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The Construction Industry and Modernization-Applying Change Concepts

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Abstract- Globalization has fully taken its course in no other sector more apparent than in the rapidly growing construction industry. The industry is being forced to change at an unprecedented pace. Nigeria and other developing countries are not exempted as they witness a fast-growing rate of construction activities also. The industry must adapt to a global trend and a sense of camaraderie to meet the huge demands, reduce risks involved; thus, safeguarding quality and profitability. Change is an enormously complex issue but the industry must take cognizance of the change demand to gain competitive advantages. The aim of this study is to examine the effect of change application on the modernization of the construction industry. This paper presents the results of a literature review carried out on change application in modernization of construction industry. It examines the issues that will cause change, reviews the available literature to find how change can be managed and controlled, and develops a model for guiding change programmes in the construction industry. Interviews and questionnaire surveys were adopted tools in getting data and analyzed to achieve the research aim.

Keywords: *change, construction industry, globalization, management and modernization.*

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The Construction Industry and Modernization- Applying Change Concepts

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Abstract- Globalization has fully taken its course in no other sector more apparent than in the rapidly growing construction industry. The industry is being forced to change at an unprecedented pace. Nigeria and other developing countries are not exempted as they witness a fast-growing rate of construction activities also. The industry must adapt to a global trend and a sense of camaraderie to meet the huge demands, reduce risks involved; thus, safeguarding quality and profitability. Change is an enormously complex issue but the industry must take cognizance of the change demand to gain competitive advantages. The aim of this study is to examine the effect of change application on the modernization of the construction industry. This paper presents the results of a literature review carried out on change application in modernization of construction industry. It examines the issues that will cause change, reviews the available literature to find how change can be managed and controlled, and develops a model for guiding change programmes in the construction industry. Interviews and questionnaire surveys were adopted tools in getting data and analyzed to achieve the research aim. The research identified effective cost savings with RII of 0.81 as the most importance benefit, earlier completion and improved performance were ranked second and third with RII of 0.80 and 0.78 respectively. The score of 8.5 show that construction stakeholders have highly accepted change which is the key driver for improving client's relationship. Values added to the industry to include time savings; automated tasks thereby cutting payroll costs; radically improved work methodology and reduction in paper work. Usage of the combination of Value Engineering, Business Process Reengineering and Total Quality Management were identified as potential change technique required in the industry. The study recommends more innovation investment in training, modern techniques, methodology, equipment and material usage and management to achieve a reliable and viable sector.

Keywords: change, construction industry, globalization, management and modernization.

I. Introduction

Change is defined by [1] as "the act or an instance of making or becoming different, an alteration or modification". There are many different reasons and sources for change which is inevitable. Since changes will never disappear, the best option is to manage them to prevent negative consequences. The impacts and consequences of changes on an organization and people varies. It depends on the type and nature of changes, but most importantly on how they are managed. The changes are to be managed to maximize the benefits, minimize the penalties, and ensure that both benefits and penalties are distributed equitably[2]. Change occurs in construction industry globally because:

- Global technological advancement
- Successful invention
- Significant shift in the world markets or exchange rates
- Surges in the world or regional demand
- Political decisions by foreign governments
- Project complexity
- Improvement in clients' satisfaction and meeting project objective
- Ensure effective cost management and control
- Meeting with climatic change/wars and act of nature

On a world-wide level, changes are occurring at a rapid pace, particularly in information technology. The increasing number of computer based applications that are now available to construction companies is changing the nature of the business which we carry out. Research projects funded by the European Union into the area of information technology are showing how we can reuse construction design information and how we can access information generally throughout the industry[3].Society is now facing an "information technology revolution" which will bring a period of change he has likened to that of the Industrial Revolution. If this is the case, then all organizations must recognize that survival in business will be dependent on their ability to adapt to changing circumstances[4].The industry must therefore adapt to a global trend to fit in and ensure risks reduction thereby improving quality of project delivery; meeting the target cost and time; thus, ensuring sustainability. This study therefore examines the effect of change application on the modernization of the construction industry in Nigeria. Different areas where change can be applied and effect were identified including change management and control.

II. Review of Related Literature

Change is not just about how people act, but it is also about how they think and this perspective forms a basis for the link between CM in organizations and internal communication with the people responsible for

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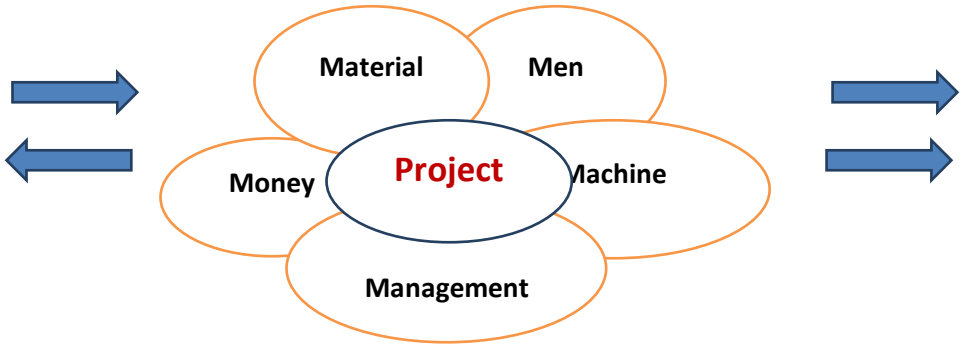
making those changes happen[5]. Change occurs in construction at two levels: organizational and project level. Throughout a project, construction organizations are faced with many changes, most of which are design changes. Project changes are inevitable even if there had been detailed studies during the design development, and prior to the construction stage. Besides handling changes at project level, construction companies are sometimes required to implement changes at organizational level related to management, technology, people and cultural issues [6].Change can be introduced in several ways depending on the aim of the change programme. In establishing how to approach a change situation, the effect of change throughout the organization must be assessed at all levels of activity. The four main levels of activity have been defined as:

- Task Level - at which individual actions take place as part of a process
- Process Level - at which a series of tasks are carried out
- System Level - at which number of processes are integrated and managed
- Organizational Level - at which decisions are made and actions are taken to determine the strategy of the organization.

These levels are tied together with a complicated series of interfaces through which individuals interact with those in their own organization and in other organizations.

a) The construction industry

The industry is subject to the law of elastic and return which can be either way depending on the scope and the nature of the project.



Source: Researcher, 2020

Fig. 1: Indicators of Project delivery

The model in fig 1 indicates that the project's nature or complexity will determines the reactions of other factors or indicators. Therefore, if the project core expands, the support systems must grow to meet the needs of the projects. On the other hand, if the workload contracts, the systems will be downsized to match the demand. It is this dependence on the project core and the cyclical nature of construction activity that brings about a constant state of change in the supporting systems. However, it is also this constant state of change that prevents meaningful attempts at change management in the supporting systems, as the status of the systems is regarded as temporary and any effort to manage the change could be impeded by a change in the project core. Construction organizations can readily apply the latest management concepts and new technology in the context of the project but appear to be reluctant to apply the same principles in an organization wide context. From this perspective, we can see why a construction organization has difficulty with planning for and coping with change. To cope with change, a construction organization must take a more global view of its operations, shifting emphasis from a project approach to a more entrepreneurial approach. Information Technology (IT) is evidently the most strategic means of effecting change in construction system. IT is currently used to a limited extent in: Design; Financial Management; Planning; Monitoring; communication and Reporting. The change includes many existing software packages designed in compatibility with the area. IT thus ensures;

- Time saving
- Automate tasks and thereby cut payroll costs
- Proper organization and radically improve the way work is done
- Avoid waste and use less paper.

The most likely underlying cause of the failure to change in the instance of IT implementation is therefore that those managing the change have attempted to implement a change without due regard for the other tasks and processes that would be affected. To avoid this situation, it is necessary to understand the effect of one task or process on another. For change to be effective, the educational curriculum must be adjusted to cope with the change. This is the reason while it seems the standard of education is falling; especially in

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developing countries. There is no fall in the standard but the standard should be redesigned to accommodate the expanded change. Previous work by [7]on change management on Irish construction discovered that; even the smallest of changes can affect the working environment of a significant proportion of those who work in the organization This matrix shows that no single change approach will be suitable in all situations. Most changes, will require action at one or more interfaces, along with action at one or more activity levels, a combination of at least two of the approaches will be required to achieve the expected change. He thus concludes that Change is an enormously complex issue, which is possibly one of the reasons for the high failure rates of some change programmes.

b) IT as a Change tool in Nigeria construction industry

The level of technological change in every industry continues to gather pace and the construction industry is no exception. New equipment and methodology has contributed to an increase in productivity, safety and quality of project delivery. Technology has a major role to play a in the change concepts transformation. Changes in designing to construction patterns drive the creation of new technologies necessary for sustainability and their adoption and diffusion at the desired pace. Success in bringing about these changes require substantial reorganization of the industry to accommodate new views and methodologies. Training and financial incentives for the creation and adoption of new tech-nologies will be needed which may include innovative policy reforms. The potential uses of Information Technology (IT) in the industry are enormous. For example:

- Buildings can now be designed and costed electronically thereby facilitating a greater re-use of design and cost information and realizing savings in design costs. Comparative analysis is easily carried out using information technology.
- Planning carried out using computers allows quick comparisons of the time and resources required to complete different designs and shows the effect of design changes on the remainder of an existing project
- Immediate access to technical information held in a computer at a remote location
- Use of e-mail to distribute documents and correspondence
- Electronic bill tendering (e-tendering), e-marketing and so on
- Sourcing of materials and services using Internet style search engines
- Electronic commerce (e-commerce) now allows the ordering of and paying for materials to be carried out electronically
- Meetings can be held using video-conferencing
- Communication are effectively carried out using media channels like whap, you tube etc
- Documents and drawings can be viewed/ recorded / stored / distributed / updated and printed using computers; information gathered on previous projects can be accessed and used to make cost savings on new projects.

Further advances are now occurring on almost daily basis, bringing newer and easier ways to tap the enormous potential of these machines. All of this has caused greater challenges for the management of construction companies. Companies grow and cope with new technology at a rate which could not have been envisaged in few years back. These same companies now face even more challenges in an ever changing construction environment. Now, an individual can use Computer Aided Drawing (CAD) software to draw, for example, a door. The lines and layers of the drawing can be copied and moved within the drawing or between drawings but to the computer they are still a series of lines and layers. It can also have other types of information attached to it such as its cost, availability and any other information required by any party who in any way encounters this door at any stage of the project. The use of Object Oriented Technology promotes a profound change in construction, as it enables different applications to make use of information in a way that has not previously been possible. Internet on the other hand is basically a series of computers in several different locations all over the world that are connected to each other across standard and high speed telephone lines. As computers share information with each other, the greater number of computers connected, the more information is available. The information is held on websites, which may be accessed through any computer connected to the Internet.

However, IT is often seen as a complex field best understood by young minds and many of the directors/managers/chief executives of Nigerian construction companies may not have had the time or the patience to keep up with the rapid pace at which this technology has been developing. Many may therefore not be aware of the direction in which IT is developing. This should be addressed by developing an organization-wide IT strategy to plan and control the increasing use of computers within the industry. New processes must be devised, implemented, monitored and improved where necessary. Changes must first be made where they will have the most noticeable effect thereby convincing all involved that the new processes are to the benefit of everyone.

c) Change for effective cost savings

A change in attitude may be needed by companies to keep trained staff and obtain maximum return for the investment in training. Experience from

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other industries should be drawn upon and approaches to staff retention might be considered- for example the Japanese policy of increasing the benefits to the individual as length of service increases. Human resources management must face the challenge of finding and retaining the staff necessary to fulfil the aims of the corporate plan. Plans must be developed and administered to ensure that the company utilizes its staff to full capacity and potential. At Systems level, the promotion of innovation, team working, delegation of authorities and an emphasis on quality must been couraged to improved workers' performance and productivity to the advantage of the company. Ever since the Latham Report (1994) cited by [7]stated that UK construction costs to the client could be reduced by 30%, the search has been ongoing to find where such savings could be made. Nigerian construction industry too has not relapsed in their efforts to cut down construction cost in the country. Materials management has subsequently emerged as an area worthy of examination in the search for suchsavings. 'In Sweden (Laage-Hellman & Gadde 1996), Finland (Wegelius-Lehtonen 1995) and in the UK (Dawood 1997), materials management has been identified as an area where some savings could be made. Each of these pieces of research approached materials management in a changed way. Laage-Hellman & Gadde gave an account of the progress made by Swedish construction company Skanska in its attempts at introducing Electronic Data Interchange (EDI) into its purchasing system. The cost of processing an invoice was found to be SEK 300 (approximately US$45). Laage-Hellman & Gadde state that this cost can be reduced by 90% by using EDI. The possibility of use of the suppliers' expertise in relation to availability, handling, etc., is not often examined. Such involvement can lead to a 10% reduction in construction times (Agapiou, Flanagan, Norman and Notman, 1998) and is now widely accepted in other countries such as Denmark, Sweden and Japan' [8]. [9]noted that the simplification of the materials management process also led to:

- Closer co-operation of the supplier and the contractor
- A higher quality of the information between contractor and supplier resulting in fewer ordering errors
- An increase in the speed of the materials handling process and in the ease with which information could be transmitted.

These factors in turn resulted in increased cost effectiveness in the construction chain.[10]objective was to discuss and introduce a new strategy for materials management for the construction industry with a view to minimizing wastage. He observed current practices and discovered that wastage accounts for 8-10% of project costs. By making a few basic changes to some aspects of the building process and by introducing a computer based materials management system. He estimated that construction costs could be reduced by at least 10%. These savings would occur because of reduced wastage, fewer project delays, early selection of suppliers leading to lower prices and greater certainty of availability of materials, greater understanding of the type and amount of materials needed thereby eliminating late and in accurate ordering, and a reduction in on-site overheads. The process of doing things in a changed and new way is termed 're-engineering'. [11]defines re-engineering as:"… discontinuous thinking…recognizing and breaking away from the outdated rules and fundamental assumptions underlying operations. These rules of work design are based on assumptions about technology, people, and organizational goals that no longer hold." Deevy argues that an organization is a living system capable of self-organization and self-renewal- if the right conditions are created. This living system, if allowed, is capable of continuously adapting to the needs of the marketplace and to changes in the business environment. Reengineering the processes should, therefore, be preceded by a major cultural change in the organization. That made [12]agrees that up to 70% of BPR projects fail and he identifies the biggest obstacles to successful re-engineering as:

- Lack of sustained management commitment and leadership
- Unrealistic scope and expectations
- Resistance to change.

d) Value Engineering

The search for improvement is also present in the concept of Value Engineering (also known as the Value Method, Value Analysis or Value Management).[13]state that the true value of an activity or product is its relationship to its perceived worth as opposed to its life-cycle costs. In Value Method terms: Value = Worth/ Cost. When an item has a value greater than 1.0, it is perceived to be fair or good value; when an item has a value less than 1.0, it is perceived to be poor or bad value. The opportunity to improve the value of a project is greatest at project inception. This shows that, to maximize savings, value engineering should commence at the earliest opportunity in the development of the design brief. It can continue up to and including the procurement of trade contractors.

There are many ways to approach change and the technique used will depend on the type of challenge that the organization is facing. Process re-engineering is used to achieve drastic improvement in the efficiency of part of an organization and is often used when new technology potentially makes an existing process obsolete. Value Engineering has produced its best results to date when applied as early in the design process as possible and consequently is generally

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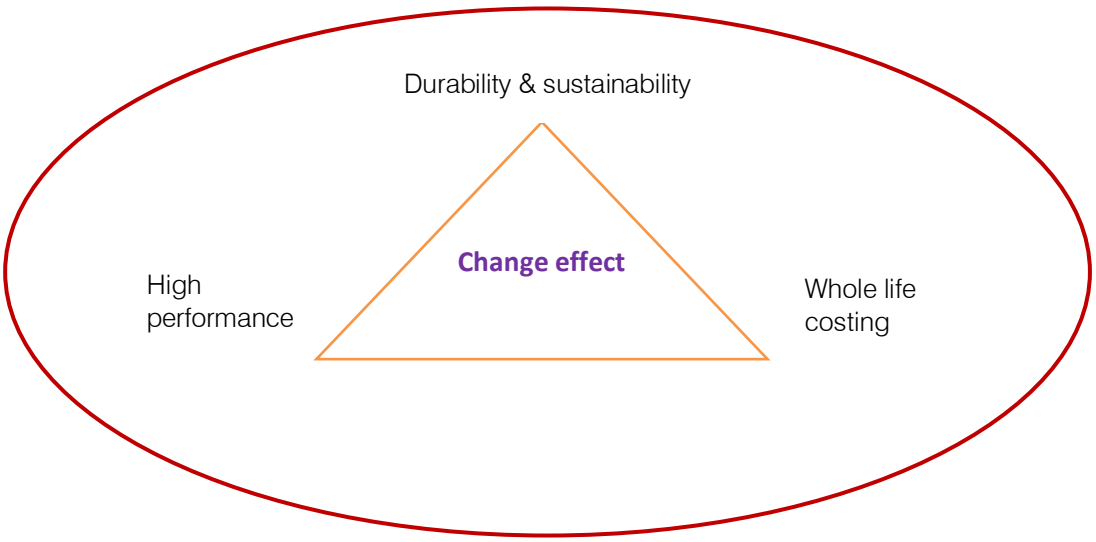
viewed as a project specific application. The potential rewards of applying change in materials management are considerable. Change techniques related to levels of activity in the industry requires strategic approach. Whatever approaches are used, their success depends on the following factors:

- The change must be fully thought out and meticulously planned.
- The highest level of management within the organization must fully understand and be totally committed to the change process.
- Lines of communication must be opened and maintained across as many levels as possible within the company.
- Training in all aspects of the new systems and all in all of the skills required by the new systems must be given to all of those involved.
- Change is dynamic; therefore, the change process itself must adapt to suit any new circumstances in which their organization finds itself.
- Once the change programme has been implemented, the process of change must continue if competitive advantage is to be maintained.

The major hindrance to organizational growth are the managers in change process. The inability of the operators to change their attitudes and behaviour as rapidly as their organizations require; slow down the pace of expected change. Change Management which is the deployment and manipulation of financial, technological, natural and human resources efficiently and effectively to accomplish set goals and objectives.



Source: Researcher, 2020

Fig. 2: Effect of change application

Summarily, the application of change concepts as shown in figure 2ensures project durability and sustainability, it increases performance and ensure whole life costing of construction projects.

III. Methodology

The research methodology was used to achieve the objectives of the project. Basically, we can identify the following steps.

a) Sample selection

The method of the data collection was through a questionnaire survey. The questionnaire was distributed among construction industry professionals working in the building construction industry.

b) The survey

Survey questionnaire was divided in to three sections. The first, section was titled "Questions regarding the experience and the about company". The second section of survey was titled "Questions regarding the impact of change on construction project delivery". These questions attempted to find out whether the company had adopted aninnovation in their working system and identified the benefits of the change methodology in their organization. The questionnaire survey was carried out using three methods. The questionnaire form was distributed among construction industry professionals by hand and via email. Face to face interviews were conducted with selected project managers, site managers and site engineers on a several projects.

c) Analysis of responses

After the survey responses were received, analytical examination was carried out. The questionnaire results were ranked according to Likert

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scale. The rank results were analyzed relatively to the mean value calculation using equation:

Mean value = $\Sigma (ni \times xi) / \Sigma ni$ equ
xi = Likert scale for item, where
I = 1,2,3,4,5
n = frequency of item

IV. Results and Discussion

Extracted information from questionnaires and direct interview can be present as follows.

Survey questionnaire was designed in three sections. The first section included questions regarding the experience and background of the respondent and his company. This section helps to get an idea about responder's position in this field. According to above result most of responders work as consultants while lesser number as contractors were reached. This is because the consultants are key to ensure new adaptability and monitoring. Working experience in construction industry responders experience was most effecting factor when doing this kind of survey. The highest number of responder are above 15years in practice, hence, given credibility to the information supplied.

a) Identified benefits of change in construction industry

Six key benefits of change were ranked by the respondents. As shown in table 1; the construction consultants such as the Architects, Engineers and Quantity Surveyors who make use of this change tools identified effective cost savings with RII of 0.81 as the most importance benefit, earlier completion and improved performance were ranked second and third with RII of 0.80 and 0.78 respectively. This was not too far from the contractors who identified improved performance as the highest benefits derived from change application with RII of 0.82 while effective cost savings ranked second with RII of 0.80. On the average rankings; effective cost savings came first with RII of 0.81. improved performance of RII of 0.80 and earlier completion with RII of 0.78 were ranked second and third respectively.

Table 1: Benefits of change in construction industry

IDENTIFIED BENEFITS	CONSULTANTS		CONTRACTORS		TOTAL SAMPLE	
	RII	RANK	RII	RANK	AV/GROUP RII	GROUP RANK
Improved Performance	0.78	3	0.82	1	0.80	2
Earlier completion	0.80	2	0.77	3	0.79	3
Effective cost savings	0.81	1	0.80	2	0.81	1
Risk reduction	0.68	4	0.74	5	0.71	4
International acceptability	0.67	5	0.72	4	0.70	5
Global competitiveness	0.60	6	0.64	5	0.62	6

Source: Researchers work, 2020

Finally, this paper assessed the acceptance level for change and modernization among construction stakeholders. This is to give credit to change implementation and promotion within the industry. The acceptance level was divided into two main factors such as "Change related to meeting client'sneeds in terms of cost, quality, time of delivery and sustainability" and "change related to risk reduction, international acceptability and competitiveness". The level of acceptance was based on the scale of:

- Low acceptance level if score less than 5; and
- High acceptance level if score more than 5.1.

Result from the questionnaire analysis show that the level of acceptance is high for both categories as shown in table 2.

Table 2: Level of acceptance by construction stakeholders from questionnaires

S/N	CATEGORY	SCORE
1	Client's satisfaction	8.5
2	International acceptability and competitiveness	7.8

Source: Researchers work, 2020

The score of 8.5 in table 2 shows that construction stakeholders have highly accepted change which is the key driver for improving client's relationship. Cost of construction are executed as targeted; project delivered to time and at required quality and sustainability. Change ensures time maximization, risk reduction securing project completion date. The score

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level of 7.8 indicates that the construction stakeholders have high level of acceptance towards ensuring international acceptability. The world is a global village. Nigeria and other developing countries should operate in an accepted standard. The change application also gives room for the companies with Nigeria background to measure up and compete with their foreign counterparts.

V. Conclusion

Modern methods of construction change the risk profiles of construction projects. Some development risks become less significant in terms of likelihood of occurring and potential impact. Examples include price fluctuations during the construction process and delays due to bad weather. Other risks become more significant. Examples of these include unpredictable planning decisions and designs that are not suitable to the construction method. The changes necessary to achieve this position include: a value engineering approach applied to the process of materials management in order to minimize the tasks in the process; a re-engineering approach to the tasks that remain in the process; a total quality management approach, with continuous improvement being actively sought in interface areas in the system; a strategic approach with a view to developing partnering arrangements within the industry and an innovative and open-minded approach to be taken to the potential of the use of new technology. If these are put in place, the identified benefits such as effective cost savings, improvement in job, earlier delivery period and so on would be made possible.

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