big data analytics which is viewed as the most vital technology in relation to the large collection, preparation, and investigation of unorganised and organised information with savvy algorithms (Petrillo *et al.*, 2018). There is also the use of autonomous robots in performing autonomous production (Bahrin *et al.*, 2016), cloud computing wherein scalable IT-related capabilities are provided as a service over the Internet to multiple external customers (Kumar and Ravali, 2012; Noor *et al.*, 2013), 3D printing which is the process of creating a physical object from a 3D digital model in a layer by layer process (Lim *et al.*, 2012), and many other technologies which are gradually gaining recognition within the construction industry.

De Andrade Régio *et al.* (2016) have noted that the implementation of these DTs is still in the early stages, and only a few have been adopted by the construction industry. Similarly, other studies have revealed that despite the immense benefits proposed by the application of DTs, its adoption within the

construction industry is considerable low (Argawal *et al.*, 2016; Castagnino *et al.*, 2016; Osunsanmi *et al.*, 2018). De Andrade Régio *et al.* (2016) opined that the espousal of DTs and the application of its concept will provide construction organisations with a competitive advantage over their counterparts. According to Petrillo *et al.* (2018), this adoption will further help improve efficiency and productivity within the workplace and maximise flexibility. However, Bienhaus and Haddud (2017) noted that although digitalisation is important and propose significant benefits, the approaches towards achieving digital transformation in organisations differ in terms of how organisations picture its inherent opportunities and handle its challenges.

3. Dynamic Capability Theory

The Dynamic Capability Theory (DCT) is an extension of the Resource-based view (RBV) which has been described as a theoretical framework which influences the organisations understanding of how competitive advantage can be achieved and sustained (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). According to Zhou and Li (2010), RBV suggests that competitive advantage within an organisation can only be derived through an organisation's valuable, rare, inimitable, and non-substitutable resources. This view has however come under various criticism, most significant of which is the submission of Teece *et al.* (1997) that the foundation of the RBV is not strong enough to support the attainment of sustainable competitive advantage. This submission was based on the fact that though the RBV take into consideration some mechanisms that can lead to the attainment of competitive advantage within an organisation, how these mechanisms go about sustaining this competitive advantage is totally omitted. This criticism led to the development of the DCT by David Teece and Gary Pisano in 1994. According to Teece *et al.* (1997), the current business environment is not static as it has a continuously shifting landscape. An organisation that will attain a sustainable competitive advantage over its competitors and survives in this rapidly changing environment must have a dynamic capability. It is through this dynamic capability that its manager can effectively utilise both the internal and external competencies of the organisation that will tackle the changes within the business environment.

Teece and Pisano (1994) have earlier clarified that the term "dynamic" is "the capacity to renew competences so as to achieve congruence with the changing business environment". "Capabilities" are referred to as "the key role of strategic management inappropriately adapting, integrating and reconfiguring, internal and external organisational skills, resources, and functional competencies to match the requirements of a changing environment". Thus, by definition, Teece *et al.* (1997) defined dynamic capabilities as "the firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments". However, due to the broad recognition of the DCT, other prolific definitions of the term have evolved (Wollersheima and Heimeriks, 2016). A significant one is the definition of Eisenhardt and Martin (2000) which stated that dynamic capability is "the organisational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die". Similarly, Zollo and Winter (2002) defined it as "a learned and stable pattern of collective activity through which the organisation systematically generates and modifies its operating routines in pursuit of improved effectiveness." Drawing from these three major definitions it is clear that the dynamic capabilities of an organisation centres around being able to withstand rapid environmental changes (Teece *et al.*, 1997), use organisation's resources to create market changes (Eisenhardt and Martin, 2000), and at the same time being able to adjust operating routines through patterned behaviour in order to achieve improved effectiveness (Zollo and Winter, 2002). The combination of these key areas can be seen as a pointer towards achieving competitive advantage for organisations. Ambrosini and Bowman (2009) have also noted that the dynamic capabilities of an organisation influences n the organisation's resources and this, in turn, serves as the source of the firm's competitive advantage. Although some literature has characterised this theory as being vague and elusive (Kraaz and Zajac, 2001), that its nature creates difficulty in determining the merits of its outcome (Winter, 2003; Zahra *et al.*, 2006), or even being repetitive (Zollo and Winter, 2002), its ability to determine sustainable competitive advantage for organisations has been appreciated (Katkalo *et al.* 2010; Wollersheima and Heimeriks, 2016).

4. Dynamic Capabilities for the attainment of competitive advantage by Construction Organisations

Although several studies have submitted diverse capabilities needed for organisations to gain competitive advantage, (Eisenhardt and Martin, 2000; Schoemaker *et al.*, 2018; Teece and Pisano, 1994; Zollo and Winter, 2002), the DCT is deemed advantageous particularly for construction organisations which operate in a dynamic environment (Behm, 2008), and an ever-changing digital world (Solis, 2016). In an attempt to simplify the DCT, Teece (2007) observed three major capabilities for organisations to increase their business performance. These are the sensing, seizing and reconfiguration capabilities. Schoemaker *et al.* (2018) also acknowledged sensing, seizing and transformation as the three major pillars towards attaining dynamic capabilities. Thus, this study reviews the DCT from the sensing of digitalisation opportunities and threats, seizing digitalisation opportunities, and reconfiguring construction organisations in an attempt to promote the digitalisation of construction organisations and creating better competitive advantage in the process.

4.1 Sensing digitalisation opportunities and threats

Teece (2007) opined that as a result of the dynamic nature of the business environments, technological opportunities, as well as competitor's activities, are constantly changing. Lots of opportunities present themselves to existing business entities and new ones. However, the profit stream of the existing business tends to be more at risk in this situation than those just coming into the business. Thus, they need to have the ability to sense new opportunities and take advantage of them as quick as possible. Schoemaker *et al.* (2018) noted that it is imperative for organisations to sense market changes before their rivals do. Teece (2007) further described the sensing of opportunities as a "scanning, creating, learning, and interpretive" activity. In fact, Schoemaker *et al.* (2013) noted that if organisations are to improve their ability to sense opportunities and detect threats within the business environment, the monitoring of trends and uncertainties, and the different systems of decision making within the organisation must be strongly linked with tools for external scanning and scenario planning.

For construction organisations that aim to attain a competitive advantage through the digitalisation of its services, the ability to sense game-changing opportunities and significant threats lurking within the environment is essential. Following Teece (2007) suggestions, such construction organisation must put in place processes that will direct internal research and development (R&D) and also select new DTs that will help the organisation provide it better services. It is believed that through R&D the search for new DTs and processes can be done. This is important as it has been observed over time that construction organisations inability to embrace new technological advancement, as well as sponsoring meaningful R&D has affected the service delivery of the construction industry in most developing countries (Aghimien *et al.*, 2018b; Chilipunde, 2010). Thus, if competitive advantage is to be attained through better service delivery, attention must be given to these crucial variables. Similarly, the organisations managerial and organisational processes must be structured in a way that the organisation can tap into suppliers and complementor's innovations. It has been observed that in the business environment, uncertainty abounds (Quinton *et al.*, 2018). To scale through this uncertain environment, construction organisation can tap into suppliers' innovations or even mimic the innovations of those organisations within the same industry (Gutierrez *et al.*, 2015). This process of mimicking others can lead to competitive advantage, considerable improvement in the use of DTs and innovations, and even development of innovative ideas based on what they have seen from others (Gutierrez *et al.*, 2015; Quinton *et al.*, 2018). Also, the organisation must put in place processes that will help identify target market segments, changing customers' needs, as well as customers' innovation. All this must be linked to a strong analytical system geared towards learning, sensing, filtering, shaping and calibrating opportunities (Teece, 2007).

4.2 Seizing digitalisation opportunities

Teece (2014) described seizing as the process of organising necessary resources to meet the needs

and opportunities identified by sensing actions in order to maximise the value from those actions. Yeow *et al.* (2018) state that the act of seizing is crucial to the aligning of organisations with digital opportunities that have been identified using the organisation's sensing capabilities. Schoemaker *et al.* (2018) have noted that while it is important to sense opportunities, in an uncertain business environment, timely implementation of newly identified systems and innovations is crucial. In the view of Teece (2007), the act of seizing transcends beyond just understanding new opportunities. It involves the actual decision-making of specific changes needed across the organisation in order to enjoy the benefits within these identified opportunities. Other studies have also described the seizing capabilities of an organisation as the organisation's learning that is revealed through the ability to create knowledge within the organisation, obtain external knowledge, and assimilate this acquired knowledge for the creation of necessary capabilities (Cepeda and Vera, 2007; Nyachanchu *et al.*, 2017). Thus, construction organisations must be conscious of the timely implementation of opportunities that they have sensed within the construction environment. Also, the process of decision making with regards to the implementation of these identified opportunities must be swift.

Following Teece (2007) suggestions, these construction organisations must create a well-defined organisational structure, procedures, designs, and incentives geared towards seizing opportunities. To achieve this, they must define the customer solution and business model of the organisation base on the knowledge acquired from sensing. This can be done through the selection of the right DTs and service style, designing of the avenue of revenue generation, selection of the target clients, and designing of the right approach towards attaining value for both the organisation and its clients. Also, selecting the right decision-making procedure, and avoiding decision error is important. Similarly, creating a clear boundary for the organisation's service is important in order to conveniently manage complements and control the organisation's service delivery. To achieve this, standardising unique assets of the organisation, controlling challenging assets, assessing appropriability, and being able to recognise and manage co-specialised economies are important. These assets as earlier identified by Teece *et al.* (1997) can be in the form of technologies, intellectual property, complementary assets, customer base, or even external relations of the organisation. Finally, in seizing opportunities, construction organisations must build loyalty and commitment. This they can achieve through quality leadership demonstration, effective communication within the organisation, with their clients, and with other project participants, and recognising non-economic factors, values, and culture (Teece, 2007).

4.3 Reconfiguring the organisation

Schoemaker *et al.* (2018) observed that in an uncertain environment, adapting to changes as they occur is not enough. Organisations may be required to reshape their activities and perhaps their ecosystems in order to enjoy the benefits of new business models. Nyachanchu *et al.* (2017) noted that the act of reconfiguring refers to the organisation's ability to create and integrate capabilities from within and outside the organisation. Teece (2007) noted that it is the constant renewal of the organisation's asset, aligning of these assets, co-alignment, and redeployment of same. This reconfiguration might require organisations to revamp their ways of conducting business, restructure units within the organisation, manage co-specialised assets, and create structures that allow knowledge development and good governance within the organisation. Yeow *et al.* (2018) summarised this as the processes of restructuring of the resources of the organisation. Rindova *et al.* (2016) noted that through the act of reconfiguring, organisations can align existing resources with newly developed strategies, and at the same time adopt new resources to augment the shortfalls of the organisational resource base. Hence, reconfiguration capabilities can be seen as the capabilities to create, and the capabilities to integrate (Nyachanchu *et al.*, 2017; Pavlon and El-Sawy, 2011).

Thus, based on the clamour for construction organisations to adopt innovative processes of delivering construction projects, reconfiguring construction organisation's processes through the digitalisation of existing processes and integrating of new DTs to help improve service delivery is necessary. Following Teece (2007) suggestions, construction organisations that seek to attain competitive advantage through the digital transformation of their processes must be willing to embrace continuous alignment and realignment of their tangible, and intangible assets with what is obtainable within the digital world. Such an organisation must be able to decentralise its activities by embracing

open innovation and developing its integration and coordination skills. Also, effective knowledge management is important. Continuous learning of the use of evolving DTs, transferring of knowledge gained, and integrating such knowledge into the services of the organisation is crucial.

5. Lessons Learnt

It is evident that the construction industry operates in a very competitive and dynamic environment. Advancement in technologies has made this environment even more competitive as everyday organisations strive to be innovative through the use of diverse technologies in a bid to deliver better services to their client and attain a competitive edge over their competitors. In this dynamic world of technology with DTs evolving by the day, construction organisations must evolve in terms of the dynamic capabilities needed to withstand these changes. Following the DCT, it is believed that the ability of a construction organisation to be digitalised could be considered as an organisation's dynamic capability in itself. This is because the ability of an organisation to be digitised complements the organisation's digital orientation since only organisations that have the skills to effectively manage new DTs will readily adopt same and make good use of them in the delivery of new products (Khin and Ho, 2018). Thus, having the capability to implement and manage digitalisation within the organisation is the first key dynamic capability for construction organisations gunning for sustained competitive advantage attained through digitalisation. Studies have further proven that if construction organisations are to attain competitive advantage, then they must attain dynamic capabilities in terms of their ability to sense, seize, and reconfigure (Schoemaker *et al.*, 2018; Teece, 2007). Construction organisation must possess the capability to identify digitalisation opportunities and threats earlier than its competitors. This can be attained through investment in R&D, careful selection of DTs that will help in innovative service delivery, structuring managerial and organisation processes to be able to tap into suppliers and complementor's digital innovations, ability to target the most suitable market segments, understand changing clients' needs, and clients' innovation (Teece, 2007).

Similarly, based on what has been sensed within the environment, the timely implementation must be carried out (Schoemaker *et al.*, 2018). Construction organisations must be quick to learn from what they have sensed within the environment and utilise the knowledge gathered to the fullest. Swift decision-making with regards to the implementation of the identified opportunities is key (Nyachanchu *et al.*, 2017; Teece, 2014; Yeow *et al.*, 2018). To adequately seize opportunities, construction organisations must consider the selection of the right DTs and service style to be adopted, design the mode of revenue generation, select the target clients, design the right approach towards attaining value for both the organisation and its clients, select the right decision-making procedure, avoid decision errors, standardise unique assets, control challenging assets, assess appropriability, recognise and manage co-specialised economies, demonstrate quality leadership, promote effective communication with all parties, and recognise non-economic factors (Teece, 2007). Construction organisations must also be ready to restructure their organisational resources in order to conform to the changing environment. The continuous alignment and realignment of tangible and intangible assets with what is obtainable within the digital world are necessary (Rindova *et al.*, 2016; Schoemaker *et al.*, 2018; Teece, 2014; Yeow *et al.*, 2018). This can be achieved through decentralising organisation's activities by embracing open innovation, developing organisation's integration and coordination skills, effectively managing knowledge, continuous learning of the use of evolving DTs, transferring and integrating knowledge gained into the services of the organisation (Teece 2007).

6. Conclusion

No doubt the 4IR is upon us with evidence of its adoption is emanating within diverse industries. Digitalisation which is a key driver of the 4IR promises immense benefits to both its adopters and their customers. However, the world of DTs is not constant as new development abounds on a continuous basis. Thus, organisations that wish to survive in this ever-changing environment must be conscious of the dynamic capabilities needed to achieve this feat. Firstly, if construction organisations are to stay competitive and even attain a competitive advantage over their counterparts, they must be ready to adopt

and implement DTs in their service delivery. This is crucial as studies have proven that the construction industry is among the least industry to imbibe the digitalisation culture. Secondly, these organisations must grow their dynamic capabilities in the area of sensing of opportunities and threats within their environment, seizing of sensed opportunities, and reconfiguring of their organisational resources to conform with the ever-changing environment. Important variables worth noting include investment in R&D, careful selection of DTs, tapping into suppliers and complementor's digital innovations, understand changing clients' needs, selection of the right DTs and service style, selection of the target clients, designing the right approach towards attaining value, selecting the right decision-making procedure, avoiding decision errors, standardising unique assets, controlling challenging assets, demonstrating quality leadership, promoting effective communication with all parties, decentralising organisation's activities by embracing open innovation, developing organisation's integration and coordination skills, effectively managing knowledge, continuous learning of the use of evolving DTs, transferring and integrating knowledge gained into the services of the organisation.

This study contributes to the body of existing knowledge on the digital transformation of the construction industry as it provides possible direction towards attaining digitalisation through the dynamic capability of construction organisations. It is believed that its findings can serve as a starting point for the awakening of construction organisations that seek to gain a competitive advantage over their competitors through the digitalisation of their services. However, it imperative to note that the study those not claim that the attainment of competitive advantage through digitalisation only lies in the variables identified as some other external factors not covered within the DCT may influence same. Therefore, further empirical studies are needed to confirm the identified dynamic capabilities as they apply within the construction organisations and to also unearth other salient variables that were not mentioned in the literature earlier reviewed.

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