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INFLUENCING FACTORS OF SUBCONTRACTORS' QUALITY OF WORK AND FLEXIBILITY IN POLAND AND NIGERIA

Every stakeholder's intention in a project is to have the best quality and minimize rework. But there are hurdles that come up during the stages and processes of a project that can compromise the quality if not handled correctly. This study aims to identify the influencing factors that affect subcontractors' quality of work and the impact of flexibility. Construction professionals from Poland and Nigeria participated in the survey. Descriptive statistics using IBM SPSS software version 27 was used to analyse the data.

The results obtained shows that there are several variables influencing subcontractors' quality of work, the overall ability of the subcontractor to ensure that the project meets the basic function of the end user's needs and intents, the degree to which the construction operations meet the design standards and specifications, strict adherence to quality assurance plan on general performance, subcontractor's ability to complete the contract on the completion date and the ability of the subcontractor to carry out the construction work with little rework, were identified as the major factors that affect the quality of work. Further analysis shows that the impact of flexibility on the subcontractors' quality of work could increase the smooth operation of the construction processes, increase compliance with the quality specifications, helps in effective decision making and effective functioning, limit non-conformities between planning and realization of work, and reduction in rework errors. The main contractors sometimes substitute or change the subcontractors. This study identify poor quality of work, failure to meet the deadline, use of inappropriate material and non-conforming to quality standards as some of the reasons for this change.

Keywords: *Subcontractors, quality of work, flexibility, construction industry, rework*

Introduction. The use of subcontractors in the construction sector for specialised services has been on the rise in recent decades. Though, the building contractor retains sole responsibility for the project management and coordination. Subcontractors are frequently used to tackle these issues to allow for rapid response in the event of staff shortages and new orders. Subcontractors do not only provide a higher level of protection, but they can also be quickly mobilized in the event of an emergency. As a rule of thumb, subcontracting is used to outsource a specific and pre-established construction work to

another party specializing in that specific construction work, Bennett and Ferry (1990). One way to hire others without making them part of your own organization is to use subcontracting, according to Hughes et al. (1994). Subcontracting construction work acknowledges the subcontractors' abilities and competence to successfully complete the construction work allocated to them, according to Lai (2000). Karim et al. (2006) reveal that technological, political, social, and economic changes have fueled the rise in the tendency for subcontracting. According to Hughes et al. (1994), technology develops increasingly and more sophisticated, which necessitates specialized knowledge in a certain field. Modern buildings, according to Oseghale and Wahab(2014), are extremely complicated, necessitating the involvement of numerous specialized experts and constructors. The rise of nominated subcontracting, according to Hughes et al. (1994), is mostly attributable to the rising sophistication of construction and the growing demands of clients. Therefore, subcontracting work has become a typical practice in the construction business. Oseghale and Wahab (2014); Skaik, and Al-Hajj, (2014) (2013).

Subcontracting has reached its height, and it will be impossible to avoid it in the future, Ofori (1990). Subcontractors perform 90 percent of the construction work alongside the main contractor, with the focus mostly on project management and coordination Karim et al.(2006). Subcontracting, according to Costantino, et al. (2001), would necessitate constant management and supervision by contractors of the subcontractors involved depending on the complexities of the projects involved. When subcontractors are dissatisfied with their management, it can cause a variety of challenges including arguments and disagreements among the various parties involved, delays in the project, and non-conformance to quality standards. Rahman, et al.,(2013) stated that many construction projects suffer from delays. Subcontractors might cause delays directly or by failing to perform their duties in accordance with the conditions of contract. Bramble, and Callhan,(1992). This assertion is backed by Mbachu, (2008), who claimed that the capacity of the general contractor and consultant to deliver the project within time, quality, and cost rests mainly on the performance of subcontractors. For complex and fast-paced projects, a lack of understanding of the scope of work and logical relationships between subcontractors' work is a major issue. One subcontractor's poor performance could have a ripple effect throughout the entire workforce, causing delays and harm to several parties Shimizu and Cardoso (2002). When it comes to meeting a project's budget, cost, and schedule, subcontractors' quality of work should not be disregarded. In construction, the term "subcontractor" is frequently used because each project is unique, the workforce is constantly changing, a variety of trades are required, the projects are planned and completed in a short period of time, and a wide range of materials and equipment are needed. As a result, a single construction project is frequently divided among many subcontractors.

Flexibility As defined by Upton (1994), "is the capacity to change or react quickly, with minimal loss of resources or performance". Flexibility is 'vague and difficult to improve, yet critical to competitiveness' Upton (1995). A project's ability to adapt to changes in its definition or scope and compensate for them with minimal impact on the project's schedule (time), costs, and quality is referred to as project flexibility. Flexibility can also be described as a means of postponing or delaying irreversible decisions until more information is available. Husby et al.(1999) define project flexibility as "the ability to adjust the project to prospective consequences of uncertain circumstances within the context of the project. However, system flexibility is defined as the ability to adapt to changes in the environment. One of the most common attributes of any organization, process, or system, is its ability to adapt to changing circumstances. Flexible work environments have become increasingly popular in recent years, but scholars have not focused on how to distinguish between the various types of flexible work environments,

despite the fact that the concept is widely accepted. Competition's next strategic weapon appears to be adaptability (Parker and Wirth, 1999). For businesses, it is a factor that helps them thrive in a chaotic and uncertain environment (Dreyer and Gronhaug, 2004).

The construction industry is plagued by delays, cost overruns, and other serious issues despite having created performance management and assessment systems many years ago. There have been numerous research that have looked into these risks and come up with effective solutions. When it comes to specialized or labor-intensive jobs, firms and organizations have increasingly outsourced certain tasks to subcontractors to save money. As a result, a number of chains were formed, each of which focused on a unique and distinct aspect of a larger (construction) project. In spite of this, managing a big, diverse, and fragmented collection of subcontractors is a problem for contractors, clients, and their project management teams. Studies suggest that subcontracting practices are causing issues for the construction sector, as there are numerous subcontractors operating under the general contractors, especially for large projects.

It is important to understand how subcontractors' quality of work is evaluated and the impact of flexibility on the quality of work by subcontractors. It is necessary to answer the following research questions:

1. What are the factors that influences the subcontractors' quality of work?
2. Does flexibility has any effect on subcontractors' quality of service?
3. Is there a reason why a project's subcontractors are constantly being changed?

The purpose of this study is to evaluate and analyze the quality of work performed by subcontractors as well as the impact of work flexibility. The study's objectives are to provide a comprehensive literature review to identify the variables which can be used to assess subcontractor quality of work. The determination of the impact of flexibility on the subcontractor's overall quality of work and to determine the reasons why subcontractors are changed on a project.

The results from this study will benefit the construction industry, particularly clients and contractors who will have a greater understanding of the need to assess subcontractor quality and flexibility impact, as well as how to execute it. Customers and contractors can also benefit from this by reducing the elements that affect the quality of building work, while enhancing the strictness of the quality assurance plan in general performance. This study does not cover the design and layout of a subcontractor database in any way. In order to integrate with a current subcontractor management system, flexibility in the quality of subcontractors' work is intended. For this investigation, the private building sector is the focus, which is mostly driven by market and economic pressures as well as by existing regulations. More so than expert subcontractors chosen by an employer or an agent of that employer, domestic subcontractors are included in the scope of this study since the main contractor has greater control over their selection. In addition, the results of the survey provides a great overview on the existing state of the system for evaluating the quality of the work performed by subcontractors.

Literature review. Definition of Subcontractors. Construction companies or individuals that the main contractor contracts to perform specific jobs on a project as part of the overall contract and may supply personnel, materials, equipment/tools, and designs (El-Kholy, 2019). A study by (Samuel, 2009) found that subcontractors often sign into contracts to carry out specific tasks inside a larger project. Subcontractors, according to Lew et al. (2018), are only acknowledged as professionals in the implementation of a certain project.. A surge in the use of subcontracting in the construction industry has led to its widespread use (Polat, 2016). The advantages of subcontracting are well documented. It is common for subcontractors to function as a sort of production system proxy. In addition to lowering the project's overall expense, they also ensure the quality of the work performed by the specialists and lessen the financial strain on general

contractors (El-Kholy, 2019; Lew et al., 2018; Choudhry et al. 2012). The Building and Engineering Standard Method of Measurement (BESMM) defined subcontractor as a contractor employed by the general contractor to undertake specific work within the construction project/engineering/industrial; also known as specialist works, trade, work package, and labour only contractors. Table 1 depicts many ways in which the subcontractor has been defined in various contracts.

Table 1

Definitions are given for subcontractor

Term	Definition	References
Subcontractor	A subcontractor is one who is designated for a certain portion of the project under the construction project's contract as a subcontractor.	Standard Bidding Document, SBD-2, 2007
	The subcontractor identified in the Appendix to the Subcontractor's Offer that was accepted by the Contractor	FIDIC Conditions of Subcontract, 2011
	Any person designated as a subcontractor for any component of the Works, whether explicitly or implicitly, in the Contract.	FIDIC Conditions of Contract, 1999
	Whoever has a contract with the Contractor to carry out the specified work: <ul style="list-style-type: none"> • construct, build or install part of the Works; • provide a service necessary to a construction project, • Provide equipment and materials that have been specifically tailored for the project by the individual or organization. 	NEC3 Engineering and Construction Contract, 2013
	The subcontractor identified in the agreement	The Joints Contracts Tribunal (JCT) Intermediate Named Sub-Contract, 2016 JCT Intermediate Sub-Contract, 2016 JCT Standard Building Sub-Contract, 2016

Source: Rodrigol and Perera, 2017

Management of Subcontractors. Coordination and monitoring of subcontracted work during construction is crucial, but selecting the correct subcontractor does not guarantee its success. Field superintendents rated subcontractors based on the types of subcontracts they had with them. To provide a fair evaluation of subcontracts, multiple evaluation parameters were used. A neural network-based rating system for management subcontractors was proposed by Albino and Garavelli (1998). The neural network's practical implementation was demonstrated through the use of a case involving the evaluation of possible subcontractors competing for a bid. It is necessary for the decision-maker to take into account five primary aspects when gaining access to competing subcontractors: price reduction, time reduction, bid technical/qualitative qualities of the bid, contractual reliability the rival and managerial abilities of the competitor. Based on the expert's previous selections, the network will suggest an appropriate subcontractor for

the project. As a result, this neural network requires the input of an expert. Subcontractor management is therefore critical. It follows that the subcontractor is to blame for a significant number of quality issues. To be successful in business, both parties need to form a partnership. Design, production, and cost-cutting are all goals that the subcontractor should help to achieve. The whole cost of the materials, including pricing and quality, should be the primary consideration.

An objective evaluation of a subcontractor's performance is provided through subcontractor quality ratings. Subcontractor assessment, distribution of business, and identification of areas for quality improvement will result from this evaluation. Management of subcontractors holds monthly meetings in which they examine their performance, quality, and relevant businesses. An evaluation and ranking meeting is held not just once a month, but four times a year. The team informs individual subcontractors of their rating and ranking in order to request improvement activities, particularly if the rating falls below 70%.

Problems of Subcontracting. Subcontracting has had a positive impact on the construction industry around the world, but it is not without its drawbacks. However, subcontracting necessitates the measurement and monitoring of subcontractors' performance by the main contractor, allowing the main contractor to delegate some organizational tasks to subcontractors. As a result, the costs of managing subcontract performance replace those of coordinating in-house production of the task, and both are transaction costs, according to FWH Yika et al. (2006). If transaction costs can be reduced, subcontracting is more efficient. Transaction costs can grow significantly when contract parties' self-interested behavior varies significantly, especially when conflict and disputes emerge. There are distinct consequences for the cost associated with measuring and monitoring contractual performance based on the features shown in Figure 1.

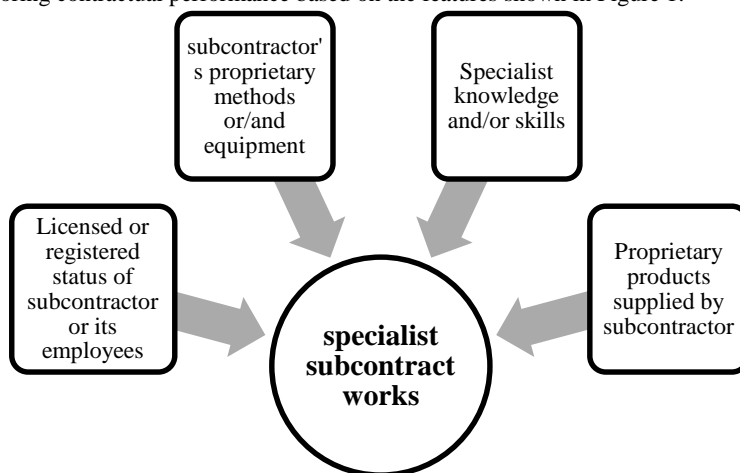


Figure 1. The key characteristics of specialist subcontract works *Source:* FWH Yik et al. (2006)

These qualities affect not just the cost and quality or performance of the final product, but also the future operation, maintenance, and replacement expenses of the system. A subcontractor's bid price strategy is influenced by their pricing strategy. Operation and

maintenance expenses for some solutions may be prohibitive, resulting in deterioration in system performance or even discontinuation of system use. As a result, "extensive subcontracting activities pose hazards to general contractors, clients, and their project management teams," Lew et al. (2018) wrote in their paper. The difficulty, according to Lew et al. (2018), stems from the difficulties these stakeholders face when trying to manage such large, diverse, and dispersed groups of subcontractors. Subcontracting in the construction industry has also been linked to a number of other risks, such as a lack of communication between parties during the construction phase (Piasny and Paslawski, 2015), a delay in the completion date (Chiang, 2009), and the safety of on-site workers, (Awwad et al., 2016).

If the subcontractors are licensed or registered persons/companies, the scrutiny of their work may be less stringent, but they will be held to a higher standard of accountability for the performance of the installed systems, especially if the contractual requirement includes the fulfillment of statutory checks. Specialist subcontractors can take advantage of the authority granted to them by regulatory requirements, such as forcing clients to accept equipment or materials that are already on an authority's approved list but delaying the approval and listing process for new products; refusing to follow a client's design instructions if doing so would violate regulations or be prohibitively expensive.

Factors Influencing Subcontractors Selection. A crucial step in every construction project is identifying the best subcontractors. When it comes to picking subcontractors, there are a slew of aspects to consider. There are numerous issues that can arise if subcontractors are chosen incorrectly. These include issues with the quality of the job and the length of the project. Many things influence this process. In order to reduce project risk, increase quality, and preserve good connections between project stakeholders, the contractor selection process has three primary goals. The selection of subcontractors follows the same principle. Research suggests that a multi-criteria selection method should be used in addition to pricing when deciding on a contractor. Many major contractors and owners are just interested in the lowest bidders. There are, however, additional considerations that must be made. Research by Z.Turksis(2008) found that 13 criteria for selecting the best contractor include "history of reasonable bid price submissions," "a work history that indicates specialization and quality of workmanship in a particular construction skill," "contractor's degree of quality control," "decorum, conduct and non-disruptiveness of contractor staff and subcontractors." If the appropriate criteria are followed, the best choice is selected, and this offers several advantages for all parties involved in the construction project, such as high-quality finishing, meeting deadlines based on the projected time, and adhering to the estimated cost. The major contractor's interests were protected in the contract via the inclusion of contract guarantees (Marzouk et al., 2013). Along with these, there are a number of other considerations, such as a supplier's capacity to supply on time, the contract's completion timeframe, a subcontractor's physical resources, the bid price, repayment difficulties, and flexibility in vital operations.

El-khalek et al.(2019) discovered further issues affecting the subcontractor's performance. For example, ensuring on-time delivery of goods, failing to fulfill a contract owing to financial difficulties, and concerns with payment were cited as key considerations in the selection process. Furthermore, factors such as reputation, competitive bidding, and the management of critical operations during the construction and progress stages that went beyond the scope of the performance contract were taken

into consideration. It was necessary to consider the project's technical problems and the project's delay in completion if the labor capacity was inadequate. Construction engineering, time control, operating method, material waste, service after work completion, cooperation with other subcontractors, safety and protection practices, usage habits tools (tools borrowed from contractors), work ground clearance, manageability, the personality of subcontractors, economic conditions are other factors that establish a contractor's strength in participating in a competency competition with other contractors (Ko et al., 2007).

Subcontractors who are up to the task will complete projects on time and within budget. Choosing the right subcontractor is an important factor in determining the task's quality. The lowest price is the most prevalent factor used to select a subcontractor. Recently, researchers have concentrated their efforts on establishing a mechanism for determining the best subcontractor for a given project, one that is not driven purely by the lowest price. Choosing the wrong subcontractor can lead to a lot of issues throughout the project's execution and acceptance, as well as a host of unforeseen issues during the project's initial use.

According to NIK's report on the General Directorate for National Roads and Highways' operations to assure quality of road work (in Polish), Warszawa, 2015's control report is critical for general contractors and subcontractors. In the construction sector, low quality of construction works and inadequate supervision on the side of construction and the investor are two of the most common causes of construction flaws. In addition to the poor quality of its investments, this lack of monitoring and the lack of consistency to the people who are in charge of the surveillance, which was not attained parameters, causes greater costs, longer building times, and difficult or impossible usage of the object. Some researchers took into account 42 characteristics that are grouped into nine criteria; quality, time, employees, cost, staff behaviour, safety, disputes and risks, tenders and experience. to decide which are the most relevant when it comes to hiring subcontractors Marzouk et al.(2013).

The Concept of Flexibility. (Hayes and Pisano, 1994) studied three types of adaptability: operational, tactical (or structural) and strategic. A firm's experience and extrapolation can allow it to develop routines to reduce any short-term uncertainty, according to Volberda (1997), despite the fact that the environment may be diverse. According to Sethi and Sethi (1990), a firm's operational flexibility is a determinant of the speed and cost of response, reinvestment, and degree of interruption in their existing systems and processes. These findings were backed up by the discovery that increased operational flexibility allows companies to reduce the time it takes between planning and implementation by making quick adjustments, and thus increases the company's capacity to improvise in response to sudden fluctuations.

Consequently, operational flexibility becomes more important when we look at construction projects on a daily basis because of its ability to respond quickly to project environmental uncertainties and changes. Heng and Lim (2009) conducted a study on construction flexibility management titled "Organizational flexibility Management in construction." The study's goal was to examine construction firms' organizational flexibility management. The six key determinants of organizational flexibility are; organizational learning culture, organizational structure, employees' skills and behavior, technological capabilities, supply chain capabilities and business strategies.

Flexibility for construction industries. The theoretical concepts of contingency theory, the law of requisite variety, and systems theory are used in the flexibility approach

(Paslawski 2008). Making a system or process more proactive means incorporating contingency plans and enhancing the system's ability to take necessary control measures by quickly adjusting to new circumstances. The majority of large-scale construction projects begin with a five- to six-year planning horizon. Demands on the infrastructure are expected to change significantly during this time period. Changes in government regulations, changes in funding agency rules, and other factors may lead to a shift in demand. Architects, consultants, and contractors are just a few of the many people who have a stake in construction projects. With so many stakeholders involved, there is the potential for frequent changes in each stakeholder's requirements. As a result, construction projects must be adaptable.

It is important to be flexible when dealing with uncertainty and changing technology. The general economic situation, the terms of financing, and the needs of the customer can all change. All construction projects are based on these factors, which are universally applicable. No serious consideration is given to making flexible allowances for the potential needs of future users of the building, despite the fact that some flexible solutions are repeated from project to project (Patrizi et al, 2006). However, during the design phase, flexibility is an attribute of a building that has been realized to some degree in all projects. Until now, the issue with flexibility was that it was viewed as an ambiguous, unquantifiable idea. Furthermore, it has different connotations for various constituencies. When it comes to a building's daily activities, users are more concerned with the flexibility of its rooms than owners are with its long-term goals (Saari & Heikkila 2008). They identified three types of flexibility; Service flexibility, modifiability and long term adaptability.

Investment in flexibility without careful consideration can lead to unnecessary expenditure that does not necessarily result in flexibility in relation to the actual changes. Users may become dissatisfied as a result of rigid design solutions. Flexibility is best achieved by having complete control over all aspects of design and construction. Construction has a significant impact on the building's flexibility because of the expensive and time-consuming nature of altering things like frame solutions, floor heights, and building service ductwork after it is completed. Consequently, in the construction industry, adaptability is a critical factor for success. The needs of the end user differ from those of the building owner when it comes to adaptability.

Perspectives on project flexibility. Flexibility management is not a new idea in the world of project management or business strategy. Flexible planning is one method Sager (1990) used to deal with uncertainty in planning. Although planners frequently use the term "flexibility," it is rarely examined theoretically, as Sager points out. Sager Under uncertain conditions, the traditional project management focus on stability is called into question, according to Kreiner (1995). This results in "drifting environments." Even if the project context shifts, Kreiner's environments can still drift. Also, when project stakeholders have a better understanding of their actual needs and a better ability to express their needs, they may occur. Amram and Kulatlaka (1999) compare flexibility to owning an option - the right, but not the obligation, to take an action in the future. The real-options paradigm states that uncertainty can increase a project's value as long as flexibility is maintained and resources are not permanently committed. According to Mandelbaum and Buzacott (1990), a measure of flexibility is the number of options left after a decision is made. Eikeland (2001) does the same thing with "project flexibility." The "room for maneuvering" is made up of internal decisions that have not yet been made, and it can also be seen as a measure of the project's internal uncertainty. In Eikeland

(2001), if a decision does not violate the consequences of previous decisions, it can be characterized as being within the realm of possibility. Flexibility management is not a new idea in the world of project management or business strategy. Flexible planning is one method Sager (1990) used to deal with uncertainty in planning. Although planners frequently use the term "flexibility," it is rarely examined theoretically, as Sager points out. Sager

An approach to decision-making in which decisions and commitments in the projects are made sequentially over episodes provides flexibility. To achieve product flexibility, the project's final product must be designed to serve multiple purposes. This approach to flexibility in building construction has been described by Brand (1994) and Blakkstad(2001) as being used. Most projects did not plan for flexibility in the decision-making process, but flexible approaches were used anyhow in those projects that had flexibility planned in. There were high degrees of actual decision-making flexibility in all projects that had a high degree of planned decision-making flexibility. Flexibility in the product could have a limited impact on the decision-making process. This suggests that if a project has the ability to be flexible, it is likely to be used.

Methodology. Data collection. A crucial input to the data analysis stage is obtained during the research data collection stage. Therefore, a questionnaire survey was administered to a predetermined random sample of construction project experts. A review of the literature as described was carried out in order to identify variables influencing the quality of work performed by subcontractors and the impact of flexibility on the quality of work. After the pilot survey, the research questionnaire was finalized by making the necessary changes. The contractors were asked to rate the factors that affect quality in terms of activity flexibility, such as completion time, based on their own construction site experiences. The survey asked respondents to identify the factors that influence the quality of their work.

A survey questionnaire was created with the study's goals in mind, which included two parts: Questions about the respondent's professional background, such as industry sector and level of experience, were included in part one of the questionnaire. Statistical analysis included questions that were treated as independent variables in this section. Twenty-two variable factors influencing the quality of subcontractors' work make up the second section. Section three identify the reasons behind the changes of subcontractors in construction project while the final survey design include factors that impact the flexibility to subcontractors' quality of work. At the questionnaire survey stage, respondents were asked to rate the levels of importance or influence of the identified factors influencing the subcontractors quality of work. A five-point Likert rating scale was provided for rating the attributes or criteria in the subset for each stage (1 'strongly disagree' ; 5 being 'Strongly agree or 'very important).

Data Analysis. The mean score was calculated based on the data collected from the questionnaire survey using equation 1. This was analyzed quantitatively using Multi-attribute analysis. This was based on Chang and Ive (2002) multi-attribute utility approaches and was deemed appropriate by Mbachu and Nkado (2006) and Mbachu and Nkado (2007) due to the nature of the research data and questions. It was necessary to compute the following values as part of the investigation:

Mean Score (MS). This was computed as the sum of the product of each Likert rating point (L) and the corresponding response to it (R), out of the total number of responses (TR) involved in the rating of the particular variable, i.e.:

$$MS = \sum_{i=1}^5 (L_i \times R_i) \quad (1)$$

where:

MS = Mean Score

L_i = Likert rating point i ($1 \leq i \leq 5$);

R_i = response to Likert rating point i .

The mean score analysis focused on evaluating respondents' collective rating of a variable on the rating scale used.

Relative index (RI). This was used to compare the MS (i.e. mean score) values obtained in equation 1 for the variables in a given subset. It was computed as a unit of the sum of MS_i in a subset of variables:

$$RI = \frac{MS_i}{A \times N} \quad (2)$$

Where:

RI= Relative Index

A = Higher weight on the likert scale

N= Total number of responses

MS_i = Mean score point of i

The relative influence index (RII) or the relative importance index (RII) of a particular attribute in a subset could be referred to as the relativity index. Subset attributes with the most important attribute in a subset. The results of the survey were analyzed using IBM SPSS version 27 and then presented.

Results and discussions. This section presents the results and analysis of the questionnaire survey carried out in Poland and Nigeria. This section identifies the rank of various factors for influencing subcontractors' quality of work, the impact of flexibility in the quality of work, and the reason for subcontractors' change. The survey questionnaire was sent to Eighty-five (85) respondents. Sixty-four (64) valid and accurate responses from experienced engineers working in various positions and companies in Poland and Nigeria, or who were involved in any construction project, were kept from the final results. It was found that approximately 75% of the validations were successful.

Respondents' characteristics. There were 55% of respondents from Poland and 45% from Nigeria. For example, as depicted in figure 2,

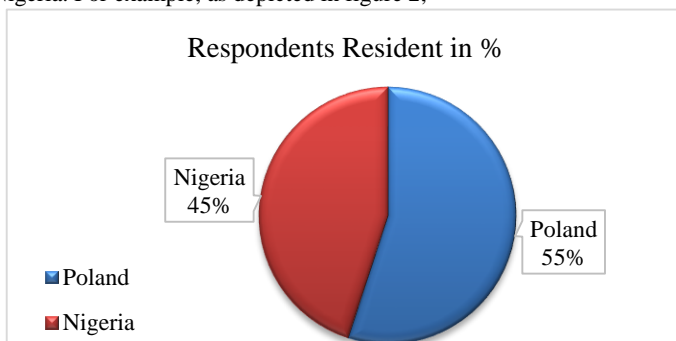


Figure 2. Residents for survey respondents. *Source:* (own work)

The following question asked respondents to identify the company they are currently employed by. So that participants can verify that they are working with construction companies to increase the validity of their results, we asked them this specific question. To add to these findings, the survey results show the grouping of the professional based on the nature of organisation’s business, as depicted in Figure 3.

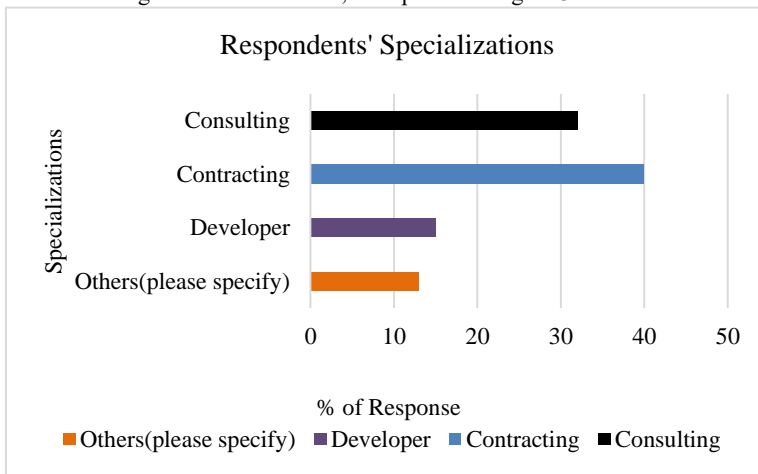


Figure 3. Grouping based on the nature of business of the *Source:* (own work)

Survey participants work for contracting companies (40%), consulting firms (32%), and developers (15%). The rest of the respondents fall into a variety of other categories. Managers and others with less experience were among those who offered their opinions, but their job titles provide additional information about the sample’s demographics as a whole (see Table 1). The number of respondents are grouped based on their professions as shown in figure 4, engineers and construction managers accounts for 45% and 25% of the respondents respectively while 10% of the respondents are project managers.

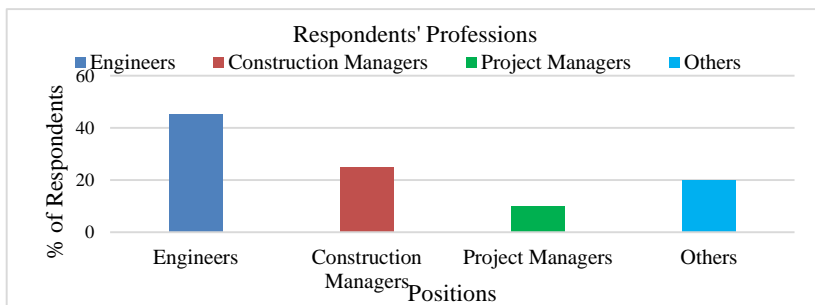


Figure 4. Various Positions held by respondents *Source:* (own work)

According to the data, engineers are the most common respondents, followed by construction and project managers. The other 5% “others” positions include; tender engineer, contract engineer, quantity surveyors, managing directors and procurement managers. the number of participants of each category.

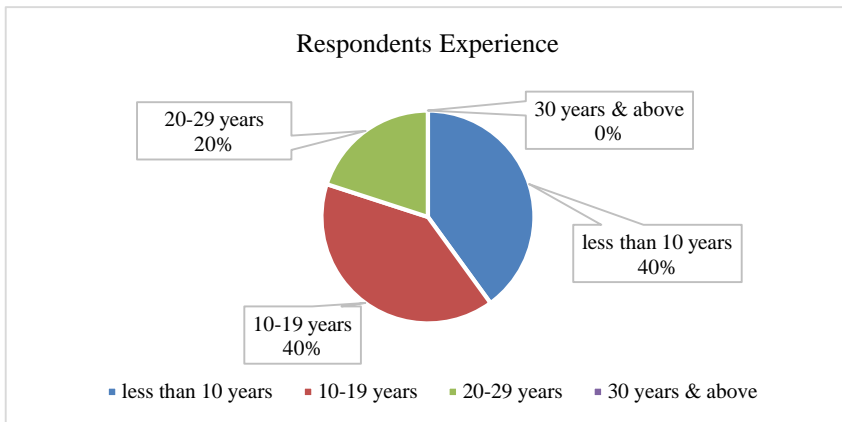


Figure 5. Respondent’s years of experience *Source:* (own work)

In this survey, the number of years of construction experience is also important, as it leads to a better understanding of the quality of work and flexibility of subcontractors. The answers revealed an even distribution of respondents with experience in the field ranging from 10 to 19 years, which is a fantastic finding.

Factors influencing subcontractors’ quality of works Analysis. Twenty-two variables influencing subcontractors’ quality of works in table 2 were identified and the respondents were asked to rank in a five-point Likert scale ticking the answer that is most appropriate to them. The mean score and relative importance index were used to analyze the relative levels of influence.

Table 2

Variables influencing subcontractors’ quality of works Analysis

Code	Variables influencing subcontractors’ quality of works (Poland Responses)	Level of significance					TR	Total	MS	A x N	RII	Rank
		SA	A	N	D	SD						
		5	4	3	2	1						
1	2	3	4	5	6	7	8	9	10	11	12	13
P1	Contract duration	6	23	6	0	0	35	140	4.0	175	0.8000	11
P2	Wait time for mobilization on-site	6	23	6	0	0	35	140	4.0	175	0.8000	11
P3	Subcontractor's ability to complete the contract on the completion date	15	20	0	0	0	35	155	4.4	175	0.8857	2
P4	Strict adherence to quality assurance plan on general performance	15	15	5	0	0	35	150	4.3	175	0.8571	3

Continuation of table 2

1	2	3	4	5	6	7	8	9	10	11	12	13
P5	Subcontractor's ability to comprehend the client's needs and require	13	13	9	0	0	35	144	4.1	175	0.8229	6
P6	Ease to which contracting services and work is achieved	9	13	13	0	0	35	136	3.9	175	0.7771	15
P7	Reaction to unexpected problems encountered during the contract	8	8	11	8	0	35	121	3.5	175	0.6914	20
P8	Willingness and readiness to provide prompt service	12	14	9	0	0	35	143	4.1	175	0.8171	8
P9	Accuracy and dependability in providing the promised service	12	15	8	0	0	35	144	4.1	175	0.8229	6
P10	Level of trustworthiness	10	10	15	0	0	35	135	3.9	175	0.7714	16
P11	Honesty, physical, financial, and confidentiality	10	15	10	0	0	35	140	4.0	175	0.8000	11
P12	Physical facilities, equipment, and appearance of employees	0	20	15	0	0	35	125	3.6	175	0.7143	19
P13	The ability of the contractor to carry out the construction work with little rework	15	15	5	0	0	35	150	4.3	175	0.8571	4
P14	The ability of the subcontractor to regain momentum after the completion of each work	10	20	0	5	0	35	140	4.0	175	0.8000	11
P15	Degree of caring, individualized attention the contractor provides his client	5	5	5	20	0	35	100	2.9	175	0.5714	22
P16	Ability to inspire trust in customers, courtesy toward coworkers, and respect for clients	7	5	3	20	0	35	104	3.0	175	0.5943	21
P17	Possession of required skills and knowledge of all employees	10	9	16	0	0	35	134	3.8	175	0.7657	17
P18	The ability of the subcontractor to keep the client/consultants in a language they can understand and listen to the client/ consultants when necessary	10	15	0	10	0	35	130	3.7	175	0.7429	18
P19	The ability of the subcontractor to repetitively provide the same level of service to all clients	11	15	9	0	0	35	142	4.1	175	0.8114	10
P20	The ability of the subcontractor to ensure that the facility meets the basic function of the end user's needs and intents	20	10	5	0	0	35	155	4.4	175	0.8857	1
P21	The degree to which the construction operations meet the design standards and specifications	15	10	10	0	0	35	145	4.1	175	0.8286	5
P22	Speed, courtesy, and competence with which maintenance on facility can be carried out	15	8	12	0	0	35	143	4.1	175	0.8171	9
	Nigeria Responses											
N1	Contract duration	15	9	5	0	0	29	126	4.3	145	0.8690	6
N2	Wait time for mobilization on-site	4	15	10	0	0	29	110	3.8	145	0.7586	

End of table 2

1	2	3	4	5	6	7	8	9	10	11	12	13
N3	Subcontractor's ability to complete the contract on the completion date	15	10	4	00	29	127	4.4	145	0.875	9	5
N4	Strict adherence to quality assurance plan on general performance	14	15	0	00	29	130	4.4	145	0.896	6	3
N5	Subcontractor's ability to complete the contract on the completion date	9	15	5	00	29	120	4.1	145	0.827	6	13
N6	Ease to which contracting services and work is achieved	12	12	5	00	29	123	4.2	145	0.848	3	9
N7	Reaction to unexpected problems encountered during the contract	14	11	4	00	29	126	4.3	145	0.869	0	6
N8	Willingness and readiness to provide prompt service	10	15	2	00	29	118	4.1	145	0.813	8	14
N9	Accuracy and dependability in providing the promised service	9	10	10	00	29	115	4.0	145	0.793	1	18
N10	Level of trustworthiness	10	10	9	00	29	117	4.0	145	0.806	9	15
N11	Honesty, physical, financial, and confidentiality	5	15	3	00	29	94	3.2	145	0.648	3	22
N12	Physical facilities, equipment, and appearance of employees	5	24	0	00	29	121	4.2	145	0.834	5	12
N13	The ability of the contractor to carry out the construction work with little rework	17	7	5	00	29	128	4.4	145	0.882	8	4
N14	The ability of the subcontractor to regain momentum after the completion of each work	5	19	5	00	29	116	4.0	145	0.800	0	17
N15	Degree of caring, individualized attention the contractor provides his client	5	15	9	00	29	112	3.9	145	0.772	4	19
N16	Ability to inspire trust in customers, courtesy toward coworkers, and respect for clients	5	15	0	90	29	103	3.6	145	0.710	3	21
N17	Possession of required skills and knowledge of all employees	10	16	1	00	29	117	4.0	145	0.806	9	15
N18	The ability of the subcontractor to keep the client/consultants in a language they can understand and listen to the client/ consultants when necessary	12	12	5	00	29	123	4.2	145	0.848	3	9
N19	The ability of the subcontractor to repetitively provide the same level of service to all clients	10	15	4	00	29	122	4.2	145	0.841	4	11
N20	The ability of the subcontractor to ensure that the facility meets the basic function of the end user's needs and intents	15	12	3	00	29	132	4.6	145	0.910	3	1
N21	The degree to which the construction operations meet the design standards and specifications	15	12	3	00	29	132	4.6	145	0.910	3	1
N22	Speed, courtesy, and competence with which maintenance of the facility can be carried out	11	15	3	00	29	124	4.3	145	0.855	2	8
Notes: Levels of significance: SA =Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree. TR = Total responses; MS = Mean score (see equation 3); RI = Relativity index. P =Poland, N = Nigeria												

Source: (own work)

The above table shows that the consistency of variables influencing subcontractors' quality of work based on RI ranking analysis from both Poland and Nigeria. The ability of the subcontractor to ensure that the facility meets the basic function of the end user's needs and intents was ranked highest by both countries while respondents from Nigeria

ranked the degree to which the construction operations meet the design standards and specifications was also ranked highest. From the Poland construction industry, the subcontractors' ability to complete the contract on the completion date was ranked in the second place. Both countries ranked strict adherence to the quality assurance plan on general performance on the third place same with the ability of the subcontractor to carry out the construction work with little rework at the fourth place. In Poland, the degree to which the construction operations meet the design standards and specifications as the fifth place which was ranked first in Nigeria construction industry. Nigeria ranked the subcontractor's ability to complete the contract on the completion date in fifth which was ranked in second for Poland. It is interesting to note that both countries ranked the same variables as the top five influencing factors affecting subcontractors' quality of work.

Change of subcontractors during projects. The analysis in table 3 presents the contributing factors why subcontractors are changed in a project. Poor quality of work as well as the use of inappropriate material and failure to meet the deadline of work ranked in first and second place as the most important factors by respondents from both countries respectively. However when subcontractor's equipment and machinery does not have full quality inspection stamps and when works need to be redone due to changes in design, drawing or specification are ranked the least by the respondents from Poland and Nigeria respectively.

Table 3

Analysis of reasons why subcontractors are changed in a project

Code	Reasons why subcontractors are changed in a project (Poland Responses)	Level of significance					TR	Total	MS	A x N	RII	Rank
		SA	A	N	D	SD						
		5	4	3	2	1						
P1	The work needs to be redone due to changes in design, drawings or specifications	14	10	0	16	0	35	142	4.1	175	0.8114	7
P2	Excessive Reworks	16	17	0	0	0	35	148	4.2	175	0.8457	5
P3	Lack of proper tools and equipment on-site	10	12	6	5	0	35	126	3.6	175	0.7200	10
P4	The subcontractor's equipment and machinery does not have full quality inspection stamps	5	15	5	10	0	35	120	3.4	175	0.6857	11
P5	The subcontractor do not performed the work according to the quality plan	20	11	4	0	0	35	156	4.5	175	0.8914	4
P6	The content of the subcontractor's report does not comply with the current construction standards	10	20	5	0	0	35	145	4.1	175	0.8286	6
P7	failure to meet the deadline for work	15	14	11	0	0	35	164	4.7	175	0.9371	2
P8	Poor quality of work	25	10	0	0	0	35	165	4.7	175	0.9429	1

End of table 2

P9	Use of inappropriate materials.	23	12	0	0	0	35	163	4.7	175	0.9314	3
P10	Improper planning	10	15	5	5	0	35	135	3.9	175	0.7714	9
P11	Less commitment to you on their part, which may negatively affect the quality of their work	14	7	14	0	0	35	140	4.0	175	0.8000	8
	Nigeria Responses											
N1	The work needs to be redone due to changes in design, drawings, or specifications	6	8	4	0	11	29	85	2.9	145	0.5862	11
N2	Excessive Reworks	15	10	4	0	0	29	127	4.4	145	0.8759	4
N3	Lack of proper tools and equipment on-site	17	6	0	0	6	29	115	4.0	145	0.7931	8
N4	The subcontractor's equipment and machinery do not have full quality inspection stamps	14	8	7	0	0	29	123	4.2	145	0.8483	6
N5	The subcontractor does not perform the work according to the quality plan	18	6	5	0	0	29	129	4.4	145	0.8897	3
N6	The content of the subcontractor's report does not comply with the current construction standards	15	8	6	0	0	29	125	4.3	145	0.8621	5
N7	Failure to meet the deadline for work	5	14	0	5	5	29	96	3.3	145	0.6621	10
N8	Poor quality of work	22	7	0	0	0	29	138	4.8	145	0.9517	1
N9	Use of inappropriate materials.	22	6	1	0	0	29	137	4.7	145	0.9448	2
N10	Improper planning	9	11	9	0	0	29	116	4.0	145	0.8000	7
N11	Less commitment to you on their part, which may negatively affect the quality of their work	9	6	14	0	0	29	111	3.8	145	0.7655	9
Notes: Levels of significance: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree. TR = Total responses; MS = Mean score; RI = Relativity index. P =Poland, N = Nigeria												

Source: (own work)

The impact of flexibility on subcontractors' quality of work. The analysis in table 4 shows the impact of flexibility on the subcontractors' quality of work, it is evident that flexibility have impact on the quality of work. Increase in the smooth operation of construction process was ranked as the most important impact of flexibility in Poland while Nigeria ranked the increased in compliance with the quality specification as the most important. Both construction industries have ranked effective decision-making and functionality as the second most important impact of flexibility on subcontractors' quality of work.

Table 4

Analysis of the impact of flexibility on subcontractors' quality of work

	Impact of flexibility on subcontractors' quality of work (Poland Responses)	Level of significance					TR	Total	MS	A x N	RII	Rank
		SA	A	N	D	SD						
		5	4	3	2	1						
P1	Reduces work that needs to be redone due to changes in design, drawings or specifications	17	18	0	0	0	35	157	4.5	175	0.8971	7
P2	Reduction in rework errors	19	16	0	0	0	35	159	4.5	175	0.9086	4
P3	cooperation when resolving delays	15	14	8	1	0	35	157	4.5	175	0.8971	7
P4	Increase in the smooth operation of the construction process	15	15	10	0	0	35	165	4.7	175	0.9429	1
P5	Improve labour skills and behaviour	12	14	7	2	0	35	141	4.0	175	0.8057	11
P6	More commitment	16	16	3	0	0	35	153	4.4	175	0.8743	9
P7	high variability in resource utilization	19	15	1	0	0	35	158	4.5	175	0.9029	5
P8	limit non-conformities between planning and realization of work	15	10	15	0	0	35	160	4.6	175	0.9143	3
P9	overcoming technological obstacles	18	17	0	0	0	35	158	4.5	175	0.9029	5
P10	Effective decision making and effective functioning	23	12	0	0	0	35	163	4.7	175	0.9314	2
P11	Increase compliance with the quality specifications	14	14	7	0	0	35	147	4.2	175	0.8400	10
	Nigeria Responses											
N1	Reduces work that needs to be redone due to changes in design, drawings or specifications	17	10	2	0	0	29	131	4.5	145	0.9034	4
N2	Reduction in rework errors	18	5	6	0	0	29	128	4.4	145	0.8828	6
N3	cooperation when resolving delays	14	12	3	0	0	29	127	4.4	145	0.8759	7
N4	Increase in the smooth operation of the construction process	19	8	2	0	0	29	133	4.6	145	0.9172	3
N5	Improves labour skills and behaviour	12	14	3	0	0	29	125	4.3	145	0.8621	9
N6	More commitment	8	6	15	0	0	29	109	3.8	145	0.7517	11
N7	high variability in resource utilization	17	8	3	0	0	29	126	4.3	145	0.8690	8
N8	limit non-conformities between planning and realization of work	16	10	3	0	0	29	129	4.4	145	0.8897	5
N9	overcoming technological obstacles	12	12	5	0	0	29	123	4.2	145	0.8483	10
N10	Effective decision making and effective functioning	20	8	1	0	0	29	135	4.7	145	0.9310	2
N11	Increase compliance with the quality specifications	21	7	1	0	0	29	136	4.7	145	0.9379	1

Notes: Levels of significance: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree. TR = Total responses; MS = Mean score; RI = Relativity index. P = Poland, N = Nigeria

Source: (own work)

CONCLUSION AND RECOMMENDATIONS. A close examination on the top five variables influencing subcontractors' quality of works indicates that the rankings given by both construction industry are almost the same, this could be that both Poland and Nigeria almost has the same variables influencing the quality of works which are:

1. The ability of the subcontractor to ensure that the project meets the basic function of the end user's needs and intents.

2. The degree to which the construction operations meet the design standards and specifications

3. strict adherence to quality assurance plan on general performance.

4. subcontractor's ability to complete the contract on the completion date.

5. the ability of the contractor to carry out the construction work with little rework.

The impact of flexibility on subcontractors' quality of work cannot be over-emphasized as flexibility is one of the ranking criteria for assessing the quality of work in a project. The study shows that flexibility from subcontractors could:

1. Increase the smooth operation of the construction processes.

2. Increase compliance with the quality specifications

3. Help in effective decision making and effective functioning

4. Limit non-conformities between planning and realization of work

5. Reduction in rework errors

6. Reduces work that needs to be redone due to changes in design, drawings or specifications.

This study could contribute to eliminating or minimizing factors that affect quality of work, thereby ensuring results in improved project delivery. In the study and analysis from both Poland and Nigeria, it could be noted that while there is a bit of difference in ranking, these criteria from both regions, the variables, factors, and impacts of flexibility on the quality of work show more similarities.

It is a common practice in construction to evaluate the quality of work performed by contractors' subcontractors. This research, however, focuses on the factors that influence subcontractor quality of work and examines some of the reasons why contractors are changed during a project, as shown in the analysis of the results. Based on the findings, it is necessary to make recommendations to reduce, if not eliminate, the factors that affect quality work and how to improve them. The following are recommended:

1. It is imperative for architects and structural engineers to limit the use of complex strategies and highlights whenever possible.

2. Regular checks on the material supplied by the supplier is necessary as this will help in strict adherence to the contract.

3. Analyses or testing should be carried out on materials before they are used on the construction site, as under-quality materials can have a significant impact on quality and safety.

4. For quality management to be effective, the project management team must pay attention to quality control and quality assurance.

5. Quality management systems that are based on mobile applications are a convenient way to keep track of current projects.

6. The construction manager or site engineer should ensure that the quality requirements are communicated to the project team in a clear and understandable manner.

7. Encourage the use of digital file management systems not only to reduce paperwork, but also to simplify the process of updating documents.

8. Encourage testing and auditing during and after the construction of a building.

Quality of subcontractors' work is of utmost importance to the construction stakeholders. Hence, future research should be in the adaption of flexibility from the planning and design stage of the construction project. The use of building information modelling in the enhancement of flexibility should be studied.

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Фактори впливу на якість роботи та гнучкість субпідрядників у Польщі та Нігерії

Намір кожної зацікавленої сторони в проекті полягає в тому, щоб мати найкращу якість і мінімізувати переробку. Але є перешкоди, які виникають під час етапів і процесів проекту, які можуть погіршити якість, якщо з ними поводитись неправильно. Це дослідження спрямоване на визначення факторів впливу, які впливають на якість роботи субпідрядників, і вплив гнучкості. В опитуванні брали участь будівельники з Польщі та Нігерії. Для аналізу даних використовували описову статистику з використанням програмного забезпечення IBM SPSS 27.

Отримані результати показують, що існує кілька змінних, які впливають на якість роботи субпідрядників, загальну здатність субпідрядника забезпечити відповідність проекту основним функціям потреб і намірів кінцевого користувача, ступінь відповідності будівельних робіт стандартам проектування. і специфікації, суворе дотримання плану забезпечення якості щодо загальної продуктивності, здатність субпідрядника завершити контракт до дати завершення та здатність субпідрядника виконувати будівельні роботи з невеликими доопрацюваннями, були визначені як основні фактори, що впливають на якість працювати. Подальший аналіз показує, що вплив гнучкості на якість роботи субпідрядників може підвищити безперервність будівельних процесів, підвищити відповідність специфікаціям якості, допомогти в прийнятті ефективних рішень і ефективному функціонуванні, обмежити невідповідності між плануванням і реалізацією роботи та зменшення помилок при переробці. Головні підрядники іноді замінюють або змінюють субпідрядників. Це дослідження визначає низьку якість роботи, недотримання термінів, використання невідповідних матеріалів і невідповідність стандартам якості як деякі з причин цієї зміни.

Ключові слова: субпідрядники, якість роботи, гнучкість, будівельна галузь, переробка

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