

State of Readiness of Nigerian Construction Industry towards Digital Transformation: The Construction Professionals' Perception

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Authors' contributions

This work was carried out in collaboration among all authors. Author FOE initiated the idea, designed, carried out data acquisition and compiled the first draft of the manuscript. Author CIO managed the literature searches and proof reading while author CBNBO carried out the data collation & analysis. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This study examines the extent of readiness of Nigeria construction firms toward digital transformation within the study area.

Study Design: It was a survey research, questionnaires containing information relating to digital Technologies, trend and transformation were administered randomly to selected construction practitioners in Anambra State, Nigeria.

Place and Duration of the Study: The study was conducted in Anambra State, Nigeria for a period of 6 months.

Methodology: A total of 84 questionnaires were administered to selected respondents; 80 copies were completed, returned and found useful, thus, giving a response rate of 95%. Data collected were analysed and presented using mean, percentages, relative importance index (RII), bar charts and pie charts.

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Results: The study found out that 63% of construction professional is satisfied with their firm readiness to digital transformation. However, the application of digital technologies skills and its transformation in the study area is still at foundation level. The use of mobile and social technologies (83%), entrepreneurship (73%) and Customer experience & strategic thinking (59%) are common in the study area while InMemory Databases skills (36%), Cloud Computing (39%) and Big Data Analytics (44%) are rare. Furthermore 35%, 53% 1% and 11% of the firms are planning to kick up digital transformation, undergoing some forms of digital transformation, attained or don't see the need for digital transformation respectively.

Conclusion: The study was concluded by recommending that construction practitioners should be properly sensitised on the need to understand and conceptualise on how digital transformation and technology will impact construction processes & activities and ability to manage or work within digitally-savvy environments.

Keywords: Digital skills & technology; digital transformation; construction industry; construction professionals; Anambra State.

1. INTRODUCTION

Rapid advances in digital technology are redefining the world today, because of the reduction in the cost of advanced technologies [1]. As technology become cheaper, it becomes quite common and accessible to the wider population. Hence, the combination effect of these technologies – mobile, cloud, artificial intelligence, sensors and analytics, among others, are accelerating this progress exponentially [1]. Consequently, businesses today are becoming highly competitive with the advancement in Technologies (particularly Information & Communication Technology). Hence, digitalization has become a hot debate topic for the moment and has become a driving force for innovation and transformation of industries globally [2–8]. To be relevant in today's business, digitization is not optional [2,9]. Comparing, the volumes of businesses conducted electronically with analogue transaction, it's clear the former has gained momentum against the later [4,10,11]. Thus, it's a clear indication that the much-anticipated digital era is now a reality [4,8,12].

Digital transformation, refers to the extent to which companies are adopting the new wave of information and communications technologies, such as cloud-based services, mobility, big data/analytics, and social business, to transform their businesses, gain competitive advantages, increase efficiency, generate new opportunities and new markets, support business growth, develop new products and services, and drive new profits (improve the bottom line) [5]. Put differently, digital transformation is an innovation that connect technology, data science, devices, design and business strategy to change a

business process or customer experience; through putting customer, device, organization or business process at the centre of change to improve agility, revenue and cost by connecting the physical world to the digital — code — world [9]. Simply, digitalization simply means the conversion of analogue information into digital information which entails the intersection of new technologies, new capabilities, and changing customer behaviour [13,14]. Therefore, Digital transformation is more than technology [9].

Going digital is not about technology; rather making customers' lives easier [13]. The sole purpose of this transformation is to make business digital; through this, put the customer, device, organization or business process at the centre of change that improves agility, revenue and cost which help the business compete for digital customers [9,15]. Also, it helps organizations become more efficient and productive, remain competitive, achieve meaningful growth and sustainability [2,16]. Furthermore, Philip and Thompson [11] stress that the future of our industry is facing a high degree of complexity, extreme competition and uncertainty with respect to the outcomes of climate change, availability of resources and the disruptive nature of innovation. Therefore, digital transformation is more important now than ever before. We live in an era of transformation of technology, social values, and the way work is done. In order to meet an increasingly global and competitive environment, organizations are undergoing re-engineering, work process redesign, and other forms of restructuring and basic changes of the way work is accomplished and Nigeria construction is not exonerated from this wind of change. Construction industry in Nigeria just like its counterpart in the developed

and other developing economies; needs to embrace this technology in its totality in order to remain in business. However, the big question is how prepared are construction firms and professionals within the study area toward this transformation? On this note, this study attempts to examine the readiness of Nigeria construction industry toward digital transformation. Particular attention is devoted to essential requirements for digital transformation and digital transformation skills and channels.

2. LITERATURE REVIEW

2.1 Digital Transformation in Construction Industry

Construction industry generally is currently experiencing a paradigm shift from traditional paper-based to digitally managed information exchange format, which other industries such as aircraft manufacturing and banking have adopted and benefited from long ago [17]. Stressing on this, Bahl [9] argued that no industry is immune to the impact of digital disruption, even the highly regulated industries, such as financial services, are under intense pressure to recast their operations. Also, this wave of disruption is not just for companies; even the society is feeling the heat of transformation towards a better future that is digitally driven [18]. Hence, technologies are changing businesses today and making clients/consumers to break the normal norms of any business and every business requires a digital orientation, meaning a digital focus in all business processes and functions [19,20]. However, [21–24] observed that the construction and real estate sector, for example, ranks lowest in terms of digital maturity (i.e. Industry lags behind other industries in using ICT). So, to avoid being left out of competition, construction industry needs to change its modus operandi in this digital era. This has to happen rapidly because most clients and/or consumers are going digital [6]. Roughly 40% of the world population today are digital and those that cannot keep up with pace may be running the risk of being push out of business by competitors that respond rapidly [6,25].

Becoming a digital enterprise, construction industry professionals will be required to thoroughly re-engineer the industry through a digital lens in terms of its processes and customer engagement [15]. Also, it will have to develop a digital strategy with a defined scope and objectives on how to achieve the transformation; because ultimate power of a

digital strategy lies in its scope and objectives [6,22]. It's important to note, that the evolving nature of technology, makes transformation not a one-time investment and initiative; but the organizational, operational, and technological foundations be put in place to foster constant evolution and cross-functional collaboration [26]. To make this work, the strategy developed should be as such that it will win the hearts and minds of people at all levels in the organization [18]. When, the industry is fully digitalised, it is believed that it will better clients experience directly or indirectly [6,15,26].

2.2 Essential Requirements for Digital Transformation

Advancement in information and communication technology (ICT) is transforming the whole world into a global village where goods and services can be made available with minimum restrictions and delays [27]. Thus, the proliferation of online businesses is gradually becoming commonplace, because the number of online customers is increasing tremendously [6]. For instance, in Nigeria, Alvarez et al. [28] projected that 38% of Nigerians have access to internet with mobile telephone subscription rate of 78.8 per 100 people. Accordingly, 60 million Nigerians are internet users. Based on the average internet penetration rate of 14% as postulated by [28] for African countries, the number of internet users in Nigeria will increase overtime. Therefore, to go digital, the following are germane according to [6,15,18,22,26,28,29]:

- First, define the global digital target picture as it affects your business and formulate strong visions, strategy and officers who will ensure its deployment across the business;
- Analyze customers' responses towards digital channels employed and study other industries' digital initiatives - these collective learning formed the basis to kick start digital transformation;
- A well-developed infrastructure such as sets of technologies that enables digital work and interactions between companies and customers are required;
- stakeholder acceptance/preparedness is paramount towards achieving meaningful transformation/changes, it is crucial to establish a high level of digital awareness;
- Digital transformation, ultimately, is a matter of executive vision and leadership; so, it requires collective buy-in and

- engagement from all, employer and employees alike whereas technology is just an enabler;
- Organizations must provide up-to-date product information online and engage with online communities to provide advice on their products
 - Corporate cultures also need to move toward a digital mind-set; innovation should be rewarded, and additional digital expertise can be brought in to help employees embrace the digital world and acquire the necessary skills and knowledge. Culture needs to support collaboration and creativity
 - Finally, find partners whose capabilities complement your own (Forrester, 2015).

Solis, Li and Szymanski [20] summarised these requirements into three key elements upon which digital transformation efforts are built as:

- i. It is most effective with pointed vision and supportive leadership.
- ii. Optimizing the digital customer experience becomes the initial objective.
- iii. Change materializes through the formation of a digital transformation team

2.3 Digital Transformation Skills and Channels

From [3,25,26,29] studies, the skills needed for digital transformation are;

- ✓ Specific technologies – mobile/social
- ✓ Analytics & insights;
- ✓ Digital Security
- ✓ Novel Interfaces
- ✓ Entrepreneurship
- ✓ Cloud Computing: Provide users and enterprises with various capabilities to store and process their data in either privately owned, or third-party data centres
- ✓ InMemory Databases
- ✓ Product Service Offerings
- ✓ Internet of Things
- ✓ Big Data Analytics
- ✓ Business Networks
- ✓ Business Change Management
- ✓ Customer experience and strategic thinking

3. METHODOLOGY

This study is carried out in Anambra State, Nigeria, using a survey method. The name

Anambra was derived from the Anambra River (Omambala) which flows through the area and is a tributary of the River Niger. Anambra State is a south-eastern state and one of the 36 states of Nigeria. Its bounded by Delta State to the west, Imo State and Rivers State to the south, Enugu State to the east, and Kogi State to the north (see Fig. 1). Anambra State consists of twenty-one (21) Local Government Areas. They are: Aguata, Awka North, Awka South, Anambra East, Anambra West, Anaocha, Ayamelum, Dunukofia, Ekwusigo, Idemili North, Idemili South, Ihiala, Njikoka, Nnewi North, Nnewi South, Ogbaru, Onitsha North, Onitsha South, Orumba North, Orumba South and Oyi (see Fig. 2). The major urban centres of Anambra state are Onitsha, including Okpoko; Nnewi, and Awka, the state capital. Awka and Onitsha developed as pre-colonial urban centres while Nnewi as post-colonial urban centre. Anambra is the eighth-most populated state in the Federal Republic of Nigeria and the second-most densely populated state in Nigeria after Lagos State. It has an estimated average density of 1,500–2,000 persons per square kilometre and over 60% of its people lives in urban areas. It is one of the most urbanized states in Nigeria.

The population of this study constitutes of fully registered professionals particularly Architects, Builders, Structural Engineers and Quantity Surveyors, residing and practicing in the study area. The population of these professionals as obtained from the various secretariats in the state is 105 (see Table 1).

Taro Yamani sample size method is employed to determine the appropriate sample size for this study.

Taro's formula is represented as:

$$i.e. n = \frac{N}{1+N(e)^2}$$

Where " n " is the sample size, " N " is the population (105) and " e " is the level of confidence (i.e. 95%).

Thus, the sample size

$$n = \frac{105}{1 + 105(0.05)^2} = 84$$

Data are collected through structured questionnaire administered to the selected respondents or their representatives.

Accordingly, out of a total of 84 questionnaires administered, only 80 questionnaires are completed, returned and found useful. This corresponds to response rate of 62.92%.

Being a descriptive research, tables, line –chart, mean and histogram are used for data presentation. However, Relative Important Index (RII) is used for ranking and computed using:

$$RII = \sum Fx / A * N$$

Where,

$\sum Fx$ = Weight given to each statement by respondents and ranges 1 – 5.

A = Higher Response Integer

N = Total Number of Respondents

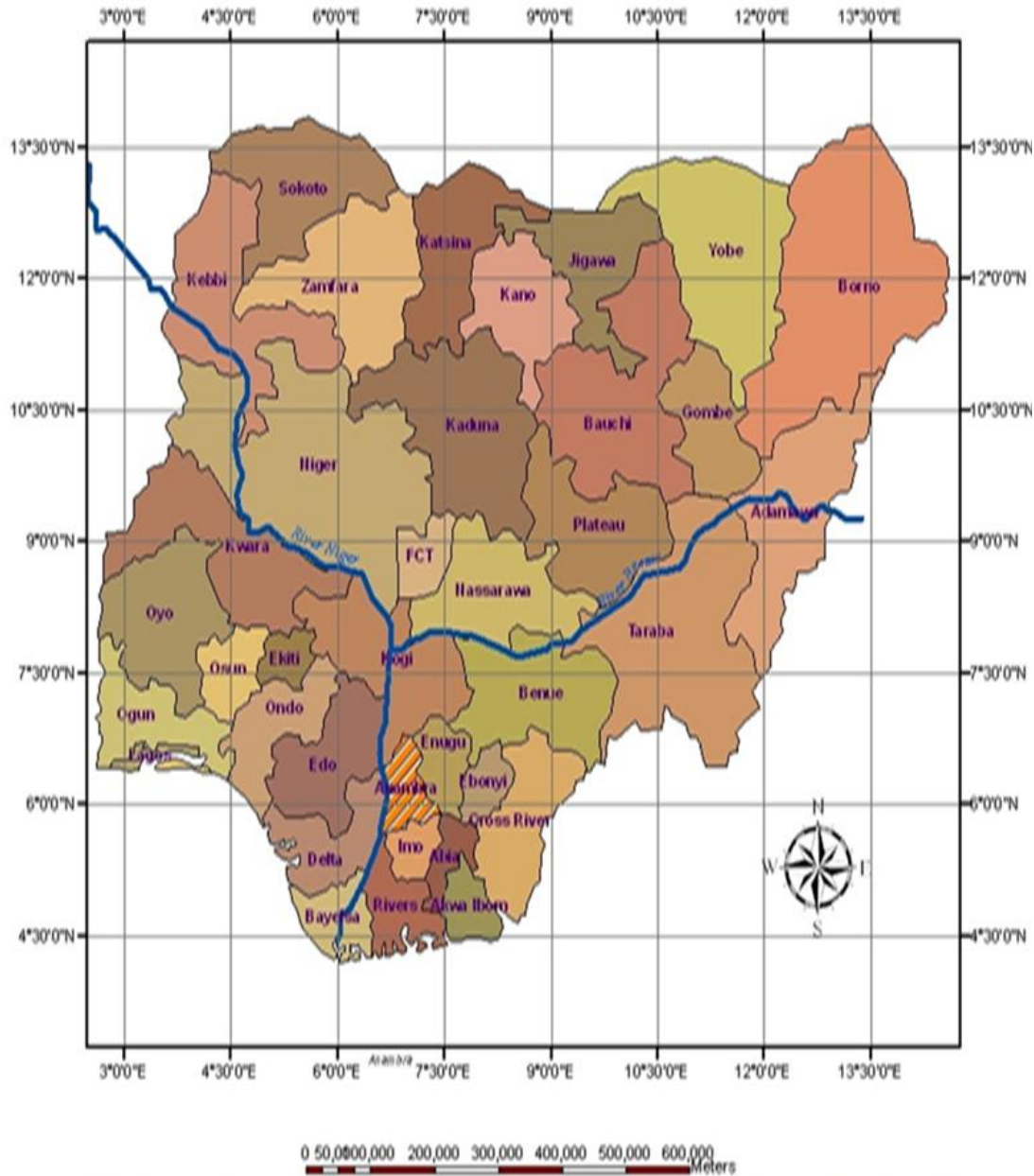


Fig. 1. Map of Nigeria showing Anambra State
Source: [30]



Fig 2. Map of Anambra State showing the local government areas
Source: [30]

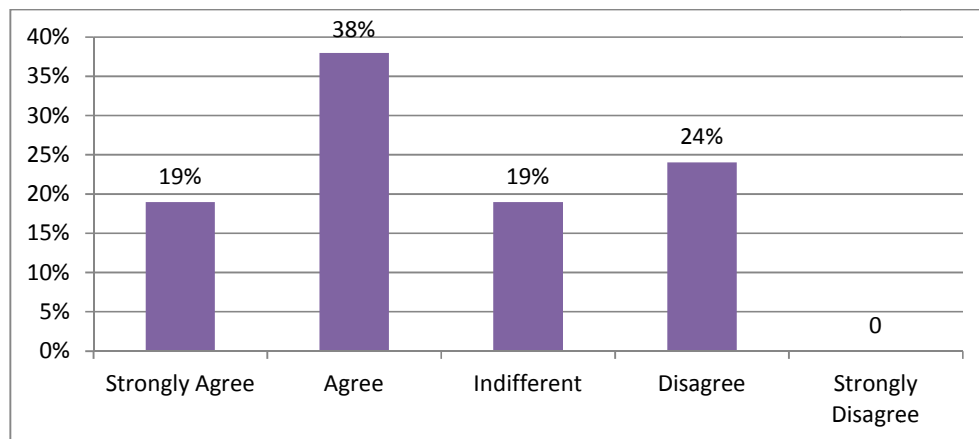


Fig. 3. Firms current reaction to digital transformation
Source: Field Survey (2018)

4. RESULTS AND DISCUSSION

Fig. 3 reveals that 57% of the respondents are satisfied with their firm current reaction toward digital transformation. However, 19% and 24% of the respondents are indifferent and not satisfied with the current digital transformation reaction of their firm.

From the response in Fig. 4, 94% of the respondents are satisfied with their leadership understanding on digital transformation whereas 6% of the respondents are indifferent.

Fig. 5 discloses that 63% of respondent are satisfied with their firm readiness to digital transformation while 37% of the respondents are indifferent.

The response in Table 3, indicates that 35% of the respondents are planning to kick up digital transformation, 53% of the respondents are undergoing some forms of digital transformation; whereas, 1% and 11% of the respondents have attained or don't see the need for digital transformation respectively.

Table 4, discloses the use of mobile and social technologies (0.83) with regards to the

application of digital technology skill ranked first in the study area; closely followed by entrepreneurship (0.73%) and Customer experience and strategic thinking (0.59). On the other hand, InMemory Databases skills (0.36), Cloud Computing (0.39) and Big Data Analytics (0.44) ranked lowest in the list.

Table 5 reveals that Understanding construction activities and being able to conceptualize how digital transformation can impact on construction processes and activities (30%) top the list of Innovative skills and abilities lacking in construction firm. Followed by Ability to manage or work with digitally-savvy environments (25%) and Readiness to experiment and take risks (20%). However, the table discloses that Ability to use digital technologies to execute construction work (15%) and Readiness to share and collaborate (10%) are least in the list. Thus, with proper sensitization the construction stakeholders in the study area can actually use digital technologies in their activities and are ready to collaborate. Therefore, the table suggests that construction should be sensitised on how take risk and work in digitally savvy environment with its impact on construction activities.

Table 1. Population distribution

| S/NO | Professionals | Population Size | Sample size |
|--------------|----------------------|-----------------|-------------|
| 1 | Architects | 15 | 12 |
| 2 | Builders | 34 | 27 |
| 3 | Quantity Surveyors | 25 | 20 |
| 4 | Structural Engineers | 32 | 25 |
| Total | | 105 | 84 |

Source: Field survey, (2018)

Table 2. Distribution of questionnaire and percentage response

| Questionnaires | Frequency | Percentage (%) |
|---------------------------------------|-----------|----------------|
| Number of questionnaires returned | 80 | 95.23 |
| Number of questionnaires not returned | 4 | 4.76 |
| Total | 84 | 100 |

Source: Field Survey (April, 2018)

Table 3. State of digital transformation

| State of Digital Transformation | Frequency | Percentage |
|--|-----------|------------|
| Planning to take-off formal digital transformation | 28 | 35 % |
| Undergoing formal digital transformation | 42 | 53 % |
| Has attained formal digital transformation | 1 | 1 % |
| Don't see the need for digital transformation | 9 | 11 % |
| Total | 80 | 100 |

Source: Field Survey (2018)

Table 4. Respondents' perception on the application of digital technological skills

| Digital Technologies and transformation skills | Frequency of occurrence | | | | | $(\sum F)$ | $\sum Fx$ | Mean | RII | Ranking |
|---|-------------------------|----|----|----|----|------------|-----------|------|------|------------------|
| | 5 | 4 | 3 | 2 | 1 | | | | | |
| Specific technologies – mobile/social | 36 | 24 | 16 | 4 | 0 | 80 | 332 | 4.15 | 0.83 | 1 st |
| Analytics & insights; | 0 | 20 | 36 | 8 | 16 | 80 | 220 | 2.75 | 0.55 | 4 th |
| Digital Security | 4 | 16 | 12 | 20 | 28 | 80 | 188 | 2.35 | 0.47 | 7 th |
| Entrepreneurship | 5 | 48 | 24 | 0 | 3 | 80 | 292 | 3.65 | 0.73 | 2 nd |
| Cloud Computing | 1 | 4 | 28 | 4 | 43 | 80 | 156 | 1.95 | 0.39 | 11 th |
| InMemory Databases | 3 | 3 | 20 | 16 | 38 | 80 | 143 | 1.79 | 0.36 | 12 th |
| Product Service Offerings | 0 | 28 | 16 | 4 | 32 | 80 | 200 | 2.50 | 0.50 | 6 th |
| Internet of Things | 2 | 16 | 8 | 34 | 20 | 80 | 186 | 2.33 | 0.47 | 8 th |
| Big Data Analytics | 3 | 2 | 28 | 20 | 27 | 80 | 174 | 2.18 | 0.44 | 10 th |
| Business Networks | 4 | 8 | 20 | 24 | 24 | 80 | 184 | 2.30 | 0.46 | 9 th |
| Business Change Management | 0 | 20 | 24 | 16 | 24 | 80 | 208 | 2.60 | 0.52 | 5 th |
| Customer experience and strategic thinking | 0 | 28 | 28 | 16 | 8 | 80 | 236 | 2.95 | 0.59 | 3 rd |
| (5) Very High (4) High (3)Moderate (2)Low (1)Not at all | | | | | | | | | | |

Source: Field Survey (2018)

Table 5. Respondents view on the innovative skills and abilities lacking in their firm

| S/NO | Innovation skills and abilities | Response (Frequency) | Response (Percentage) |
|--------------|---|----------------------|-----------------------|
| 1 | Understanding construction activities and being able to conceptualize how digital transformation can impact construction processes and activities | 24 | 30 % |
| 2 | Readiness to experiment and take risks | 16 | 20 % |
| 3 | Ability to manage or work with digitally-savvy environments | 20 | 25 % |
| 4 | Ability to use digital technologies to execute construction work | 12 | 15 % |
| 5 | Readiness to share and collaborate | 8 | 10 % |
| Total | | 80 | 100% |

Source: Field Survey (2018)

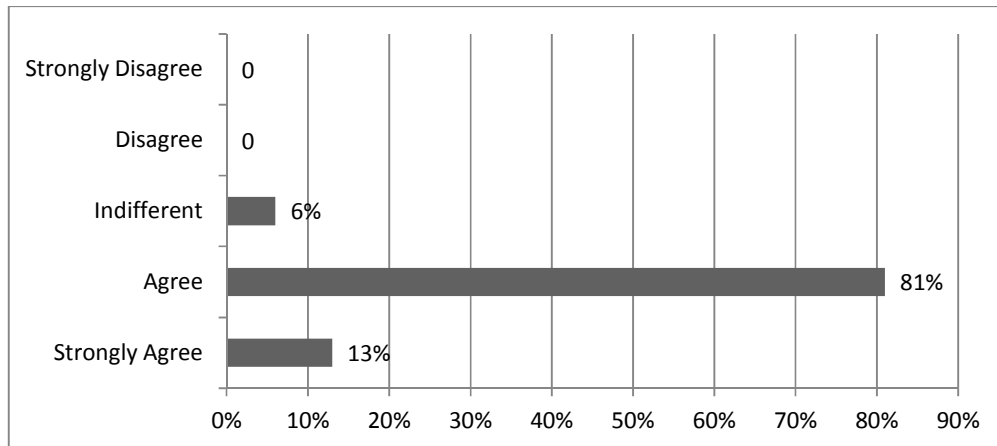


Fig. 4. Leadership understanding of relevant digital trends/transformation

Source: Field Survey 2018

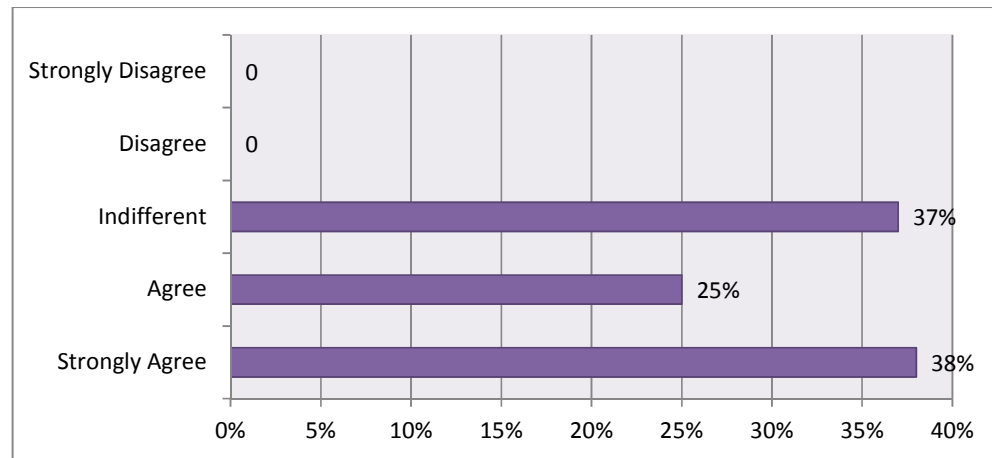


Fig. 5. Level of readiness of firm to digital transformation

Source: Field Survey 2018

5. CONCLUSION AND RECOMMENDATION

Digital technologies are gradually penetrating into the business, practices and procedures of construction industry globally. This situation, introduces lots of changes into the industry. Because of this, most construction firms are gradually changing their mode of operation to digital base in-order to compete favourably. Consequently, 63% of respondents are satisfied with their firms' readiness to imbibe digital transformation. The awareness of the benefits of digital transformation to most leaders in the construction firms in Nigerian construction industry particularly in Anambra State, is steadily on the increase. Thus, greater percent of the construction professionals are quite satisfied with their firms' current reaction toward

digital transformation. However, the application of digital technologies skills and its transformation in Nigerian construction particularly in the Anambra State is still at foundation level. The use of mobile and social technologies, entrepreneurship and Customer experience & strategic thinking are common in the study area, while InMemory Databases skills, Cloud Computing and Big Data Analytics are rare. Furthermore 35%, 53% 1% and 11% of the firms are planning to kick up digital transformation, undergoing some forms of digital transformation, attained or don't see the need for digital transformation respectively.

It's time to say goodbye to analogue leadership. Accordingly, its recommended that construction practitioners should be sensitised on the following:

- i. The need to understand and conceptualise on how digital transformation and technology could impact on construction processes & activities to be pursued;
- ii. Ability to manage or work with digitally-savvy environments; and
- iii. Readiness to experiment and take risks.

Thus, with proper sensitization, the construction practitioners in the study area coupled with the provision of the needed digitalised environment could create a viable climate in which the firms could collaborate to achieve higher economies of scale. The construction firms in Anambra will be totally transformed from being analogue to digital. When this happens, construction industry in Anambra State will stand a chance to compete favourably with its counterparts within and outside the country, thus, contributing its quota to the improvement of the GDP of the State.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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