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Assessment of the Improved Structural Design, Analysis and Implementation for A 7-Storey Building in Rwanda: Evidence of Muhanga District-Nyamabuye City

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ABSTRACT

This study focuses on investigating the improved structural design, analysis, and implementation for a 7-storey building in Muhanga District, specifically in Nyamabuye City, Rwanda. The research objectives aim to assess the impact of the housing master plan, evaluate the influence of project planning, determine the effects of stakeholders' involvement, examine the impact of monitoring and evaluation, and analyze the influence of structural design and analysis on the implementation of such buildings. A quantitative research approach was employed, utilizing both descriptive and correlational research designs. Data were collected from 95 respondents using a meticulously crafted questionnaire, supplemented by interviews and secondary data from various sources. Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) and Excel software. Findings revealed significant positive relationships between independent variables, such as housing master plans, project planning, stakeholders' involvement, monitoring and evaluation, and structural design and analysis, and the dependent variable, success implementation for a 7-storey building. These relationships highlight the critical importance of thorough project planning, stakeholder involvement, effective monitoring and evaluation, and sound structural design in achieving project success. The multiple linear regression analysis further supported these findings, demonstrating a strong positive correlation between the predictors and the success of implementing the building project. For instance, the standardized coefficient (Beta) for Housing Master Plan was 0.341 ($p < 0.01$), Project Planning was 0.267 ($p < 0.01$), Stakeholders' Involvement was 0.292 ($p < 0.01$), Monitoring and Evaluation was 0.254 ($p < 0.01$), and Structural design and analysis was 0.248 ($p < 0.01$). These figures indicate the significant influence of each variable on project success. Recommendations include prioritizing thorough project planning, engaging stakeholders actively, establishing robust monitoring and evaluation mechanisms, investing in sound structural design, integrating housing master plans, fostering continuous improvement, investing in training and capacity building, and promoting cross-sector collaboration.

Key Words: *Improved Structural Design, Housing master plan, Stakeholder involvement*

1.INTRODUCTION

Land-use zoning policies as interpreted in current planning practice evidenced in the American, Canadian and Australian context have focused on single-use functions to the point that mixed-use developments storey building is less likely to occur (Grant 2016; Hirt, S 2017; Wardner 2015). Mixed-use development storey building is the practice of allowing more than one type of use in a building or set of buildings. In planning terms, this can mean some combination of residential, commercial, industrial, office, institutional or other land uses. This tends to create shorter distance between work, residence and recreation and goes a long way to enhance the livelihood of the inhabitants. The United States, with its diverse climatic and geological conditions, presents unique challenges for the construction of multi-storey buildings. The law has since been updated as recently as 2013, shifting much of its focus outside the downtown area which have been a part of the main city since 1998. With the regulations in place, the city has overseen the development of high-rise condominiums throughout the city with amenities and transit stops nearby. Africa is the globe's least-urbanized continent, accommodating 11.3 percent of the world's urban population, and the Sub-Saharan region is the continent's least-urbanized area. Nonetheless, the region's cities are expanding rapidly. The United Nations predicts that Africa will overtake Asia as the world's most rapidly urbanizing region by 2025 (UN 2014).

Rwanda has developed its own building regulations and standards to ensure the safety and sustainability of construction projects. The Rwanda Housing Authority (RHA) is responsible for overseeing these regulations. Compliance with these standards is crucial for ensuring that buildings are constructed to withstand local environmental challenges. Understanding and integrating these regulations, as outlined in documents like the "Rwanda Building Code," are essential for successful building projects in the country. Rwanda, known for its commitment to sustainability and environmental conservation, has a strong interest in promoting eco-friendly and energy-efficient construction practices. Research and guidelines, such as Sustainable Building Design in Rwanda by Martin Hakizimana and Bert Blocken (2019), highlight the importance of sustainable building techniques using locally available materials. This research is instrumental in aligning structural design with Rwanda's sustainability goals.

In Rwanda, community engagement is a crucial element in the construction process. Involving local communities and incorporating their traditional knowledge can enhance the quality of building projects. Moreover, collaboration with local engineers and architects who understand the specific challenges of the region is essential. A Sustainable Solution for Rwanda by Mutabazi Francois and Rudaheranwa Jean-Baptiste (2017) underscores the significance of community involvement in construction. The main objective of the Rwanda Urban Development Project is to provide trunk infrastructure through strategic identification, selection and implementation of identified in six secondary cities; Muhanga, Musanze, Rubavu, Nyagatare, Rusizi, Huye in consultation with respective districts administrations. Development of aforesaid infrastructure include the storey building would promote urban development in the cities by improving access, mobility and integration of secondary support functions necessary for cohesive urban development. Muhanga secondary city is strategically to build the modern houses. (MIFOTRA, 2014).

The development and implementation of an improved structural design for a 7-storey building in Rwanda, specifically within the Muhanga-City's master plan, is a vital endeavor. The Muhanga-Nyamabuye area, designated for residential use in the master plan, faces significant challenges that necessitate urgent attention.

Currently, the Nyamabuye area lacks a standardized housing system, and the existing structures have become obsolete. This obsolescence, coupled with an environment that is unsuitable for work and leisure, underscores the need for reconstruction and the creation of a mixed-use 7-storey building that aligns with national standards and the goals of the Muhanga-City master plan (Rwanda Housing Authority, 2021). The primary objective of this project is to design and construct a modern, mixed-use 7-storey building that addresses these pressing issues. This building provides suitable and sufficient housing, promote a conducive environment for work, and align with the Muhanga-City master plan. It is resilient and comfortable, capable of accommodating a substantial influx of residents, considering the projected population growth in the city. In light of the current state of development in Rwanda and the country's aspirations, this project is a pivotal step in the direction of creating sustainable and contemporary infrastructure (Rwanda Ministry of Infrastructure, 2020).

Study Objectives

The main objective was to assess the improved structural design, analysis and implementation for a 7-storey building in Rwanda. The study achieved the following specific objectives:

[1.] Assess the impact of housing master plan on the implementation of storey mixed-use building in Muhanga-Nyamabuye City

[2.] Evaluate the influence of project planning on the implementation of storey mixed-use building in Muhanga-Nyamabuye City

[3.] Determine the influence of stakeholders' involvement in the implementation of storey mixed use building in Muhanga-Nyamabuye City

[4.] Find out the effects of monitoring and evaluation the implementation of storey mixed-use building in Muhanga-Nyamabuye City

[5.] Examine the influence of structural design and analysis on the implementation of story mixed -use building in Muhanga-Nyamabuye City

Research Hypotheses

Based on the above research questions, the following alternative hypothesis were verified and tested:

[1.] **Ho_1**: Housing master plan has significant impact on implementation of storey mixed-use building in Muhanga-Nyamabuye City

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[2.]**Ho2**: Project planning has significant influence on implementation of storey mixed-use building in Muhanga-Nyamabuye City

[3.]**Ho3**: Stakeholders involvement has significant influence in implementation of storey mixed-use building in Muhanga-Nyamabuye City

[4.]**Ho4**: Monitoring and evaluation has significant effects on implementation of storey mixed-use building in Muhanga-Nyamabuye City

[5.]**Ho5**: Structural design and analysis has significant influence on implementation of storey mixed-use building in Muhanga-Nyamabuye City

2. State of Art

2.1 Structural Design Principles

The foundation of an effective structural design for a 7-storey building lies in adhering to established engineering principles. These principles encompass load-bearing capacity, structural integrity, and safety. Load-bearing capacity involves a careful assessment of the anticipated loads, including dead loads, live loads, wind loads, and seismic forces. By understanding these loads and their distribution, engineers can design a building that can safely support these forces throughout its lifespan (Kassimali, 2014). Furthermore, structural integrity is essential for ensuring that the building remains stable and maintains its load-carrying capacity under various conditions. Engineers must consider factors like the choice of materials, structural components, and the layout to create a structurally sound design. Safety measures, such as redundancy in structural elements and proper connections, are also integral components of a robust structural design (Hibbeler, 2017).

2.2 Structural Analysis

The analysis of a 7-storey building's structural system is a critical step in ensuring its stability and performance. Structural analysis methods, such as finite element analysis (FEA) and computer-aided design (CAD), have revolutionized the field by allowing engineers to simulate and evaluate complex structures. FEA enables engineers to model the entire building, considering its various components and loading conditions, to assess how it will behave under different forces (Zienkiewicz, Taylor, & Zhu, 2005).

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2.3 Incorporation of Innovative Technologies

The implementation of innovative technologies in structural design and construction has become increasingly vital in achieving improved building performance. For a 7-storey building, this includes advancements in materials, construction methods, and sustainability. High-strength materials like reinforced concrete and structural steel offer greater load-bearing capacity and flexibility in design (Salmon, Johnson, & Malhas, 2012). Sustainability is another critical consideration, with green building practices such as energy-efficient design, waste reduction, and renewable energy systems playing a significant role in modern structural design. The implementation of innovative technologies not only enhances the building's performance but also contributes to its long-term environmental and economic sustainability. The design, analysis, and implementation of a 7-storey building demand a comprehensive understanding of structural engineering principles, rigorous analysis, and the integration of innovative technologies.

2.4 The Housing Master Plan and Implementation of Storey Mixed-Use Building

Housing master plans play a pivotal role in urban development and can significantly influence the implementation of story mixed-use buildings. These master plans typically define land use, zoning regulations, and building guidelines within a city or region. When a master plan encourages mixed-use development, it can lead to a more streamlined approval process and reduced regulatory barriers for constructing storey mixed-use buildings (Calthorpe, 2010). Furthermore, housing master plans often incorporate provisions for infrastructure development, transportation networks, and environmental sustainability. These elements can directly impact the feasibility and success of storey mixed-use building projects.

2.5 The Project Planning and the implementation of Storey Mixed-Use Building

Effective project planning is a critical determinant of the successful implementation of storey mixed-use buildings. Project planning involves defining project objectives, establishing timelines, allocating resources, and setting milestones. This process ensures that the project stays on track, within budget, and meets its objectives (Kerzner, 2017). Project planning for mixed-use buildings also involves selecting suitable locations, considering zoning regulations, and

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conducting feasibility studies. A well-thought-out plan not only ensures a smooth construction process but also minimizes risks and unforeseen challenges. Furthermore, it helps in securing financing and attracting investors, both of which are essential for the successful completion of storey mixed-use building projects (Schwalbe, 2018).

2.6 The Stakeholders' Involvement and Implementation of Storey Mixed-Use Building

Stakeholder involvement is a crucial factor in the implementation of storey mixed-use building projects. Stakeholders can include local government officials, community members, property developers, and business owners. Engaging stakeholders throughout the project's lifecycle promotes transparency, garners support, and mitigates potential conflicts (Bryson, 2018). Involving stakeholders in the decision-making process, particularly regarding the design, land use, and community impact, can lead to more favorable outcomes (Reed, 2008).

2.7 Monitoring and Evaluation and Implementation of Storey Mixed-Use Building

Monitoring and evaluation (M&E) are vital components in the successful implementation of storey mixed-use buildings. M&E processes involve systematically assessing project progress, identifying deviations from the plan, and making necessary adjustments. By monitoring and evaluating various aspects of the project, including budget, timeline, and quality, stakeholders can ensure that the implementation remains on track and that issues are promptly addressed (Patton, 2019). M&E processes also provide an opportunity to measure the project's impact on the community, economy, and environment. Regular assessments can help identify areas for improvement, demonstrate accountability to funders and the public, and inform future project planning. Proper M&E can significantly enhance the effectiveness and sustainability of storey mixed-use building implementations (UN-Habitat, 2014).

2.8 The Structural Design and Analysis on the Implementation of Storey Mixed-Use Building

Structural design and analysis are fundamental to the successful implementation of storey mixed-use buildings. A well-designed structure must not only be aesthetically pleasing but also meet stringent safety standards and address functional requirements. Engineers and architects must consider factors such as

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load-bearing capacity, materials, sustainability, and structural integrity (Nethercot, 2011). Incorporating innovative structural analysis tools, like finite element analysis (FEA), allows for a comprehensive evaluation of the building's performance under various loads and conditions. These tools aid in optimizing the design, reducing risks, and ensuring that the structure can withstand dynamic forces, making them essential for safe and efficient storey mixed-use building implementations (Zienkiewicz, Taylor, & Zhu, 2005).

2.10 Conceptual Framework

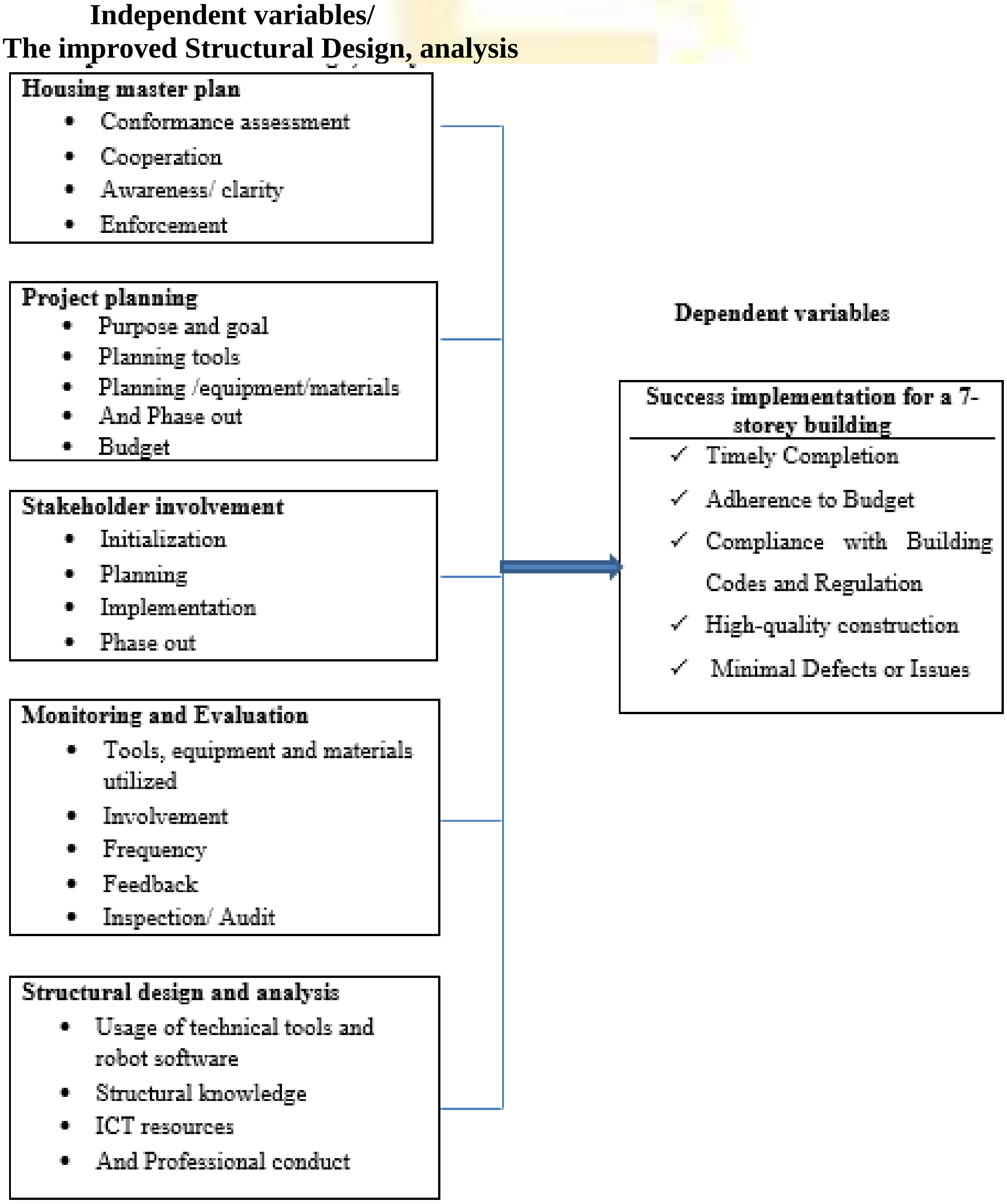

Figure 1: Conceptual Framework
Source: *researcher conceptualization and documentation (2023)*

3. Materials and Methods

3.1 Research design

The study also used both descriptive and correlational research designs. The major purpose of descriptive research is description of the state of affairs as it exists. Kombo and Tromp (2014) opine that descriptive studies are not only restricted to fact findings but may result in the formulation of important principles of knowledge and solution to significant problems.

3.2 Presentation of the Study Area

Selection of plot is very important for buildings a house. Site was in good place where their community but service is convenient but not so closed that becomes a source of inconvenience or noisy. The conventional transportation is important not only because of present need but for retention of property value in future closely related to are transportation, shopping, facilities also necessary. One observed the road condition whether there is indication of future development or not in case of un developed area. The factor to be considered while selecting the building site are as follows, access to park and playground, agriculture of polytonality of the land, availability of public utility services, especially water, electricity and sewage disposal, contour of land in relation of the building cost. Cost of land, distance from places of work, ease of drainage, location with respect to school, college and public buildings, nature of use of adjacent area, transport facilities and wind velocity and direction.

3.3 Sampling Methods and Techniques

One can evaluate the strength of the association between two or more variables using the correlational design. It examines the relationships between two or more different variables. One hundred twenty-five (125) respondents in Muhanga-Nyamabuye City, which are overseen at various levels of national administration, were the study's target population. A sample is as a smaller group or sub-group obtained from the accessible population. A sample is as a smaller group or sub-group obtained from the accessible population. The sample is small element the representing a big group of population. Due to the fact that the population under study is statistically large than a hundred (N=125), the sample is calculated using Yamane formula with a margin error of 5% and confidence level of 95 %. This formula is written as:

$$n = \frac{N}{1 + N(e^2)} = \frac{125}{1 + 125 * (0.05^2)} \approx 95.23 = 95$$

A stratum is a subset of the population that shares at least one common characteristic. The researcher identifies the relevant strata and their actual representation in the population. Stratified sampling allows the researcher to obtain desired representation from various sub-groups (Public institutions; Consultants' companies; Contractors) in the population. By targeting individuals with specialized knowledge and experience within the execution of a storey mixed-use construction project in Muhanga-Nyamabuye City.

3.4 Data Collection Techniques and Instruments

The questionnaire is meticulously crafted to align with the research questions and specific objectives of the study. Each question in the questionnaire directly corresponds to the research questions and specific objectives outlined in the study. The questionnaire was designed to encourage respondents to provide honest and candid responses, particularly to sensitive questions. Clear and neutral language will be used to frame questions, minimizing bias and creating a non-threatening environment for respondents to express their views openly. The use of Likert scales, ranging from "Strongly Disagree" to "Strongly Agree," enable quantitative assessment of respondents' opinions and attitudes towards different aspects of project planning and performance. The Five Likert scales were composed of the following: 1=Strongly Disagree (SD), 2=Disagree (D), 3=Neutral, 4=Agree (A) and 5=Strongly Agree (SA).

3.5 Data Analysis Techniques

Statistical Package for Social Sciences (SPSS) version 23.0, and excel were used by researcher in processing and analysis of data which inform the presentation of findings, analysis and interpretation. The data collected was analyzed, with respect to the study objectives, using both descriptive and comparative research design. The tools of analysis were adopted in this study is statistical Package for Social Sciences (SPSS) version 23.0 for descriptive data. Correlation was positive or direct when two variables move in the same direction and negative or inverse when they move in opposite directions. This was shown through the finding of the correlation coefficient; that was concerned with the collection and interpretation of quantitative data and the use of probability theory. Multiple linear Regression analysis models were adopted to show relationships using equation econometric

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models as formulated: y=f(x); $Y= \beta 0+ \beta 1\chi 1+ \beta 2\chi 2+ \beta 3\chi 3+ \beta 4\chi 4 + \beta 5\chi 5 +\varepsilon$, where Y is dependent variable representing implementation of storey mixed -use building; while X is independent variable equals the improved Structural Design, analysis represented by the following sub-variables: x1: housing master plan; x2: project planning; x3: stakeholders' involvement; x4: monitoring and evaluation; x5: structural design and analysis; β0: is the y-intercept; β1-β5: are the slopes of the line; and ε: is an error term.

3.6 Research Procedure

The researcher complied with ethical procedures to protect the rights of the research participants, involving the principle of voluntary participation which requires that participants do not need to be coerced into participating in this research. The following ethical measures will be adhered to right of the participant, in this study, no attempt was made to harm participants deliberately and those who could experience any form of harm be it through victimization, emotional or otherwise, was informed in advance of their right to withdraw from participating in the study. Confidentiality and anonymity, confidentiality means that information from participants were not going to be divulged to the public nor made available to colleagues, subordinates or superiors. In this study, all information about participants were treated with confidentiality and the participants were anonymous. A covering letter also assured respondents that all responses were treated with utmost confidentiality and anonymity.

4.Results and Discussion

The collected data underwent quantitative analysis using computer software, specifically the Statistical Packages for Social Sciences (SPSS) version 23.0 and Excel. The results are presented and explained in association with the research objectives, which include assessing the impact of the housing master plan on implementation, examining the influence of project planning on successful implementation, evaluating the role and impact of stakeholders' involvement, analyzing the effects of monitoring and evaluation practices, and investigating how structural design and analysis methodologies influence successful implementation. The questionnaires were distributed to 95 respondents, and a response rate of 100.0% was achieved within four-weeks period.

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4.1 Piloting Results/ Pre-Test of Validity and Reliability

Piloting is a crucial step undertaken at Silver Back Construction Project in Kicukiro District-Kigali to assess the feasibility and effectiveness of a research design before embarking on a full-scale study. It serves as a preliminary test to evaluate the clarity of instructions, the suitability of chosen measures, and to identify any unforeseen issues that may arise during data collection. Participants' feedback, observational notes, and encountered challenges are carefully analyzed to make necessary adjustments and enhancements before commencing the main study on the improved structural design, analysis, and implementation for a 7-Storey Building in Rwanda, with evidence from Muhanga District-Nyamabuye City.

Table 1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.748	.848	7

The reliability statistics presented in Table 1 indicate the internal consistency of the measurement scale used in the study. Cronbach's Alpha coefficient is a measure of reliability, with values ranging from 0 to 1. Generally, a higher Cronbach's Alpha value suggests greater internal consistency among the items in the scale. In this study, the Cronbach's Alpha coefficient is calculated to be 0.748, which indicates a moderate level of internal consistency among the items. According to conventional standards, a Cronbach's Alpha value above 0.7 is considered acceptable for research purposes. Therefore, the obtained value of 0.748 suggests that the measurement scale used in the study is reasonably reliable. Additionally, the Cronbach's Alpha coefficient based on standardized items is reported to be 0.848, which further confirms the reliability of the measurement scale. This coefficient takes into account the standardized scores of the items and provides a more accurate estimate of internal consistency. The higher value of 0.848 indicates a stronger level of internal consistency among the items when standardized.

Table 2: Item Statistics

	Mean	Std. Deviation	N
Housing Master Plan	40.4042	5.25849	95
Project Planning	40.6021	4.08203	95

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Stakeholders' Involvement	40.8137	4.48130	95
Monitoring and Evaluation	40.2263	3.66888	95
Structural design and analysis	40.3968	3.81005	95
Success Implementation for A 7-Storey Building	202.5695	15.04758	95
The Improved Structural Design, Analysis	112.7368	15.32916	95

Table 2 provides the item statistics for various constructs measured in the study, including Housing Master Plan, Project Planning, Stakeholders' Involvement, Monitoring and Evaluation, Structural The mean values provide an indication of the average response for each construct, while the standard deviation reflects the dispersion of responses around the mean. For all constructs, the means range from approximately 40 to 202.5695, suggesting that respondents, on average, provided moderate to high ratings for each construct. The standard deviations range from approximately 3.66888 to 15.32916, indicating varying degrees of dispersion in responses. Lower standard deviations suggest less variability in responses, while higher standard deviations imply greater variability. The mean scores for housing master plan, project planning, stakeholders' involvement, monitoring and evaluation, and structural design and analysis are relatively close to each other, ranging from 40.2263 to 40.8137. This suggests that respondents perceive these constructs similarly in terms of importance or effectiveness.

Table 3: Inter-Item Correlation Matrix

	Housing Master Plan	Project Planning	StakeholderInvolvement	Monitoring and Evaluation	Structural design and analysis	Success Implementation for A 7-Storey Building	Improved Structural Design, Analysis
Housing Master Plan	1.000						
Project Planning	.300	1.000					
Stakeholders' Involvement	.254	.708	1.000				
Monitoring and Evaluation	.513	.351	.383	1.000			

Structural design and analysis	.183	.354	.316	.481	1.000		
Success Implementation for A 7-Storey Building	.671	.754	.744	.754	.620	1.000	
The Improved Structural Design, Analysis	.281	.345	.291	.342	.237	.445	1.000

Correlation coefficients range from -1.000 to 1.000, with values closer to 1.000 indicating a strong positive correlation, values closer to -1.000 indicating a strong negative correlation, and values close to 0 indicating no correlation. The correlation between housing master plan and other constructs ranges from 0.183 to 0.671, indicating moderate to strong positive correlations. This suggests that the housing master plan is moderately to strongly associated with project planning, stakeholders' involvement, monitoring and evaluation, structural design and analysis, success implementation for A 7-Storey Building, and the improved structural design, analysis. The project planning, stakeholders' involvement, and monitoring and evaluation exhibit moderate to strong positive correlations with each other, ranging from 0.351 to 0.754. The structural design and analysis show moderate positive correlations with project planning, stakeholders' involvement, monitoring and evaluation, and success implementation for A 7-Storey building, ranging from 0.316 to 0.481. The success implementation for A 7-Storey building and the improved structural design, analysis exhibit moderate positive correlations with other constructs, ranging from 0.445 to 1.000. This indicates that the success of implementation and improvements in structural design and analysis are moderately associated with the other aspects of the study.

Table 4: Scale Statistics

Mean	**Variance**	**Std. Deviation**	**N of Items**
517.7495	1543.243	39.28414	7

Table 4 presents the mean value of 517.7495 indicates the average score across all items in the scale. It represents the central tendency of the data distribution, suggesting the typical response of participants on the measurement scale. A higher variance and standard deviation suggest greater variability or inconsistency

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in responses across the measurement scale. In this case, the variance of 1543.243 and the standard deviation of 39.28414 indicate a moderate degree of variability in scores across the items in the scale.

4.2 Profile of Respondents

This section provides valuable understandings od the demographics, characteristics, and backgrounds of the respondents who participated in the study.

Table 5: Findings on the Social Demographic Characteristics of Respondents

Respondents profile	Data	Frequencies	Percentages
Gender	Male	70	73.7
	Female	25	26.3
	Total	**95**	**100.0**
Level of Education	Secondary level	25	26.3
	Bachelor’s Degree	62	65.3
	Master’s Degree	7	7.4
	PhD	1	1.1
	Total	**95**	**100.0**
Age	Below 30 years	30	31.6
	31 to 40 years	15	15.8
	41 to 50 years	33	34.7
	Over 50 years	17	17.9
	Total	**95**	**100.0**
Experience in working with construction project work;	Less than a year	6	6.3
	Between 1 to 2 years	25	26.3
	Between 2 to 4 years	41	43.2
	Over 4years	23	24.2
	Total	**95**	**100.0**

Source: *Primary data (2024)*

Findings on gender stated that the majority of respondents are male, accounting for 73.7% of the sample population, while females represent 26.3%. The majority of respondents hold Bachelor's degrees, comprising 65.3% of the sample population. A significant portion of respondents have secondary level education (26.3%), while smaller percentages hold Master's degrees (7.4%) or PhDs (1.1%). The predominance of Bachelor's degree holders suggests a well-educated sample

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population with a good level of academic qualification, which may influence their perspectives and contributions to the study. Respondents' ages are distributed across different age brackets, with the highest percentage falling within the 41 to 50 years category (34.7%). The distribution is relatively balanced across other age groups, including below 30 years (31.6%), 31 to 40 years (15.8%), and over 50 years (17.9%). The diverse age distribution indicates a varied range of experiences and perspectives among respondents, contributing to the richness and depth of the study's findings. The majority of respondents have between 2 to 4 years of experience in working with construction projects, constituting 43.2% of the sample population. Significant proportions of respondents also have between 1 to 2 years of experience (26.3%) or over 4 years of experience (24.2%), while a smaller percentage have less than a year of experience (6.3%).

4.3 Inferential Statistics analysis Results

By employing inferential statistics, we aim to uncover patterns, relationships, and associations within our data, ultimately providing deeper insights and guiding decision-making processes. In this section, we explore the significance of relationships between variables, test hypotheses, and examine the generalizability of our findings to the wider population.

Test of Normality

By conducting various tests of normality, such as the Kolmogorov-Smirnov and Shapiro-Wilk tests, we aim to ascertain the appropriateness of parametric statistical techniques for further analysis. This section lays the groundwork for subsequent inferential analyses by providing insights into the nature of the data distribution, ultimately ensuring the validity and reliability of our statistical conclusions.

Table 6: Descriptives

			Statistic	Std. Error
Success Implementation for A 7-Storey Building	Mean		202.5695	1.54385
	95% Confidence Interval for Mean	Lower Bound	199.5041	
		Upper Bound	205.6348	
	5% Trimmed Mean		203.6421	

	Median	203.1000	
	Variance	226.430	
	Std. Deviation	15.04758	
	Minimum	151.60	
	Maximum	227.50	
	Range	75.90	
	Interquartile Range	13.00	
	Skewness	-1.023	.247
	Kurtosis	2.489	.490

The mean value of 202.5695 represents the average level of success in implementing the building project. It gives us a central tendency around which the data is distributed. The 95% confidence interval for the mean ranges from 199.5041 to 205.6348. This interval provides a range within which we can be 95% confident that the true population mean lies. The 5% trimmed mean, which removes the lowest and highest 5% of values, is 203.6421. This statistic provides an alternative measure of central tendency that is less influenced by extreme values. The median value of 203.1 represents the middle value of the dataset when arranged in ascending order. It gives us another measure of central tendency and is less affected by extreme values than the mean. The variance of 226.430 and the standard deviation of 15.04758 measure the spread or dispersion of the data points around the mean. A higher variance and standard deviation indicate greater variability in the dataset. The minimum value of 151.60 and the maximum value of 227.50 represent the lowest and highest values in the dataset, respectively. They provide insights into the range of the data. The range of 75.90 (maximum - minimum) indicates the extent of variability in the dataset from the lowest to the highest value. The Interquartile Range (IQR) of 13.00 represents the range between the 25th and 75th percentiles of the data. It gives us a measure of the spread of the middle 50% of the data, which is less influenced by extreme values. The skewness of -1.023 indicates that the distribution is negatively skewed. This means that the tail of the distribution extends towards the lower values, indicating more observations on the higher end of the scale. The kurtosis of 2.489 indicates that the distribution is leptokurtic, meaning it has heavier tails and a sharper peak compared to a normal distribution.

Table 7: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Success Implementation for A 7-Storey Building	.124	95	.001	.910	95	.000
a. Lilliefors Significance Correction						

Two common tests of normality, the Kolmogorov-Smirnov test and the Shapiro-Wilk test, have been conducted. The statistic for the Kolmogorov-Smirnov test is 0.124, with 95 degrees of freedom, and a significance level of 0.001. The test assesses whether the distribution of the data significantly differs from a normal distribution. The p-value of 0.001 indicates that the null hypothesis, which assumes normality, is rejected at the 0.05 significance level. This suggests that the data does not follow a normal distribution. The statistic for the Shapiro-Wilk test is 0.910, with 95 degrees of freedom, and a significance level of 0.000. Like the Kolmogorov-Smirnov test, the Shapiro-Wilk test evaluates whether the data significantly deviates from a normal distribution. The extremely low p-value of 0.000 also indicates rejection of the null hypothesis at the 0.05 significance level, suggesting that the data is not normally distributed.

Correlation Coefficient analysis

By calculating correlation coefficients, we seek to quantify the strength and direction of associations between pairs of variables, shedding light on potential patterns and dependencies within our data. This analysis aims to uncover meaningful insights into how changes in one variable may relate to changes in another, providing valuable information for decision-making and further exploration of our research questions.

Table 8: Correlation Coefficient Matrix Results

		Housing Master Plan	Project Planning	Stakeholders' Involvement	Monitoring and Evaluation	Structural design and analysis	The Improved Structural Design, Analysis	Success Implementation for A 7-Storey Building
Housing Master Plan	Pearson Correlation	1						
	Sig. (2-tailed)							
	N	95						
Project Planning	Pearson Correlation	.300**	1					
	Sig. (2-tailed)	.003						
	N	95	95					
Stakeholders' Involvement	Pearson Correlation	.254*	.708**	1				
	Sig. (2-tailed)	.013	.000					
	N	95	95	95				
Monitoring and Evaluation	Pearson Correlation	.513**	.351**	.383**	1			
	Sig. (2-tailed)	.000	.000	.000				
	N	95	95	95	95			
Structural design and analysis	Pearson Correlation	.183	.354**	.316**	.481**	1		
	Sig. (2-tailed)	.076	.000	.002	.000			
	N	95	95	95	95	95		
The Improved Structural Design, Analysis	Pearson Correlation	.281**	.345**	.291**	.342**	.237*	1	
	Sig. (2-tailed)	.006	.001	.004	.001	.021		
	N	95	95	95	95	95	95	
Success Implementation for A 7-Storey Building	Pearson Correlation	.671**	.754**	.744**	.754**	.620**	.445**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	95	95	95	95	95	95	95
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

The correlation coefficient matrix reveals significant relationships between the independent variables - Housing Master Plan, Project Planning, Stakeholders'

Involvement, Monitoring and Evaluation, and Structural design and analysis - and the dependent variable, Success Implementation for A 7-Storey Building. Housing Master Plan shows a strong positive correlation with Success Implementation for A 7-Storey Building ($r = 0.671$, $p < 0.01$). This indicates that a well-developed Housing Master Plan is strongly associated with successful implementation of the 7-storey building project. Project Planning exhibits a very strong positive correlation with Success Implementation for A 7-Storey Building ($r = 0.754$, $p < 0.01$). This suggests that thorough project planning is highly correlated with successful implementation of the building project. Stakeholders' Involvement demonstrates a very strong positive correlation with Success Implementation for A 7-Storey Building ($r = 0.744$, $p < 0.01$). This implies that active involvement of stakeholders is closely associated with successful implementation of the building project. Monitoring and Evaluation shows a very strong positive correlation with Success Implementation for A 7-Storey Building ($r = 0.754$, $p < 0.01$). This suggests that effective monitoring and evaluation processes are highly correlated with successful implementation of the building project. Structural design and analysis exhibit a strong positive correlation with Success Implementation for A 7-Storey Building ($r = 0.620$, $p < 0.01$).

Multiple Linear Regression Analysis

By utilizing this method, we aim to uncover the underlying factors that contribute to the variation in our dependent variable, Success Implementation for A 7-Storey Building. Through the examination of regression coefficients, significance tests, and model diagnostics, we seek to identify the most influential predictors and assess their collective impact on the outcome variable. This analysis offers a comprehensive understanding of the complex interplay between various project factors and the ultimate success of implementing the 7-storey building project. By elucidating these relationships, we can inform strategic decision-making processes and optimize project management practices to enhance overall project outcomes.

Table 9: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.997[a]	.993	.993	1.24965	2.117
a. Predictors: (Constant), Structural design and analysis, Housing Master Plan , Stakeholders' Involvement , Monitoring and Evaluation , Project Planning					
b. Dependent Variable: Success Implementation for A 7-Storey Building					

In this model, the R value is 0.997, indicating an extremely strong positive correlation between the predictors and the success of implementing the 7-storey building project. The coefficient of determination (R^2) represents the proportion of variance in the dependent variable that is explained by the independent variables included in the model. In this case, the R^2 value is 0.993, indicating that approximately 99.3% of the variance in the success of implementing the building project is accounted for by the predictors included in the model. This suggests an excellent fit of the model to the data. The adjusted R^2 value adjusts the R^2 value to account for the number of predictors in the model and penalizes for overfitting. The adjusted R^2 value of 0.993 suggests that the inclusion of the independent variables adequately explains the variability in the dependent variable while avoiding overfitting. The standard error of the estimate provides a measure of the accuracy of the predictions made by the regression model. In this case, the standard error of the estimate is 1.24965, indicating that the average difference between the observed and predicted values of the dependent variable is approximately 1.25 units. The Durbin-Watson statistic tests for the presence of autocorrelation in the residuals (errors) of the regression model. In this model, the Durbin-Watson value is 2.117, which is close to the ideal value of 2, suggesting no significant autocorrelation in the residuals.

Table 10: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21145.416	5	4229.083	2708.114	.000[b]
	Residual	138.985	89	1.562		
	Total	21284.401	94			
a. Dependent Variable: Success Implementation for A 7-Storey Building						
b. Predictors: (Constant), Structural design and analysis, Housing Master Plan, Stakeholders' Involvement, Monitoring and Evaluation, Project Planning						

In this case, the SSR is 21145.416. The residual sum of squares (SSE) represents the amount of unexplained variability in the dependent variable after accounting for the effects of the independent variables. In this case, the SSE is 138.985. The total sum of squares (SST) represents the total variability in the dependent variable without considering any predictors. In this case, the SST is 21284.401. The degrees of freedom represent the number of independent pieces of information available to estimate a parameter. In the ANOVA table, there are two sets of degrees of freedom: one for the regression model (df = 5) and one for the residual error (df = 89). The mean square is calculated by dividing the sum of squares by its respective degrees of freedom. It provides a measure of variance within each source of variability. For the regression model, the mean square is 4229.083, and for the residual error, it is 1.562. The F-statistic is the ratio of the mean square for the regression model to the mean square for the residual error. It tests the overall significance of the regression model. In this case, the F-statistic is 2708.114.

Table 11: Regression Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.511	1.785		.846	.400		
	Housing Master Plan	.976	.029	.341	33.526	.000	.709	1.411
	Project Planning	.985	.046	.267	21.320	.000	.467	2.140
	Stakeholders' Involvement	.980	.042	.292	23.542	.000	.477	2.095
	Monitoring and Evaluation	1.044	.047	.254	22.173	.000	.557	1.795
	Structural design and analysis	.981	.040	.248	24.589	.000	.718	1.392
a. Dependent Variable: Success Implementation for A 7-Storey Building								

Ha1 stated that Housing master plan has a significant impact on the implementation of a storey mixed-use building in Muhanga-Nyamabuye City as the standardized coefficient (Beta) for Housing Master Plan is 0.341 with a p-value of 0.000, indicating a significant impact. Therefore, Ha1 is retained. Ha2 stated that Project planning has a significant influence on the implementation of a storey mixed-use building in Muhanga-Nyamabuye City. The standardized coefficient for Project Planning is 0.267 with a p-value of 0.000, indicating a significant influence. Thus, Ha2 is retained. Ha3 said that Stakeholders' involvement has a significant influence on the implementation of a storey mixed-use building in Muhanga-Nyamabuye City. The standardized coefficient for Stakeholders' Involvement is 0.292 with a p-value of 0.000, indicating a significant influence. Therefore, Ha3 is retained. Ha4 stated that Monitoring and evaluation have significant effects on the implementation of a storey mixed-use building in Muhanga-Nyamabuye City. The standardized coefficient for Monitoring and Evaluation is 0.254 with a p-value of 0.000, indicating significant effects. Thus, Ha4 is retained. Ha5 said that Structural design and analysis significantly influence the implementation of a storey mixed-use building in Muhanga-Nyamabuye City. The standardized coefficient for Structural design and analysis is 0.248 with a p-value of 0.000, indicating significant influence. Therefore, Ha5 is retained. Now, to analyze the impact of one-unit change in the independent variables on the Success Implementation for A 7-Storey Building, we'll consider the slopes (coefficients). For each unit increase in Housing Master Plan, the success implementation for A 7-Storey Building is expected to increase by approximately 0.976 units. For each unit increase in Project Planning, the Success Implementation for A 7-Storey Building is expected to increase by approximately 0.985 units. For each unit increase in stakeholders' involvement, the Success Implementation for A 7-Storey Building is expected to increase by approximately 0.980 units. For each unit increase in monitoring and evaluation, the success implementation for A 7-Storey Building is expected to increase by approximately 1.044 units. For each unit increase in Structural design and analysis, the Success Implementation for A 7-Storey Building is expected to increase by approximately 0.981 units.

5. Conclusions and Recommendations

5.1 Conclusion

The findings from various analyses provide valuable insights into the critical determinants of project success. Firstly, the correlation coefficient matrix highlighted significant positive relationships between independent variables such as housing master plan, project planning, stakeholders' involvement, monitoring and evaluation, and structural design and analysis, and the dependent variable, Success Implementation for A 7-Storey Building. These relationships suggest that a well-developed Housing Master Plan, thorough Project Planning, active Stakeholders' Involvement, effective Monitoring and Evaluation processes, and robust Structural design and analysis are closely associated with successful project implementation. Moreover, the multiple linear regression analysis further corroborated these findings, demonstrating a strong positive correlation between the predictors and the success of implementing the building project. The regression model exhibited an excellent fit to the data, with a high coefficient of determination (R^2) indicating that approximately 99.3% of the variance in the success of implementing the project can be explained by the included predictors. Additionally, the standardized coefficients revealed that all independent variables significantly influence the success of the project. Specifically, the analysis indicated that for each unit increase in Housing Master Plan, Project Planning, Stakeholders' Involvement, Monitoring and Evaluation, and Structural design and analysis, the Success Implementation for A 7-Storey Building is expected to increase by approximately 0.976, 0.985, 0.980, 1.044, and 0.981 units, respectively. In conclusion, the study underscores the critical importance of thorough project planning, stakeholder involvement, effective monitoring and evaluation, and sound structural design in achieving successful implementation of the 7-storey building project in Muhanga-Nyamabuye City.

5.2 Recommendations

Based on the findings of the study regarding the factors influencing the successful implementation of a 7-storey building project in Muhanga-Nyamabuye City, the following recommendations can be made: Thorough Project Planning: Prioritize comprehensive project planning processes to ensure that all aspects of the construction project are meticulously considered and adequately addressed. This includes detailed scheduling, budgeting, resource allocation, risk assessment, and contingency planning. Active Stakeholder Involvement: Engage stakeholders from various sectors, including government entities, local communities, investors, and end-users, throughout all stages of the project. Encourage open communication, collaboration, and participation to ensure alignment of interests and collective commitment to project success. Effective Monitoring and Evaluation: Establish robust monitoring and evaluation mechanisms to track project progress, identify potential issues or risks early on, and implement corrective actions as needed.

Appendix:

Figure 2: Selected area for building

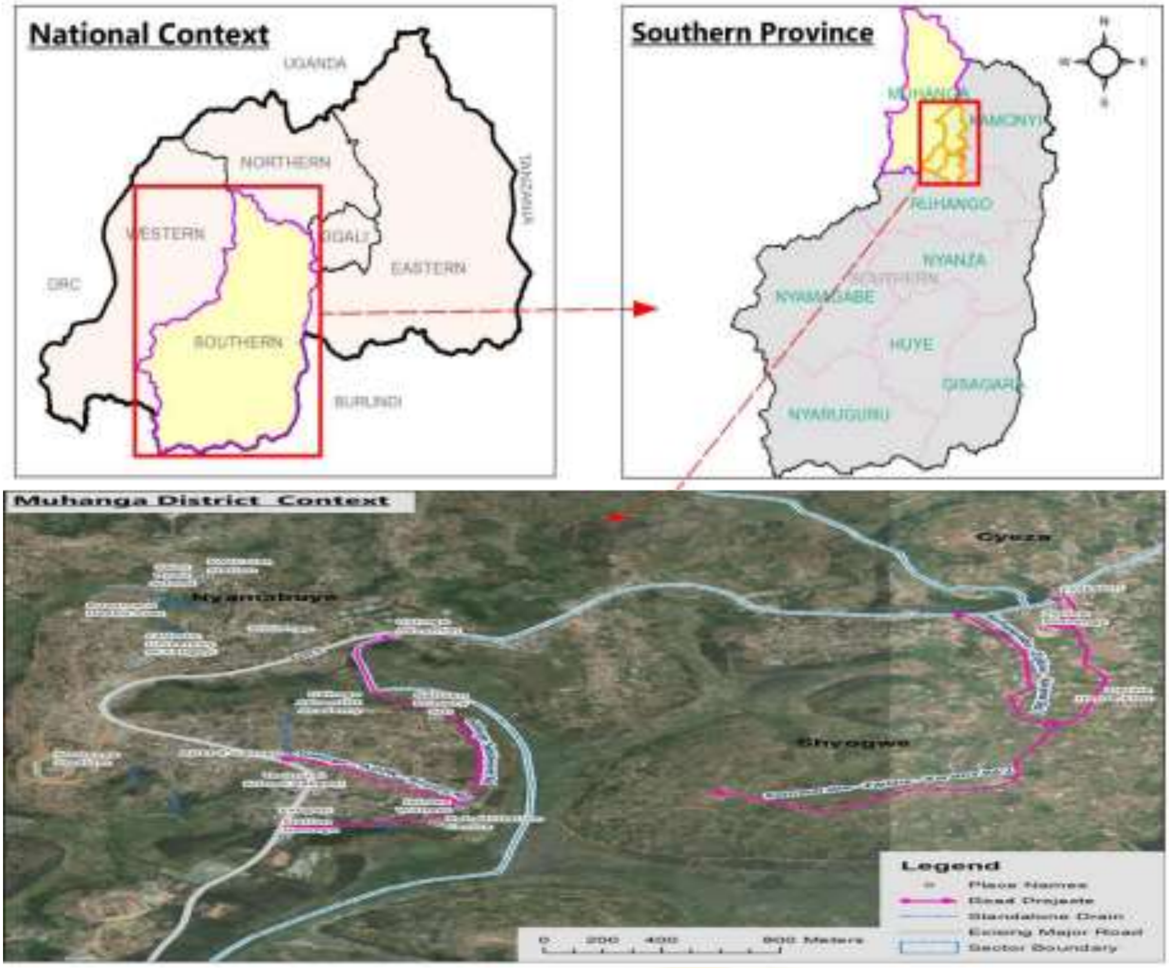

Figure 3: Location of study area in National and local context

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