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IMPACT OF VARIATION ON COST PERFORMANCE OF BUILDING CONSTRUCTION PROJECTS IN NKANU-WEST LGA, ENUGU STATE

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Abstract
Construction projects are the major things that contribute to the socio-economic growth of any country in the world and for a country to be developed there must be a lot of construction projects in the country which include the construction of roads, schools, hospitals, bridges, dams, railways, highways, ports, airports etc. The construction industry in both developed and developing countries is viewed as the sector of the economy which planning, design, construction, maintenance, repair and operation transforms various resources into constructed facilities The research aims to evaluate the effect of variation on cost of building construction project in Nkanu-West LGA of Enugu state with specific case studies within Nkanu-West LGA, the study seeks to identify casual factors contributing to variation occurrences and its effects in construction building project and assesses the effectiveness of good project management and monitoring can help to mitigate variations. The study employs comprehensive case study approach, utilizing both qualitative and quantitative research methods. Data is collected through structured interviews, document analysis, and on-site observations. The findings of this study will offer practical recommendation and the best practices for minimizing the adverse effects of variations on building construction projects. This research contributes to the body of knowledge in construction management and serves as a valuable resource for stakeholders, including contractors, project managers, clients etc. in enhancing project delivery efficiency and effectiveness.

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1.0 Introduction

Building construction projects is being carried out in different places in the world. Construction projects are the major things that contribute to the socio-economic growth of any country in the world and for a country to be developed there must be a lot of construction projects in the country which include the construction of roads, schools, hospitals, bridges, dams, railways, highways, ports, airports etc. The construction industry in both developed and developing countries is viewed as the sector of the economy which planning, design, construction, maintenance, repair and operation transforms various resources into constructed facilities Isa et al., (2013). The importance of the construction industry in the development of any nation cannot be under emphasized Oshodi, (2012). Developing countries in West Africa, a lot of economic infrastructure has been constructed which is used to evaluate how developed the country is. World Data (2019) states that Nigeria is one of the developing countries in West Africa and construction industry plays a vital role in the economic growth and development of the country.

In the construction industry variation orders during construction of projects are unavoidable and it arises at various stages therefore it is important to establish trust and ensure that these projects are being constructed successfully without any rise of disputes, arbitration between parties involved in the project, time and cost overrun, contract termination and abandonment. In construction projects the term 'variations' means any change or alterations to the scope of work originally specified in the contract, whether by way of addition, omission, or substitution to the works or through a change to the manner in which the works are to be carried out. Variation in the construction industry has become one of the common and serious issues Aftab et al., (2014). Almost all projects vary from the original design, scope or specification at some point during the construction. One can say that variations orders are not necessarily detrimental to the success of the project but could also be beneficial in some situations such as when it reduces the project cost, schedule and degree of difficulty in a project.

In Enugu state for example a lot of project delivery time has been delayed due to variations in the scope of work therefore causing cost and time overrun and in some cases project abandonment.

However, for a project to be delivered as planned with all the clients' requirements being met without exceeding the budget it is very necessary to manage variations that will arise during the construction.

2.0 Statement of the Research Problem

Variation order is one of the unfortunate conditions that disturb the flow of construction process and simultaneously delay construction project Msallam et al., (2015). Various authors intimate that variation orders are common to all types of projects (Thomas et al., 2002; Oladapo, 2007). Variations in construction project delivery not only disrupt the planned schedule and budget but also have an effect on multiple aspects of the project, including resource allocation, productivity, and clients' satisfaction. Arguably, the more the occurrence of variation, the greater the likelihood that unnecessary costs could build up impacting on the overall project cost Bello & Saka, (2017). Variation order raised on certain construction projects is responsible for project abandonment, lawsuits and the incorrect branding of such contractors as 'late or slow' (Amu et al., 2015; Pourrostam& Ismail, 2011).

The lack of comprehensive understanding, proactive monitoring and management of these variations pose significant challenges and can have detrimental effects on project delivery. These effects include cost overrun, schedule delays, extended project durations, compromised quality and strained client-contractor relationships. The lack of strategies, tools and practices such as good contract negotiation, contract evaluation and monitoring to manage and curb these variations further exacerbates the problem. However, the variation order in project construction ultimately leads to high waste created by the construction project (Afolabi et al.2018 & Umar (2017)

3.0 Systematic Review of Related Literature

3.1 Concept of Construction Projects delivery

A project is a series of related tasks which when they are carried out in the correct order will lead to the completion of the project. Projects are temporary, generally resulting in the creation of a tangible product or outcome. A construction project, sometimes just referred to as 'project' is the organised process of constructing, renovating, refurbishing, retrofitting or adapting a building or other built assets such as tunnels, bridges, hospital, refinery etc. Chitkara, (2013) defines a construction project as a high-value, time bound, special construction mission creating a construction facility or service, with predetermined performance objectives defined in terms of quality specification, completion time, budgeted cost and other specified constraints. There are several types of construction projects, each of which is comprised of many components. Almost all construction projects can be broadly categorised into one or three types of projects;

- Building and houses
- Public works
- Industrial type structures

For any project to be successful, a project must be completed within requirement and limits of scope, quality, time and cost (Ogunbiyi et al., 2014; Parida& Ray, 2015). Project performance is affected by many factors namely; cost factor, time factor and quality factor. The top three cost factor affecting project performance is escalation of material prices, design changes and discrepancies on contract documents. Cost factor is the most important amongst all other factors which according to Molavi & Barral, (2016) stated that the performance of construction could be assessed by the completion schedule, cost of completion, and safety. The top three time factor that affect project performance are; non-availability of resources as planned throughout project, slow decision making and time required to implement variation orders. The top three quality factors affecting project performance are the availability of experienced and quality personnel, deficiencies in coordination and lack of managers involved in decision making.

Amongst all these factors that affects project performance it is worthy to note that project success is the foundation for managing and controlling current projects, and for planning and orienting future projects Chovichien & Nguyen, (2013). Construction industry is one of the main contributors to development of any country therefore requires proper management of the factors that affects project delivery and improve its performance. The choice of project delivery method plays a crucial role in determining the success of a construction project, choosing the right project delivery method is a crucial step as it sets the tone for how the team will communicate and how payments will be distributed. This section provides an overview of types of project delivery method as stated by different scholars.

3.2 Overview of construction project delivery methods;

- Design-Bid-Build (DBB); this project delivery method was known as 'traditional method Hosseini et al., (2016), it involves a design team and a general contractor working directly for the owner under separate contracts. The design team works with the owner to develop the contract documents, once the design is finished it is sent out for general contractors to provide a bid for the project. The total cost of construction was a determinant in the final selection of the contractor Carpenter & Bausman, (2016). Typically, the lowest bidder would be selected to build the project (Hosseini et al., 2016; Azhar et al., 2014). The DBB is used when the owner wishes to divide the project into packages and contracts with a separate designer and general contractor for each package. This method rewarded individual success but disregarding the impact on project outcome and it was a system that created difficulties and impossibility for project optimization The advantage

of using this method is cost savings and schedule compression, while the disadvantages are coordination and management difficulties.

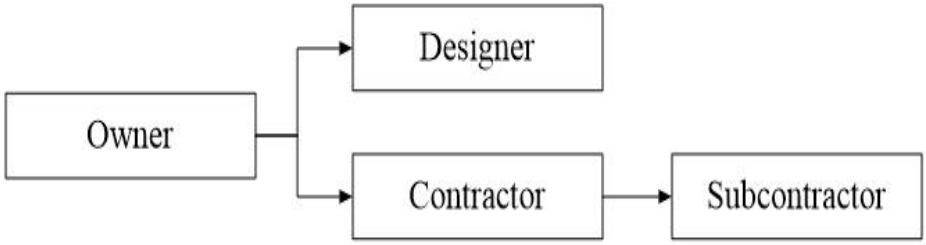


Figure 1: Design-Bid-Build
Source: Adopted from Fong et al.2014

- Construction Manager at Risk (CMAR); The commitment from CM at Risk was required in this project delivery method in order to deliver the project within a specified schedule and price, either a fixed lump sum or guaranteed maximum price (GMP) DBIA (2015). As with traditional method, the construction manager at risk method separates the design and building processes. There were three linear phases in the traditional method; design, bid and build however, it was faster compared to the traditional method. Unlike the traditional method CMAR allowed for team integration as the CM at Risk integrated with the designer at the early stage of design phase even though the owner had separated contracts with CM at Risk and designer Fong et al., (2014). The CM at Risk have two different roles; (1) as a consultant to the owner regarding construction and cost during the pre-construction phase and (2) as a general contractor in the construction phase Fong et al., (2014). However, when project issues arise in the project the owner will be responsible for the conflict resolution though at the pre-construction phase there was integrated relationship between contractors and designer it will not guarantee the same cooperation in construction management process.

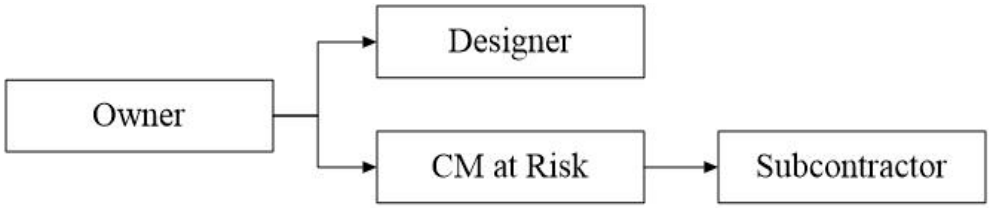


Figure 2: CM at Risk
Source: Adopted from Fong et al., 2014

- Design Build (DB); in this method, the owner contracts with a single firm or entity for a project design and construction. The entity could be integrated design-build firm, contractor led, designer led, joint venture or developer led DBIA, (2015). Here, the designer is not contracted by the owner and therefore has limited control or influence on the final design quality. At the design phase, the design was mostly cost driven in the context of quality and scope and some of the designs made are not verified by the owner and construction related issues in the project remained undisclosed.

Figure 3: Design Build
Source: Adopted from Fong et al, 2014

Amongst all these construction project delivery methods there is no particular method that can be said to be better than the other, selected or used for each project. However, CM at risk and DB are considered to have a better performance compare with DBB reason being that they encourage team integration from the early stage of design. However, DBB is still the most used method for project delivery due to challenges faced in integrating team members with DBB that can be managed and the project fully delivered.

3.3 Problems that create Delay and Disruption to Progress of Works.

Delays and disruptions are among the challenges faced in the course of executing construction projects. Delay in building construction project can be defined as the lateness of completion; it either exceeds the date specified in the contract or the date decided by the parties for delivery of the project Abdullah & Bera, (2018). According to Thorat et al., (2017), construction delay is classified into critical delay, non-critical delay, causable delay, non-causable delay and concurrent delay. The main causes of delays and disruptions are; design change, delays in payment to contractors, information delays, funding problems, poor management, compensation issues and disagreement on the valuation of work done. On the other hand, time overrun, cost overrun, negative social impact, idling resources and disputes are the main effects of delays and disruptions. It is therefore recommended that adequate construction budget, timely issuing of information, finalizing of design and project management skills should be the main focus of the parties in project procurement process.

3.4 Variations on Construction Projects

Variation in construction can be defined as 'any alteration or change in pre-existing conditions or requirements on the project. This alteration or modification includes cost, time and method of performance Soumya, (2020). Memon et al. (2014) defined variation as any divergence from a well-defined framework and timeline decided upon. Housing is unarguably one of the basic necessities of man. It is ranked second after food in the hierarchy of man's needs. Olutuah and Taiwo (2015) observed that housing need in Nigeria increases by the day, whereas the vast majority of the population lacks the withdrawal to make effective demand on housing. The demand and prices of housing needs cannot be fully examined without talking about the play of variations on construction projects. According to many literatures reviewed these changes usually has a resultant effect on the total cost which is referred to as the contract sum of the construction project. There are two types of variations;

- **Beneficial variations:** a beneficial variation is one issued to improve the quality standard, reduce cost, schedule or degree of difficulty in a project. A beneficial variation eliminates unnecessary costs from a project.
- **Detrimental variations:** a client who is experiencing financial problem may require the substitution of quality standard expensive materials to substandard cheap materials. For example, on a construction project where there is limited land the client will have to limit his requirement to what the land can accommodate.

3.5 Causes of Variations on Construction Project

Many causes of variations have been identified by researchers and most of those researchers have related the causes to construction project factors such as time, cost and quality and project stakeholders Bello & Saka, (2017). have discussed the causes of variations under four categories; employer-related variations, consultant related variations, construction related variations and other causes which are beyond the control of the parties. The study used the same categories to assess the causes of variations on construction projects.

1. Change in scope of work: this is prevalent issue in the construction industry and most times affect the project cost and time. Insufficient planning during the conceptualization stage and lack of owner's participations during design activities are major reasons causing change in scope Arain & Pheng, (2014)

2. Design changes: changes in project design may arise due to evolving requirements, client preferences, regulatory updates, or unforeseen site conditions. These modifications can result in alterations to the project's scope and specifications.
3. Unforeseen site conditions: the drawings and specifications do not always show the real site conditions nor do preliminary investigations. Once construction begins, contractors may encounter unexpected conditions such as poor soil quality, underground utilities or archaeological findings. Dealing with conditions requires adjustment to the construction plan, leading to variations.
4. Changes in clients' requirement: In the beginning, the clients' requirement for a project could include a vision, mission, and set of goals for what they want it to accomplish. Clients may request changes during the construction process, either to accommodate their changing needs or as a result of design preferences that emerge during construction.
5. Errors and Omission: Mistakes or omissions in the projects' initial design and documentation can lead to required changes to correct these errors hence variations. If a contractor uses the original provided drawings and specifications to bid and further enter into a contract with the client and later when it becomes apparent that there exist errors and omissions contract will be varied.
6. Delays and Disruptions: Project delays or disruptions can create a ripple effect, leading to modifications to align the schedule and budget with the new timeline.
7. Value engineering: Value engineering is a process of cost optimization that may lead to changes in materials, design or construction methods to achieve better cost-effectiveness.
8. Lack of proper coordination during project implementation: proper coordination and management of construction projects is a very vital key to achieving the desired final outcome in a construction project. The poor project coordination is majorly caused by the inadequacy of proper planning and failure to communicate which will lead to confusion and mistakes will eventually happen. Proper strategic planning is an important factor for successful completion of a construction project Aftab et al., (2014)..

3.6 Effects of Variation on Construction Project Delivery.

Variation orders are very critical issues in the construction project. These issues have given the professional a thought of concern on how it can be managed without jeopardizing the success of the project. International Journal of Scientific Research in Science, Engineering and Technology IJSRSET, (2020) states that variance has a negative effect on project efficiency in terms of cost overruns, extra time, decreased quality and issues with professionals. Additionally, El Asmar et al., (2013) found that when a project involves many variants, the contractor achieves lower productivity than expected. Variations have adverse effects on project delivery and they included;

- **Cost overrun:** Project cost overrun is defined as excess of actual cost over budget. Cost overruns sometimes also called as "cost escalation", "Cost increase", "budget overrun" Vaidehi & Ashish, (2019). Any alteration or addition in the design during execution of the project may result in demolition or rework of any project component and eventually increase the project cost Bello & Saka, (2017). For these changes to be implemented in construction project the overhead expenses for all the participants will increase thereby causing cost overrun.
- **Time overrun:** variations often hinder the project progress leading to delay in achieving the targeted milestones during construction Bello & Saka,(2017). Clients require their construction projects to be completed within minimum time limits to achieve some monetary savings. Contractors sometimes are heavily

penalized when they exceed the original project delivery date. The penalty imposed is meant to compensate damages suffered by the client owing to the prolonged delivery period (Ulunji&Nokulunga, 2022).

- **Quality reduction**: Avornorkadzi (2017) stated that since contracts pose a significant risk to unknown variables such as lump sum, contractors can reduce both quality and quantity to maximize profit. If requests for change are common, they may potentially affect the quality of the work.
- **Disputes with stakeholders**: a construction project is not merely brick and mortar brought together. Rather, it creates professional relationships between parties in the contract. Each project successfully completed constitutes an added experience to participants and their reputation builds up. But disputes may arise between parties in the contract due to variations. Misunderstanding may arise when contractors are not satisfied with the determination and valuation of variation by the client's consultant. Khalifa &Mahamid, (2019) found that a large proportion of current arbitration were claims for additional time and expenses.
- **Causes reworks and demolition**: this effect is to be expected due to variations during the construction phase while variations during the design phase do not require any rework or demolition on construction sites. It was revealed that the cost of rework caused variation orders accounted for more than four-fifth of the total costs of rework Love et al., (2019).

3.7: Project Monitoring

Project monitoring is a vital aspect of construction project delivery. Project Monitoring means to keep a careful check of project activities over a period of time. It involves continuously tracking and assessing the project's progress, performance, and compliance with the plan to ensure that it stays on track and meets its objectives. Due to this, monitoring process has increasingly become important tool acting as a check and balance tool to achieve economic and social sustainability in projects (OECD, 2018; Umar T. I 2017) Effective project monitoring helps identify potential issues early on, enabling timely corrective actions and ensuring the successful completion of the project. Here are some key aspects of project monitoring in construction:

- **Schedule Monitoring**: Regularly track the project's schedule against the planned timeline. Identify any deviations, delays, or critical path issues and take corrective measures to keep the project on schedule. This may involve adjusting work sequences, adding resources, or renegotiating deadlines.
- **Cost Monitoring**: Keep a close eye on the project's budget and expenditures. Compare actual costs with the budgeted amounts to detect cost overruns or savings. If there are variations, investigate the reasons behind them and manage change orders appropriately.
- **Quality Assurance**: Ensure that the construction work meets the required quality standards and adheres to the approved plans and specifications. Implement a robust quality assurance and control process to identify and rectify any construction defects or deviations.
- **Safety Compliance:** Monitor the construction site regularly to ensure compliance with safety regulations and standards. Address any safety issues promptly to mitigate the risk of accidents and injuries.
- **Communication and Collaboration**: Ensure effective communication and collaboration among all project stakeholders, including the client, contractors, suppliers, and regulatory authorities. Regular meetings and progress updates facilitate transparency and the prompt resolution of issues.

3.8: The Study Area

It is bounded in the east by Nkanu East Local Government Area, in the west by Udi Local Government Area, in the north by Enugu East Local Government Area and in the south by Agwu Local Government Area. The following are the location maps: Map of Nigeria showing Enugu State (see fig 3.1), the map of Enugu State showing the location of Nkanu-West Local Government Area (see fig 4).

Figure 4: Map of Nigeria Showing Enugu Administrative Set Up
Source: Adopted imageries obtained from Google Map (2024)

Figure 5: Map Showing Enugu Senatorial Zone & Nkanu- West LGA
Source: Adopted imageries obtained from Google Map (2024)

3.0 RESEARCH METHOD

Survey research design was adopted. Both qualitative and quantitative data collection were used. Collection of qualitative data was through oral interviews and non-participant observation, while quantitative data were collected using structured questionnaire and secondary sources such as books and journal articles. The oral interview targeted key senior member of the scheme management team. Interview was conducted based on questions drawn from prepared interview guide and recorded manually. The non-participant observation data were derived using observation schedule and photographic material during several visits made to the site.

4.0 DISCUSSION OF FINDING

The research aimed to uncover the impact of variation on building construction project delivery in Nkanu-West LGA. The findings explored a range of factors causing variation on building projects such as change in client's requirements, change in scope of work, error omission, design changes, changes in specification of the consultant etc. One can say that most of the identified causes of variations on building construction project are unavoidable or inevitable but with good project delivery method and effective project monitoring can be mitigated at different stages of the building construction project the result is show below

To evaluate the effect of variation on cost of building construction project in Nkanu-West LGA, Enugu state

S/N	Project Title	Date of Award	Completion Date	Contract sum as at the date of award with VAT (₦)	Sum paid to the contractor	Project Status (%)	Contract sum as at 2023 (₦) (Variation)	Percentage difference
1.	Construction of fence for Agbani primary school	15thSep, 2022	16thSept, 2023	5,457,511.50	3,274,506.90	60% completed	6,198,235.20	12.71%
2.	Construction of three-story residential development at ozalla	12th April, 2021	12th April, 2022	70,920,243.75	42,552,146.25	60% completed	74,489,322.48	4.91%
3.	Proposed one story building at Obe	16th May, 2021	16th May, 2022	47,398,301.66	33,178,811.16	Ongoing 70%	52,109,215.43	9.47%
4.	Proposed construction of Duplex with pent house at Amurri	13th June, 2021	13th June, 2022	62,771,835.38	43,940,284.77	Ongoing 70%	67,326,534.45	7.00%
5.	Proposed residential building at umueze	20th June, 2021	20th June, 2022	59,436,396.78	38,633,657.91	65% completed	61,494,150.00	3.40%
6.	Meeting house at Akpugo	20th October, 2021	20th October, 2022	85,560,026.17	57,892,018.32	Ongoing 70%	91,494,818.55	6.70%

7.	Proposed residential development at Enugu road, Agbani	24th February, 2019	24th February, 2020	86,650,000.00	69,320,000.00	Ongoing 80%	88,286,567.89	1.87%
8.	Proposed lodge development at umueze	11th March, 2019	11th March, 2022	147,637,456.56	118,109,965.25	Ongoing 80%	151,534,496.00	2.65%
9.	Construction of Lecture Hall at Law school, Agbani	10th July, 2019	10th July, 2019	112,527,918.48	78,769,542.94	Ongoing 70%	119,673,456.65	3.08%
10.	Proposed hotel development at secretariat, Agbani	10th October, 2019	10th October, 2020	149,455,518.75	112,091,639.06	Ongoing 75%	153,503,103.60	5.34%
11.	Proposed faculty of Engineering complex	16th August, 2018	16th August, 2019	180,545,210.21	144,436,168.17	Ongoing 80%	186,723,412.73	3.36%
12.	Proposed Department of Geology and mining	16th August, 2018	16th August, 2019	255,097,555.70	191,332,922.35	Ongoing 85%	261,287,389.00	2.40%
13.	Proposed Department of Mass communication	16th August, 2018	16th August, 2019	245,719,508.72	196,575,606.98	Ongoing80%	252,312,296.49	2.65%
14.	Proposed Department of computer and information science	16th August, 2018	16th August, 2019	247,257,697.06	197,806,157.65	Ongoing80%	253,543,653.75	2.51%
15.	Proposed faculty of Environmental sciences extension (ESUT)	16th April 2018	16th August, 2019	328,441,395.14	262,753,116.11	Ongoing80%	335,589,234.03	2.15%

Source: Bill of quantities of building construction projects from 2019-2024

Covariance = $\Sigma(Xi-\mu)(Yj-v)/n$

Average value as at the date of award (μ) = 138,991,771.52

Average value as at 2023 (v) = 2,155,565,886.25

S/N	Project title	Xi-μ (Rounded to the nearest million)	Yj-v (Rounded to the nearest million)
1.	Project 1	328.44 – 138.99 = 189.44	335.60 - 2,155.57 = -1819.97
2.	Project 2	247.26 – 138.99 = 108.27	253.54 - 2,155.57 = -1902.03
3.	Project 3	255.09- 138.99 = 116.11	261.29 - 2,155.57 = -1894.28
4.	Project 4	112.53 – 138.99 = 26.46	119.67 - 2,155.57 = -2035.90
5.	Project 5	245.72 – 138.99 = 106.73	252.31 - 2,155.57 = -1903.26
6.	Project 6	180.55 - 138.99 = 41.55	186.72 - 2,155.57 = -1968.85
7.	Project 7	85.56- 138.99 = -53.43	91.49 - 2,155.57 = -2064.08
8.	Project 8	62.77 – 138.99 = -76.22	67.33 - 2,155.57 = -2088.24
9.	Project 9	147.64 – 138.99 = 8.65	151.53 - 2,155.57 = -2004.04
10.	Project 10	86.65- 138.99 = -52.34	88.29 - 2,155.57 = -2067.28
11.	Project 11	47.39 – 138.99 = -91.59	52.11 - 2,155.57 = -2103.46
12.	Project 12	59.44- 138.99 = -79.55	61.49 - 2,155.57 = -2094.08
13.	Project 13	5.46 – 138.99 = -133.53	6.19 - 2,155.57 = -2149.38
14.	Project 14	149.46- 138.99 = 10.47	153.50 - 2,155.57 = -2002.07
15.	Project 15	70.92 – 138.99 = 68.07	74.49 - 2,155.57 = -2081.08

Source: Bill of quantities of building construction projects from 2019-2024

S/N	Project title	Xi-μ	Yj-v	(Xi-μ)(Yj-v)
1.	Project 1	189.44	-1819.97	-344,775.12
2.	Project 2	108.27	-1902.03	-205,932.79
3.	Project 3	116.11	-1894.28	-219,944.85
4.	Project 4	26.46	-2035.90	-53,869.91
5.	Project 5	106.73	-1903.26	-203,134.94
6.	Project 6	41.55	-1968.85	-81,805.72
7.	Project 7	53.43	-2064.08	-110,283.79
8.	Project 8	-76.22	-2088.24	159,165.65
9.	Project 9	8.65	-2004.04	-17,334.95
10.	Project 10	52.34	-2067.28	-108,201.44
11.	Project 11	-91.59	-2103.46	192,655.90
12.	Project 12	-79.55	-2094.08	166,584.06
13.	Project 13	133.53	-2149.38	-287,006.71
14.	Project 14	10.47	-2002.07	-20,961.67
15.	Project 15	-68.07	-2081.08	141,659.12
Total				-993,187.16

Source: Bill of quantities of building construction projects from 2019-2024

Cov (X, Y) = -993,187.16/15

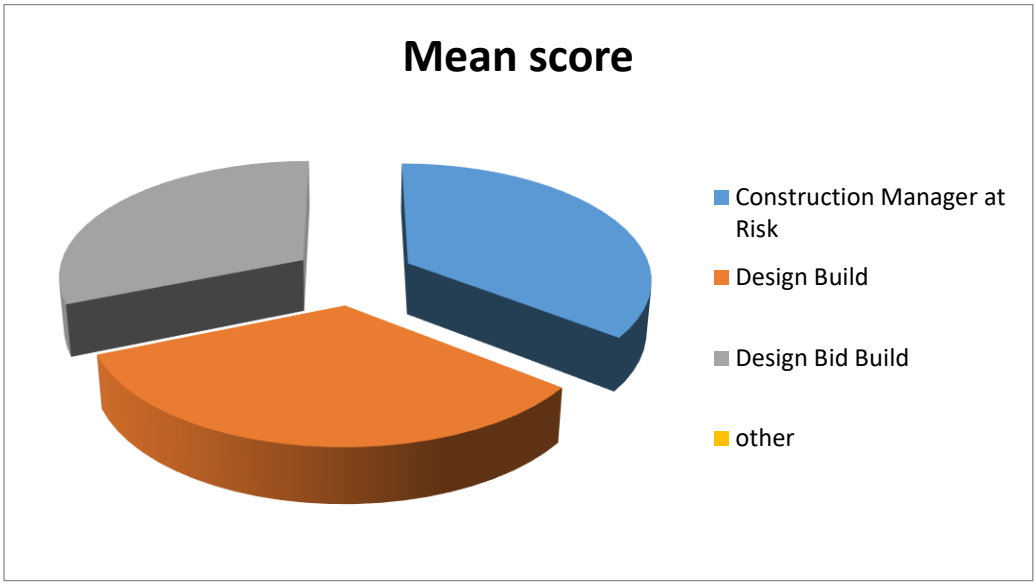
= -66,212.48

From the result it shows the movement of the contract sum and it is moving in opposite direction which means that the contract sum increases as the year increases due to variation and decreases as the year decreases.

Which project delivery method do you think is most effective in minimizing the impact of variations on building construction project delivery?

Project delivery Method	Mean score	Rank
Construction Manager at Risk	3.3	1
Design-Build	3.1	2
Design-Bid-Build	2.9	3
Other	-	-

Source: Researcher's Field Survey 2024



Source: Researcher's Field Survey 2024

From the table project delivery method were examined to determine the method that can help to minimize the impact the variation on construction project delivery. Construction manager at risk is ranked highest with the mean score of 3.3 followed by design-bid with the mean score of 3.1 and design-bid-build is ranked lowest with the mean score of 2.9 among other delivery methods.

5.0: Conclusion / Recommendation

This study has provided valuable insights into the significant impact of variation on building construction project delivery with a specific focus on Nkanu-West LGA, Enugu state. it has become evident that variations in construction projects can lead to cost overruns, time overruns, and quality issues. It also emphasizes the importance of proactive management techniques which through effective communication can help to mitigate the adverse effects of variations. it is also crucial to acknowledge that construction industry plays a vital role in the socio-economic development of any region, and Nkanu-West at large. The policymakers, industry practitioners, and regulatory bodies to work collaboratively in implementing measures that streamline the management of project variations, which will help to enhance building construction project delivery in Nkanu-West.

Recommendations

The following recommendations will serve as means of minimizing the impacts of variation on building construction project delivery in Enugu state and Nigeria at large.

- Post-project evaluation and lessons learned: after project completion, conducting a comprehensive review to analyse the causes and impacts of variations can provide valuable insights for future projects. Documenting lessons learned and best practices will contribute to continuous improvement.
- Early contractor involvement: engaging contractors in the early stage of project planning and design can lead to a more comprehensive understanding of potential challenges and variations. Their input can help develop more realistic project plans.
- Flexibility and contingency planning: recognizing that variations are inevitable, project stakeholders should incorporate flexibility into project schedules and budgets. This includes establishing contingency funds and timelines to account for unforeseen changes.
- Stakeholder communication and collaboration: open and transparent communication among all project stakeholders is vital. Regular meetings and progress updates should be scheduled to ensure everyone is aligned and informed about any potential variations.
- Risk identification and mitigation: proactively identifying potential sources of variation and implementing strategies to mitigate their impact is essential. This may involve conducting thorough risk assessments and developing contingency plans.
- Design and Build form and other similar forms of contracts, should be operated for major projects. This reduces the risk of variations.
- Project managers should study the materials that have irregular trends of inflation and carefully prepare their inventory management so that they can reduce the menace of inflation. They should also get accurate information and research with regard to procurement procedure, material and plant.

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