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Assessing the Impact of Risks on Mortgage-Financed Construction Projects in Kenya

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Abstract Mortgage-financed construction projects (MFCPs) in Kenya are critical for economic growth and housing development, yet they frequently suffer from cost overruns, delays, and quality defects. This study investigates the risks affecting the performance of MFCPs, focusing on market, financial, planning, construction, legal, and environmental risks. Data was collected from 122 developers using a cross-sectional survey and analyzed through descriptive statistics and correlation analysis. The findings indicate that construction risks, particularly material cost fluctuations and project delays, have the most significant negative impact on project performance. Legal and regulatory risks, such as permit delays and design flaws, also marginally affect outcomes. Market, financial, planning, and environmental risks show negative but statistically non-significant correlations, suggesting indirect influence. The strong intercorrelations among risk categories highlight the need for integrated risk management. The study recommends proactive risk identification, holistic mitigation strategies, and further research into mediation effects to improve the success of MFCPs in Kenya.

Keywords Construction Project Performance, Mortgage Finance, Survey Research, Kenya

1. Introduction

Kenya's construction industry significantly contributes to the nation's economic growth, providing infrastructure and housing essential for development. Within this sector, mortgage financing plays a crucial role in enabling individuals and developers to undertake construction projects, thereby stimulating economic activity and addressing the growing demand for housing. However, construction projects, particularly those financed through mortgages, are inherently complex and exposed to numerous risks that can adversely affect their performance, leading to delays, cost overruns, and quality defects [1].

Mortgage-financed construction projects in Kenya (MFCPs) have been associated with dismal performance. These projects have been riddled with cost and schedule overruns, among other challenges. This has been reported in numerous studies [2], [3], [4], [5]. According to [6], schedule and cost overruns have been the norm rather than the exception. [7] found out that 88% of projects in the Kikuyu constituency suffered delays, 12% of the projects were on time, while no project (0%) was ahead of schedule. [8] reported schedule overruns of 33.3%. According to [9], on average, 35-73% of construction projects in Kenya overrun their schedule. In another study, [10] reported cost overruns of up to 24.92%. There is also further evidence that the time and cost performance of projects is to the extent that over 70% of projects initiated are likely to escalate with time by more than 50% and over 50% of projects are likely to escalate in cost by more than 20% [8].

Risk management is a critical process that involves identifying, assessing, and mitigating potential threats to a project's objectives [11]. Effective risk management enables project teams to proactively address challenges, minimize negative impacts, and maximize opportunities for success [12]. In the context of construction projects, risk management encompasses a wide range of factors, including financial risks, design risks, construction risks, environmental risks, and regulatory risks [13], [14].

Despite the recognized importance of risk management, its implementation in the Kenyan construction industry, particularly in mortgage-financed projects, remains inadequate. Many construction firms lack the necessary knowledge, tools, and techniques to effectively manage risks, leading to poor project outcomes. This deficiency is further compounded by a lack of standardized risk management frameworks tailored to the specific needs and challenges of the Kenyan construction industry.

Several factors contribute to the inadequate implementation of risk management in Kenyan construction projects. First, there is a lack of awareness and understanding of the benefits of risk management among project stakeholders [15]. Many stakeholders view risk management as a costly and time-consuming exercise, rather than a value-added process that can improve project outcomes. Second, there is a shortage

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of skilled risk management professionals in the Kenyan construction industry [16]. This scarcity of expertise limits the ability of construction firms to effectively identify, assess, and mitigate risks. Third, there is a lack of data and information on past project performance, making it difficult to accurately assess the likelihood and impact of potential risks [17].

The absence of a comprehensive risk management framework for mortgage-financed construction projects in Kenya has significant implications for the performance of the construction industry and the broader economy. Project delays and cost overruns can lead to financial losses for developers, contractors, and homeowners, as well as increased borrowing costs and reduced investment in the construction sector [18]. Quality defects can result in costly rework, safety hazards, and dissatisfied clients. Ultimately, these negative impacts can undermine the sustainability and competitiveness of the Kenyan construction industry. The objectives of this paper included evaluating the performance of MFCPs, establishing risks associated with MFCPs, and determining their impact on the performance of MFCPs.

2. Research Methodology

2.1. Research Design

A research design establishes a framework for data gathering and analysis. This study adopts the cross-sectional survey research design described by [19] and [20]. Bryman [19] describes a cross-sectional survey as one that studies multiple cases at a single point in time by measuring quantifiable data with the aim of identifying patterns of association. The aim of studying multiple cases was to enable the detection of variations among the selected cases, while the single-point time perspective provides meaning to the comparisons of the multiple cases. The advantage of data quantification is that it provides a consistent benchmark to the researcher and at the same time makes it possible to understand relationships between variables [19].

2.2. Sampling Methods and Sample Size

In this study, the population includes all construction projects financed through mortgages throughout the country. This study focuses on the 1,063 mortgages initiated during the 2021/2022 financial year, as per the annual banking report by the [21].

The sample size was calculated based on the following formulae from [22] and [23].

$$n_o = \frac{t^2 \times s^2}{e^2}$$

Where: -

- n_0= required return sample size
- t = alpha level value (0.01 = 2.576 for sample size of 120 or more; the alpha level of .01 indicates the level of risk the researcher is willing to take that the true margin of error may exceed the acceptable margin of error.) 2.576 is the z-score for a 99% confidence interval.
- s = estimated standard deviation in population for 7-point scale (1.167; estimate of variance deviation for 7-point scale calculated by using 7 [inclusive range of scale] divided by 6 [number of standard deviations that include almost all (approximately 98%) of the possible values in the range]).
- e = acceptable level of error for the mean being estimated (0.21; number of points on primary scale × acceptable margin of error; points on primary scale = 7; acceptable margin of error = .03 [error researcher is willing to accept]).

Therefore;

$$n_o = \frac{2.576^2 \times 1.167^2}{0.21^2} = 205$$

However, since this sample size exceeds 5% of the population (1,063×5%=53), the following [22] correction formula was used to estimate the final sample size.

$$n_f = \frac{n_0}{1 + \frac{n_0}{population}} = \frac{205}{1 + \frac{205}{1063}} = 171\ projects$$

Where;

- n_f = final sample size
- n_0 = original sample size
- Population = target population

This study adopted simple random sampling as its choice of selecting the sample size from the population. According to [24], this sampling method is also known as chance sampling or probability sampling because each item in the population has an equal chance of being included in the sample and each of the possible samples, in the case of a finite universe, has the same probability of being chosen. An ideal sample is one that meets the requirements of efficiency, representativeness, dependability, and adaptability.

2.3. Data Collection

According to [25], structured interviews and questionnaires are the two most common research methods associated with survey research design. Both were adopted in this study as the methods of collecting data. The measured indicators were derived from previous literature and refined so that they would not only be appropriate for the respondents but also generate enough data for hypothesis testing. The questionnaires were self-administered, and the majority of the questions were closed-ended. This makes the collected data easily compatible with statistical analysis, which is the preferred method of data analysis in this study. A few open-ended questions were also included in order to get additional information, which was used to understand the behaviour of the statistical data.

2.4. Data Analysis

The collected quantitative data were subjected to descriptive analysis. Descriptive statistics were used mostly

to describe the distribution of variables. Measures of frequency (percent, count), measures of central tendency (mean), measures of variation/dispersion (range, kurtosis, skewness, standard deviation, variance) are among the descriptive statistics that were performed. While the majority of these metrics were used to examine data obtained for the various variables, kurtosis and skewness were employed to ensure that the data distribution is normal. Pearson Correlation was carried out to establish the underlying bivariate relationships.

2.5. Validity and Reliability

To ensure the questionnaire's validity, expert reviews were conducted to establish face and content validity. Five experts, including three from academia (thesis supervisors) and two from the industry, all with a combined experience of 112 years, gave suggestions on how to improve the data collection instrument. Further, a pilot test was performed with a subset of the target audience to identify issues. In addition, factor analysis was used to confirm that the questionnaire measured the intended construct. To ensure questionnaire reliability, clear and unambiguous questions were used. Additionally, a pilot test was also conducted. Internal consistency (Cronbach's Alpha) was used to test the reliability, whereby all the constructs achieved values exceeding 0.7, as recommended by [25]. Minor revisions were made following suggestions from the experts and the pilot study participants.

2.6. Ethical Considerations

All professions are governed by a code of ethics that has changed over time to reflect the evolving ethos, values, requirements, and expectations of people involved in the professions. The research process is no different. According to [26], ethics in research is defined as a researcher's behaviour toward research participants or persons affected by the research. [27] on the other hand, feels that ethics should include rules or concepts relevant to effective professional activity. The following ethical issues were observed while carrying out this investigation. At the onset of the questionnaire administration, informed consent was obtained from each respondent. The respondents were also made aware of how long it would take to fill the questionnaire. Further, data collected from the respondents was treated with utmost confidentiality and was used for academic purposes only. The researcher also ensured that no harm befell the respondents during the data collection exercise. Finally, the researcher ensured correct and unbiased reporting of the findings as advised by [28]. Approval was secured from both the Jomo Kenyatta University of Agriculture and Technology (JKUAT) Graduate School and the National Commission for Science, Technology and Innovation (NACOSTI).

3. Findings and Discussion

This section presents the empirical findings of the study based on data collected from developers engaged in MFCPs in Kenya. The results are structured into three main categories: background information about the respondents and their project characteristics, risks affecting MFCPs, and the effect of the risks on the performance of MFCPs across five key indicators: budget adherence, schedule adherence, quality, safety, and cash flow.

3.1. Background Information

Five aspects of background information were considered in the data collection tool. These were: level of education, professional background, type of project, project value, and project duration. Their results have been presented in the following sections.

3.1.1. Level of Education

Results presented in **Figure 1** showed that 52.5% (n=64) of the respondents had a Bachelor's degree, while 36.1% (n=44) had a Master's degree. Together, these two categories account for 108 out of 122 respondents (approximately 89%). This suggests that the sector is largely comprised of highly educated professionals. This could be attributed to the fact that most financial institutions prefer to give mortgages to salaried individuals who tend to be educated professionals. 5.7% (n=7) had a Diploma while only 3.3% (n=4) were PhD holders. The low number of Doctorates was expected, given that only a small percentage (probably only those in academia) of professionals advance beyond a master's degree. The least represented group was the post-secondary certificate holders, 2.4% (n=3).

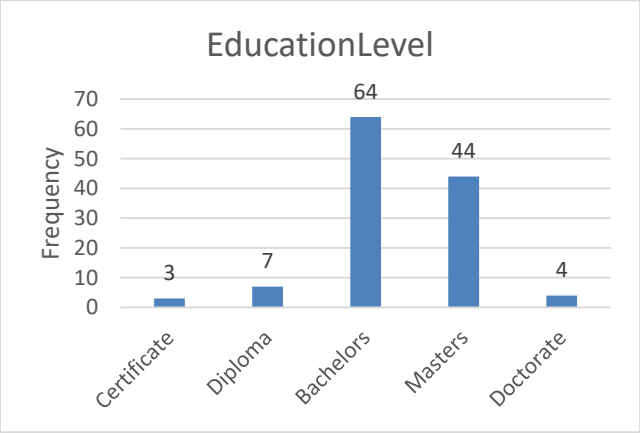

Figure 1. Level of Education (*Source: Author's analysis (2025).*)

3.1.2. Professional Background

Given the expected diverse backgrounds of the respondents (developers), the question on their professional background was framed in an open-ended format. The results have been presented in the form of a word cloud as demonstrated in **Figure 2.** A significant proportion of respondents have backgrounds in construction-related disciplines. These included Construction Management, Civil Engineering, Quantity Surveying, Structural Engineering, Architecture, and Mechanical Engineering, among others. A number of developers come from finance and banking backgrounds.

This is expected since bank officials are well exposed to the various mortgage financing options available in the market. As expected, the range of professions was very wide, as demonstrated in **Figure 2.**

Figure 2. Professional Background (*Source: Author's analysis (2025).*)

3.1.3. Type of Projects

The respondents were asked to indicate the type of project they were currently undergoing, and which was mortgage-financed. Results presented in **Figure 3** showed that residential houses were the most commonly mortgage-financed, with a frequency of 68.3% (n=82). They were followed by distantly mixed-use development 13.3% (n=16) and commercial buildings 11.7% (n=14). Office buildings and industrial houses were the least mortgage-financed types of construction projects, each with a frequency of 3.3% (n=4).

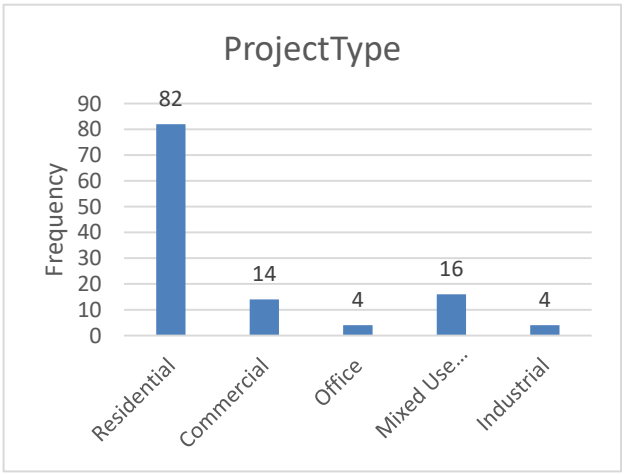

Figure 3. Type of Project (*Source: Author's analysis (2025).*)

3.1.4. Project Value

The respondents were asked to indicate the value of the construction project they were currently undertaking. **Figure 4** presents interesting results where the extremes recorded the highest frequencies. The results assumed an inverted bell curve. The majority of the construction projects (n=62, 51.2%) undertaken had a value of "up to 20 million" Kenyan shillings, followed by those with a value of "above 120 million" Kenyan shillings (n=32, 26.4%). Projects worth KShs. 81 – 100 million had a frequency of 9.1% (n=11), while those worth KShs. 21 – 40 million had a frequency of 8.3% (n=10). Projects worth KShs. 41 – 60 million and KShs. 61 – 80 both came last with a frequency of 2.5% (n=3).

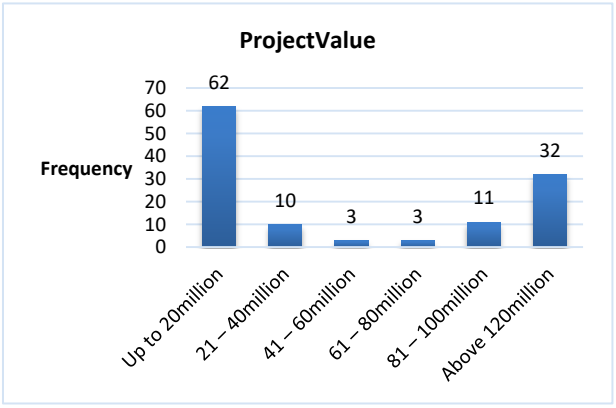

Figure 4. Project Value (*Source: Author's analysis (2025).*)

3.1.5. Project Duration

The project duration was measured in weeks. This was done based on intervals of 12 weeks. Results in **Figure 5** showed a fair distribution across all groups. Projects with a duration of "above 72 weeks" were the most with a frequency of 24.8% (n=30). Projects with a duration of "61-72 weeks" had the least representation with a frequency of 5.0% (n=6). Short-duration projects of "less than 12 weeks" had a frequency of 9.1% (n=11).

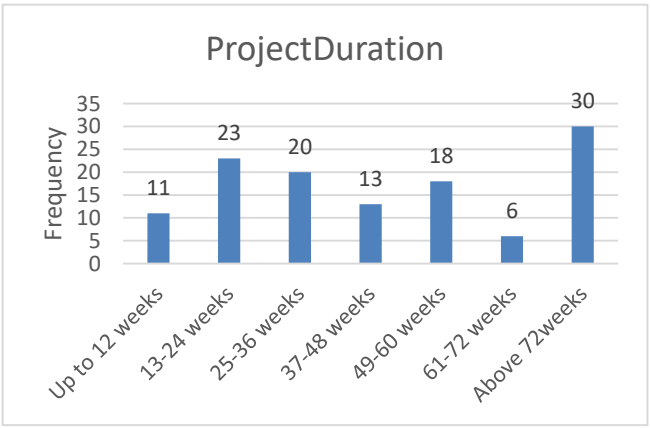

Figure 5. Project Duration (*Source: Author's analysis (2025).*)

3.2. Performance of MFCPs

Five aspects were used to evaluate the performance of MFCPs. These were: budget adherence, schedule adherence, project quality, safety standards, and project cash flow. The results have been presented in the following sections.

3.2.1. Budget Adherence

Respondents were asked to what extent the project was currently adhering to the set budget. Seven options were presented to them, ranging from "extremely above budget" to "extremely under budget". As presented in **Table 1(a),** the largest group, 52.8%, reported being slightly above budget. This suggests that while many projects exceed their budgets, the overruns are generally modest. Combining all categories

above budget (extremely, moderately, and slightly above) accounts for 67.5% of projects. This indicates that two-thirds of projects experience cost overruns, which can impact financing costs. About 26.8% (n=33) of projects are reported as on budget, reflecting effective cost control in a quarter of the cases. A small minority (5.7%, n=7) is under budget, which may indicate efficient management or conservative budgeting.

Table 1(a). Budget Adherence (Frequencies)

Budget Adherence	Frequency	Percent	Valid Percent	Cumulative Percent
Extremely above Budget	4	3.3	3.3	3.3
Moderately above budget	14	11.4	11.4	14.6
Slightly above budget	65	52.8	52.8	67.5
On budget	33	26.8	26.8	94.3
Slightly under budget	6	4.9	4.9	99.2
Moderately under budget	1	.8	.8	100.0

Source: Author's analysis (2025).

According to further results presented in **Table 1(b),** a mean of 3.21 was obtained, indicating that, on average, MFCPs are run "slightly above budget." This suggests that while most of these projects aren't severely over budget, they consistently experience minor budget overruns. The coefficient of variation (CV) was calculated as the ratio of the standard deviation to the mean expressed as a percentage. It is a measure of the data's relative variability. A lower CV suggests data points are clustered closer to the mean, while a higher CV indicates greater dispersion. Various authors [29], [30], [31], [32] have no consensus on the CV thresholds, but argue that it is a tool for comparing the variability of data among variables. A CV of 27% reflects moderate relative variability in budget adherence across projects, suggesting moderate consensus among projects.

Table 1(b). Budget Adherence (Mean)

Variable	N	Min	Max	Mean	SD	CV
Budget Adherence	123	1	6	3.21	.861	27%

Source: Author's analysis (2025).

Further, the questionnaire sought to quantify the extent of cost overruns being experienced in MFCPs. The purpose of this was to get a relatively more objective measure of the extent of budget adherence. The results are presented in **Figure 6.** 36.6% (n=45) of the projects had a cost overrun of 6-10% while 26.8% (n=33) had a cost overrun of 0-5%. Furthermore, 18.7% (n=23) of the projects had a cost overrun of 11-15% while 7.3% (n=9) had a cost overrun of 16-20%. Additionally, 4.9% (n=6) of the projects had a cost overrun of 21-25% while 4.1% (n=5) had a cost overrun exceeding 30%. Only 2 projects (1.6%) had a cost overrun of 26-30%. The mean cost overrun for MFCPs was established to be 9.9%. This corroborates the findings on budget adherence that most MFCPs in Kenya exceed their budgets slightly, with a significant majority experiencing some level of cost overrun.

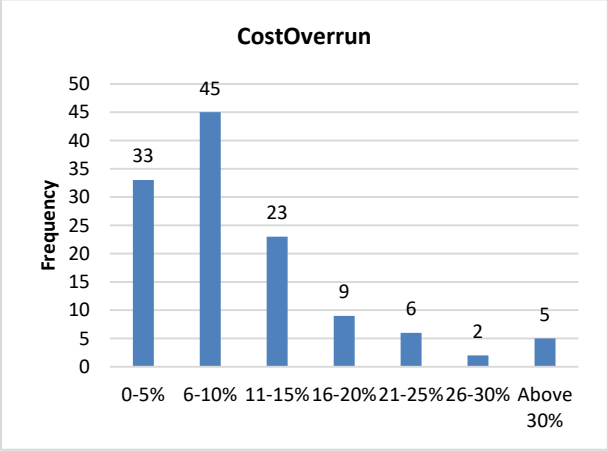

Figure 6. Cost Overruns of MFCPs (*Source: Author's analysis (2025).*)

3.2.2. Schedule Adherence

Respondents were asked to what extent the project was currently adhering to the initial schedule. Seven options were presented to them, ranging from "extremely behind schedule" to "extremely ahead of schedule". As presented in **Table 2(a),** 65% of projects (4.9% "extremely" + 14.6% "moderately" + 45.5% "slightly") were behind schedule, with nearly half (45.5%) reporting slight delays. Only 30.1% are on schedule, and a mere 4.9% are slightly ahead. 19.5% of projects (4.9% "extremely" + 14.6% "moderately behind") face significant delays, which can jeopardize stakeholder confidence and financial viability. Slight delays (45.5%) may stem from manageable issues such as weather disruptions or minor administrative bottlenecks. These are often mitigated through contingency planning. Severe delays (19.5%) likely reflect systemic challenges, such as poor contractor performance, design changes, or funding gaps.

Table 2(a). Schedule Adherence (Frequencies)

Schedule Adherence	Frequency	Percent	Valid Percent	Cumulative Percent
Extremely behind schedule	6	4.9	4.9	4.9
Moderately behind schedule	18	14.6	14.6	19.5
Slightly behind schedule	56	45.5	45.5	65.0
On schedule	37	30.1	30.1	95.1
Slightly ahead of schedule	6	4.9	4.9	100.0

Source: Author's analysis (2025).

According to further results presented in **Table 2(b),** a mean of 3.15 was obtained, indicating that, on average, MFCPs are run "slightly behind schedule." The data indicate

that schedule adherence is a significant challenge for mortgage -financed projects in Kenya, with the majority experiencing minor to severe delays. Resolving these difficulties necessitates enhanced planning, risk management, and collaboration to conform to global best practices and local conditions.

A CV value of 29% shows moderate relative variability, suggesting that while many projects hover around on schedule, a notable proportion are either behind or slightly ahead. This variability reflects the inherent uncertainties and challenges in construction scheduling, such as weather, supply chain disruptions, and labour issues [33].

Table 2(b). Schedule Adherence (Mean)

Variable	N	Min	Max	Mean	SD	CV
Schedule Adherence	123	1	5	3.15	.906	29%

Source: Author's analysis (2025).

Further, the questionnaire sought to quantify the extent of time overruns being experienced in MFCPs. The purpose of this was to get a relatively more objective measure of the extent of schedule adherence. The results are presented in **Figure 7**. 35.5% (n=43) of the projects had a time overrun of 0-5%, while 29.8% (n=36) had a time overrun of 6-10%. This suggests that for the majority, delays are relatively minor and potentially manageable within project contingencies. Furthermore, 17.4% (n=21) of the projects had a time overrun of 11-15% while 8.3% (n=10) had a time overrun of 16-20%. Additionally, 5.0% (n=6) of the projects had a time overrun exceeding 30% while 2.5% (n=3) had a time overrun of 21-25%. Only 2 projects (1.7%) had a time overrun of 26-30%. The mean time overrun for MFCPs in Kenya was established to be 9.4%.

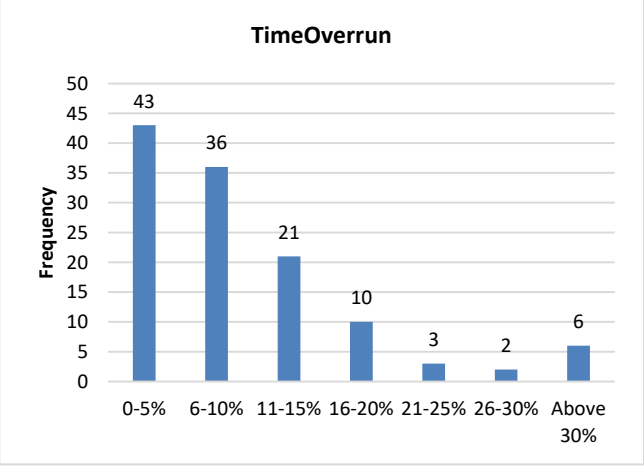

Figure 7. Time Overruns of MFCPs (*Source: Author's analysis (2025).*)

3.2.3. Project Quality

Respondents were asked to rate the extent to which the project was meeting the expected quality. Seven options were presented to them, ranging from "not acceptable" to "exceeded expectations". As seen in **Table 3(a),** a significant majority, 59.3%, report that their projects are meeting quality expectations. An additional 16.3% (11.4% "slightly above" + 4.9% "exceeded") indicates that projects are performing above expectations. This suggests a generally positive perception of quality standards in MFCPs in Kenya. Meeting or exceeding quality expectations is critical for client satisfaction, regulatory compliance, and long-term asset value [34].

About 24.4% of projects fall below expectations (1.6% "significantly below" + 4.1% "moderately below" + 18.7% "slightly below"). This sizeable minority highlights challenges in maintaining consistent quality across all MFCPs. Causes of quality shortfalls may include inadequate materials, poor workmanship, insufficient supervision, or budget constraints [35]. Quality deficiencies can lead to costly rework, delays, and reduced market confidence.

Table 3(a). Quality Expectations (Frequencies)

Extent of Quality Expectations	Frequency	Percent	Valid Percent	Cumulative Percent
Significantly below expectations	2	1.6	1.6	1.6
Moderately below expectations	5	4.1	4.1	5.7
Slightly below expectations	23	18.7	18.7	24.4
Meeting expectations	73	59.3	59.3	83.7
Slightly above expectations	14	11.4	11.4	95.1
Exceeded expectations	6	4.9	4.9	100.0

Source: Author's analysis (2025).

Further results presented on **Table 3(b),** indicate a mean of 4.89 was obtained, indicating that, on average, MFCPs are "slightly below expectations" but tending towards "meeting expectations". The data reveal that although the majority of MFCPs in Kenya meet or exceed quality standards, a notable minority encounter quality deficiency. This highlights the necessity for improved quality management techniques, more robust regulatory monitoring, and ongoing skills development to guarantee the consistent provision of high-quality building results. A CV value of 18% revealed relatively low variability of the data, suggesting moderate consensus among respondents.

Table 3(b). Quality Expectations (Mean)

Variable	N	Min	Max	Mean	SD	CV
Quality Expectations	123	2	7	4.89	.895	18%

Source: Author's analysis (2025).

Further, the questionnaire sought to quantify the percentage of the total work completed that had required rework. This was interpreted as the estimated cost increase incurred due to rework on the MFCP as a percentage of the total project cost. The results are shown in **Figure 8**. The data corroborates the findings on quality expectation, that while most mortgage-financed construction projects in

Kenya meet or exceed quality expectations, a notable minority experience quality shortfall. The majority of the projects (n=105, 85.4%) had a rework cost of between 0% and 10%. 64.2% (n=79) of the projects had a rework cost of 0-5%, while 21.1% (n=26) had a rework cost of 6-10%. Furthermore, 5.7% (n=7) of the projects had a time overrun of 16-20% while 4.0% (n=5) had a rework cost of 11-15%. Only 4.8% (n=6) of the projects had a rework cost exceeding 20%. The mean rework cost for MFCPs in Kenya was established to be 6.1%.

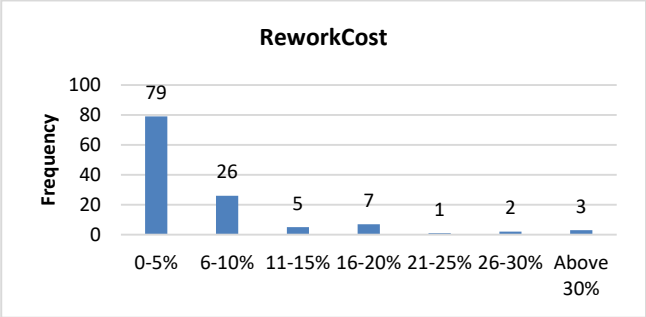

Figure 8. Rework Cost of MFCPs (Source: Author's analysis (2025).)

3.2.4. Project Safety Standards

Respondents were asked to describe the seriousness of the safety incidents and accidents reported in the project. Seven options were presented to them, ranging from "extremely high" to "extremely low". As seen on **Table 4(a),** the majority of respondents (61.0%) reported safety incidents as Low, Very Low, or Extremely Low in seriousness (23.6% + 14.6% + 22.8%). About 17.9% reported incidents as High or above seriousness (5.7% extremely high + 5.7% very high + 6.5% high). The remaining 21.1% rated incidents as Moderate in seriousness.

Table 4(a). Safety Standards (Frequencies)

	Frequency	Percent	Valid Percent	Cumulative Percent
Extremely High	7	5.7	5.7	5.7
Very High	7	5.7	5.7	11.4
High	8	6.5	6.5	17.9
Moderate	26	21.1	21.1	39.0
Low	29	23.6	23.6	62.6
Very Low	18	14.6	14.6	77.2
Extremely Low	28	22.8	22.8	100.0

Source: Author's analysis (2025).

The data suggests that while most projects experience safety incidents that are not severe, a notable minority (nearly 18%) face serious safety issue. This distribution is consistent with global construction industry trends, where minor incidents are common, but serious accidents, though less frequent, have significant consequences [36], [37], [38]. The presence of severe incidents signals the need for improved safety management, training, and enforcement of safety protocols [39], [40]. Construction sites in Kenya often face challenges such as inadequate safety training, limited use of personal protective equipment (PPE), and enforcement gaps [41]. Economic pressures and informal labour practices may contribute to higher-risk environments, increasing the likelihood of serious incidents [42].

According to further results on **Table 4(b),** a mean of 4.86 was obtained, indicating that on average, MFCPs experience a "moderate" level of seriousness in the safety incidents and accidents. The data shows that while the majority of mortgage-financed construction projects in Kenya report low severity of safety incidents, a significant minority experience serious accidents that could threaten worker wellbeing and project continuity. Addressing these issues requires a multi-faceted approach involving training, enforcement, resource allocation, and cultural change to foster safer construction environments. A CV value of 35% revealed relatively high variability of the data, which was also supported by the high range (1-7) among the responses. This indicated a relatively low consensus among respondents on the seriousness of safety incidents experienced in their projects.

Table 4(b). Safety Standards (Mean)

Variable	N	Min	Max	Mean	SD	CV
Safety Incidents	123	1	7	4.86	1.719	35%

Source: Author's analysis (2025).

Further, the researcher sought to quantify the percentage of workers consistently using the required PPEs. The results are shown in **Figure 9.** The data was fairly distributed, indicating that in some cases there was very low compliance where only a handful of workers wore PPEs, and in other cases there was high compliance where almost all workers wore the required PPEs. The data reveals a wide variability in PPE compliance, with a substantial portion of projects at risk due to low PPE usage. This further supports the variability noted in the previous section regarding quality expectations.

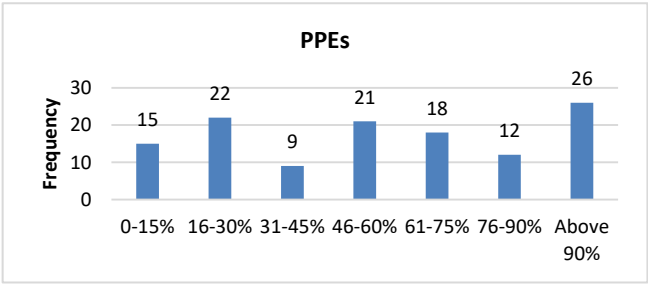

Figure 9. Number of Workers with PPEs (*Source: Author's analysis (2025).*)

3.2.5. Project Cashflow

Respondents were asked to indicate the extent to which they experienced cash flow problems during the project. Seven options were presented to them, ranging from "extremely high" to "extremely low". Results in **Table 5(a)** show that moderate cash flow problems were the most common,

reported by 41% (n=50) of respondents. High or greater (High, Very High, Extremely High) cash flow problems affect 23.8% of projects. Low or less (Low, Very Low, Extremely Low) cash flow problems are reported by 35.3% of projects. This distribution shows that while severe cash flow issues are not the norm, a significant minority of projects face substantial financial stress.

Table 5(a). Extent of Cash Flow Problems (Frequencies)

Extent of Cash Flow Problems	Frequency	Percent	Valid Percent	Cumulative Percent
Extremely High	5	4.1	4.1	4.1
Very High	5	4.1	4.1	8.2
High	19	15.4	15.6	23.8
Moderate	50	40.7	41.0	64.8
Low	23	18.7	18.9	83.6
Very Low	11	8.9	9.0	92.6
Extremely Low	9	7.3	7.4	100.0

Source: Author's analysis (2025).

The findings show that cash flow problems are a common challenge in Kenya's MFCPs. While most projects avoid extreme financial distress, nearly a quarter experience high or very high cash flow problems, and only a small minority report very low risk. Cash flow problems are a leading cause of project delays, cost overruns, and even project abandonment in construction [43]. Projects experiencing moderate to high cash flow issues may struggle to pay suppliers, subcontractors, and workers on time, which can disrupt schedules and quality [44]. The finding that only about 7% report "Extremely Low" cash flow problems suggests that smooth, uninterrupted cash flow is rare in the sector. As seen in **Table 5(b),** a mean of 4.23 was obtained, indicating that, on average, MFCPs experience a "moderate" level of cash flow problems. A CV value of 32% revealed relatively high variability of the data, which was also supported by the high range (1-7) among the responses.

Table 5(b). Extent of Cash Flow Problems

Variable	N	Min	Max	Mean	SD	CV
Cash Flow Problems	122	1	7	4.23	1.365	32%

Source: Author's analysis (2025).

3.3. Risks Associated with MFCPs

This section sought to establish the risks associated with MFCPs. Six types of risks were considered. A seven-point Likert scale ranging from "extremely low" to "extremely high" was adopted for both risk probability and risk impact. The means were converted to RII values by dividing by the highest possible score on the Likert scale (7) as advocated for by [45]. The overall risk impact was calculated by obtaining the means of the three types of risk impact evaluated. The risk level was then calculated by multiplying the risk probability and the overall risk impact, and converted to a percentage. The results are presented in the following sections.

3.3.1. Market Risks

As demonstrated in **Table 6**, the most dominant market risk was found to be "fluctuations of material prices" with a risk level of 49%, followed by "high interest rates" (41%), and "national economic decline/recession" (39%). The two least significant market risks were "oversupply of developed property" (24%) and "low demand for the developed property" (21%). The mean risk level for the market risks was 35%.

Material price volatility significantly affects project budgets and quality standards, as sudden price hikes can strain finances and force compromises on material quality or quantity [46]. In Kenya, inflation contributes to this risk. This risk can be mitigated by the use of fixed-price contracts, bulk purchasing, and contingency budgeting [47]. High borrowing costs increase project financing expenses, reducing profitability and potentially delaying progress due to cash flow constraints [48]. This aligns with Kenya's relatively high mortgage interest rates, as already analysed. This risk can be mitigated by negotiating better loan terms and fixed-rate loans. Variable interest rates introduce uncertainty in financing costs, complicating budgeting and cash flow management [47], and can be mitigated through fixed-rate loans. Oversupply of developed property can depress market prices and reduce sales velocity, impacting revenue and project viability. In Kenya, rapid urbanization sometimes leads to localized oversupply [49]. Possible mitigation measures include market research, phased development, and diversified project portfolios.

3.3.2. Financial Risks

Results in **Table 7** revealed the most dominant financial risk to be "high cost of finance" with a risk level of 48%, followed by "lack of access to project finance" (47%). The two least significant market risks were "reduced profitability of developed property" (31%) and "high costs of acquiring permits and approvals" (37%). The mean risk level for the financial risks was 41%.

The high cost of borrowing significantly increases project expenses, potentially limiting scope or quality and affecting timelines due to cash flow constraints [48], [49]. To mitigate this, developers should negotiate better loan terms, consider fixed-rate loans, and optimize project cash flow management [47]. Difficulty in securing adequate financing can delay project initiation and progress, increase costs through alternative funding, and compromise quality due to resource constraints [48], [50]. Access barriers include stringent collateral requirements and limited long-term financing options [51]. Some of the potential mitigations are strengthening creditworthiness, diversifying funding sources, and government -backed financing schemes. Regulatory fees and bureaucratic expenses add to project costs, potentially delaying commencement or progress [52]. In Kenya, complex permit processes and fees have been cited as barriers to efficient construction [53]. Mitigation measures include streamlining regulatory processes and advocating for fee rationalization.

3.3.3. Planning Risks

Five planning risks were considered in this study. Results in **Table 8** revealed the most dominant planning risk to be "delays in obtaining NEMA approvals" with a risk level of 47%, followed by "delays in obtaining county government approvals" (41%). The two least significant market risks were "delays in obtaining NCA approvals" (39%) and "lack of project consultants" (40%). The mean risk level for the planning risks was 41%.

Delays in National Environment Management Authority (NEMA) approvals significantly affect project timelines and can increase costs due to extended schedules and potential redesigns to meet environmental standards [49]. Environmental compliance is critical in Kenya, and bureaucratic inefficiencies often cause bottlenecks [54]. These can be mitigated through early engagement with NEMA, thorough environmental impact assessments, and proactive follow-up. County-level approvals are essential for land use, building permits, and compliance with local regulations. Project delays can stall project commencement and disrupt schedules [55]. This can be mitigated through streamlining county approval processes and improving coordination between developers and local authorities. Absence or inadequacy of qualified consultants compromises project design, supervision, and quality control, leading to rework and delays [56]. In Kenya, once developers get the required approvals, the majority tend to drop the project consultants due to perceived high costs associated with their fees. Delays in obtaining NCA approvals had the lowest risk score. This could be attributed to online systems implemented by the authority with regard to project registration and approvals.

3.3.4. Construction Risks

As demonstrated in **Table 9**, the most dominant construction risk was found to be "high cost of construction materials" with a risk level of 51%, followed by "project delays" (47%), and "inexperienced contractors" (46%). The three least significant market risks were "unavailability of construction materials" (39%), "extreme weather events" (36%), and "occurrence of construction accidents" (28%). The mean risk level for the construction risks was 42%.

Table 6. Market Risks

	Market Risks	P	Ic	It	Iq	I	R	Rank
a)	Low demand for the developed property	0.52	0.45	0.41	0.37	0.4	21%	6
b)	Oversupply of developed property	0.52	0.49	0.39	0.48	0.45	24%	5
c)	Fluctuating interest rates	0.65	0.65	0.46	0.43	0.51	34%	4
d)	High interest rates	0.68	0.78	0.53	0.48	0.6	41%	2
e)	Fluctuations of material prices	0.72	0.86	0.49	0.67	0.67	49%	1
f)	National economic decline/recession	0.7	0.66	0.54	0.46	0.55	39%	3

P=Risk Probability, Ic=Impact on Cost, It=Impact on Time, Iq=Impact on Quality,
I=Overall Impact (Mean; Ic, It & Iq), R=Risk Score=P*I

Source: (Author, 2025)

Table 7. Financial Risks

	Financial Risks	P	Ic	It	Iq	I	R	Rank
a)	Lack of access to project finance	0.62	0.91	0.87	0.48	0.75	47%	2
b)	High cost of finance	0.7	0.88	0.54	0.62	0.68	48%	1
c)	High costs of acquiring permits and approvals	0.69	0.64	0.43	0.54	0.54	37%	3
d)	Reduced profitability of developed property	0.64	0.55	0.48	0.44	0.49	31%	4

P=Risk Probability, Ic=Impact on Cost, It=Impact on Time, Iq=Impact on Quality,
I=Overall Impact (Mean; Ic, It & Iq), R=Risk Score=P*I

Source: (Author, 2025)

Table 8. Planning Risks

	Planning Risks	P	Ic	It	Iq	I	R	Rank
a)	Delays in obtaining county government approvals	0.7	0.53	0.87	0.35	0.58	41%	2
b)	Delays in obtaining NEMA approvals	0.66	0.55	0.89	0.54	0.66	43%	1
c)	Delays in obtaining NCA approvals	0.64	0.56	0.84	0.43	0.61	39%	4
d)	Lack of project consultants	0.49	0.77	0.8	0.89	0.82	40%	3

P=Risk Probability, Ic=Impact on Cost, It=Impact on Time, Iq=Impact on Quality,
I=Overall Impact (Mean; Ic, It & Iq), R=Risk Score=P*I

Source: (Author, 2025)

Material costs significantly inflate project budgets, potentially forcing compromises on quality or scope [46]. In Kenya, inflation and price fluctuations exacerbate this risk. This can be mitigated through bulk purchasing, long-term supplier contracts, and contingency budgeting [47]. Project delays disrupt schedules, increase overheads, and may degrade quality due to rushed work or rework [57]. Some of the causes include material shortages, weather, and contractor inefficiencies [49]. Possible mitigation measures include robust scheduling, proactive risk management, and effective communication. Lack of contractor experience leads to inefficiencies, errors, and delays. Defects increase rework costs and delay project completion. Defects often stem from poor workmanship or material quality [58]. Construction defects can be mitigated through quality control, inspections, and contractor competency. Weather delays construction activities, especially during rainy seasons. Climate variability is a growing concern in Kenya. Weather contingency planning and adaptive scheduling are some of the mitigation measures that can be adopted.

3.3.5. Legal and Regulatory Risks

Six legal and regulatory risks were considered in this study. Compared to other types of risks, the legal and regulatory risks were found to be less significant, as evidenced in their relatively lower risk levels. Results in **Table 10** revealed the most dominant construction risk to be "design flaws resulting in building defects" with a risk level of 36%, followed by "land disputes" (32%), and "legal action from authorities or other public interest groups" (28%). The three least significant market risks were "potential changes to environmental regulations" (22%), "potential changes to zoning regulations" (18%), and "potential changes to building codes" (17%). The mean risk level for the legal and regulatory risks was 26%.

Design flaws are a critical legal and regulatory risk, leading to structural failures, increased repair costs, and project delays. The recent implementation of the National Building Code (2024) aims to reduce such defects by enforcing modern standards [59]. Poor design compliance can result in legal liabilities and forced reconstruction or demolition. Design flaws can be mitigated by engaging qualified consultants, adhering strictly to updated building codes, and conducting thorough design reviews.

Land ownership conflicts remain a significant challenge in Kenya's real estate sector, causing project stoppages and legal battles [60]. Disputes may arise from unclear titles, encumbrances, or overlapping claims, especially in urban areas. Potential mitigation measures include conducting thorough due diligence, verifying land titles, and engaging legal experts before acquisition.

Non-compliance with regulations or community opposition can trigger legal challenges, halting projects [61]. Such actions may arise from environmental concerns, zoning violations, or failure to obtain proper approvals. This can be mitigated by ensuring full regulatory compliance, engaging stakeholders early, and maintaining transparent communication.

Environmental laws in Kenya are evolving, with stricter enforcement by NEMA [49]. Regulatory changes can impose additional requirements, causing redesigns or delays. Mitigation measures include monitoring regulatory updates, conducting comprehensive Environmental Impact Assessments (EIAs), and maintaining compliance.

The National Building Code (2024) replaces outdated regulations, introducing modern standards [59]. While changes may initially pose compliance challenges, they ultimately improve safety and quality. This can be mitigated by staying updated on code revisions and training project teams accordingly.

3.3.6. Environmental Risks

Of all the risk categories, environmental risks were found to have the lowest risk scores, attributed mainly to their low probabilities. Results in **Table 11** revealed the most dominant environmental risk to be "contaminated land that requires remediation" with a risk level of 24%, followed by "excessive vibrations during construction" (22%). The two least significant market risks were "excessive noise and air pollution during construction" (21%) and "damage to habitats and protected species" (19%). The mean risk level for the environmental risks was 22%. Compared to other types of risks, these risks were found to be the least significant.

Remediation of contaminated land increases project costs and duration due to the necessary cleanup and compliance with environmental standards. Contaminated sites require specialized assessments and interventions, which can delay construction and affect project viability. Vibrations from heavy machinery can damage adjacent structures and disturb communities, leading to complaints and potential work stoppages [62]. Managing vibrations is critical, especially in dense urban areas, to prevent structural damage and maintain community relations. Noise and dust pollution are common environmental nuisances during construction, impacting worker health and nearby residents.

3.4. Effect of Risks on the Performance of MFCPs

Table 12 presents a correlation analysis between the performance of MFCPs and the six types of risks affecting MFCPs. Construction Risks show a significant negative correlation with project performance ($r=-0.189$, $p=0.041$). This means that as construction risks increase (e.g., risks related to workmanship, delays, onsite accidents, materials problems), project performance tends to decline. This aligns with existing literature highlighting that construction-phase uncertainties and disruptions directly degrade cost, schedule, and quality outcomes [56]. Legal and Regulatory Risks have a marginally significant negative correlation with performance ($r=-0.180$, $p=0.051$). Though just above the conventional 0.05 threshold, this suggests that risks arising from regulatory changes, permit delays, compliance failures, or legal disputes can adversely affect project outcomes. Other risk types,

market, financial, planning, and environmental risks, show negative but statistically non-significant correlations with performance in this dataset. These negative trends suggest that increasing risks in these areas may diminish project success, but the evidence here is not strong enough to confirm these relationships statistically. It is possible that their impact is indirect, mediated by other factors, or that the limited sample size masks significance. The weakest and non-significant effect is observed with environmental risks (r=-0.044, p=0.635). This may indicate that while environmental factors (e.g., weather, site conditions) are important, their direct effect on overall project performance in mortgage-financed projects is less pronounced or sufficiently managed in the studied context.

The risk variables themselves are strongly positively correlated with each other (all $p<0.01$), with correlations ranging from moderate to strong. For example, market risks correlate strongly with financial risks (r = 0.748) and legal & regulatory risks (r=0.480). Financial risks are highly correlated with planning risks (r=0.648) and construction risks (r=0.580). Legal & regulatory risks have a particularly strong correlation with environmental risks (r=0.758). This pattern reflects that risks in construction projects tend to cluster and interact, where elevated problems in one area often coincide with risks elsewhere. Such risk interdependence complicates management, as addressing one risk area may require holistic strategies encompassing related risks.

Table 9. Construction Risks

	Construction Risks	P	Ic	It	Iq	I	R	Rank
a)	Inexperienced contractors	0.53	0.87	0.89	0.85	0.87	46%	3
b)	High cost of construction materials	0.72	0.88	0.56	0.71	0.72	51%	1
c)	Unavailability of construction materials	0.49	0.79	0.83	0.76	0.79	39%	5
d)	Extreme weather events	0.5	0.83	0.88	0.49	0.73	36%	6
e)	Occurrence of construction accidents	0.44	0.66	0.67	0.61	0.65	28%	7
f)	Project delays	0.6	0.78	0.92	0.67	0.79	47%	2
g)	Construction defects	0.52	0.85	0.8	0.88	0.84	44%	4
P=Risk Probability, Ic=Impact on Cost, It=Impact on Time, Iq=Impact on Quality, I=Overall Impact (Mean; Ic, It & Iq), R=Risk Score=P*I								

Source: (Author, 2025)

Table 10. Legal and Regulatory Risks

	Legal and Regulatory Risks	P	Ic	It	Iq	I	R	Rank
a)	Potential changes to building codes	0.43	0.51	0.44	0.34	0.41	17%	6
b)	Potential changes to zoning regulations	0.45	0.43	0.48	0.32	0.41	18%	5
c)	Potential changes to environmental regulations	0.43	0.57	0.5	0.42	0.5	22%	4
d)	Legal action from authorities or other public interest groups	0.47	0.55	0.78	0.45	0.59	28%	3
e)	Design flaws resulting in building defects	0.46	0.76	0.72	0.89	0.79	36%	1
f)	Land disputes	0.45	0.78	0.92	0.44	0.71	32%	2
P=Risk Probability, Ic=Impact on Cost, It=Impact on Time, Iq=Impact on Quality, I=Overall Impact (Mean; Ic, It & Iq), R=Risk Score=P*I								

Source: (Author, 2025)

Table 11. Environmental Risks

	Environmental Risks	P	Ic	It	Iq	I	R	Rank
a)	Contaminated land that requires remediation	0.36	0.78	0.64	0.61	0.68	24%	1
b)	Damage to habitats and protected species	0.37	0.55	0.51	0.49	0.52	19%	4
c)	Excessive noise and air pollution during construction	0.45	0.53	0.55	0.33	0.47	21%	3
d)	Excessive vibrations during construction	0.45	0.55	0.48	0.41	0.48	22%	2
P=Risk Probability, Ic=Impact on Cost, It=Impact on Time, Iq=Impact on Quality, I=Overall Impact (Mean; Ic, It & Iq), R=Risk Score=P*I								

Source: (Author, 2025)

Table 12. Correlation between Performance of MFCPs and Project Risks

		PP	MRs	FRs	PRs	CRs	LRs	ERs
Project Performance (PP)	Pearson Correlation	1	-.138	-.103	-.096	-.189*	-.180	-.044
	Sig. (2-tailed)		.136	.260	.295	.041	.051	.635
Market Risks (MRs)	Pearson Correlation	-.138	1	.748**	.457**	.480**	.295**	.363**
	Sig. (2-tailed)	.136		.000	.000	.000	.001	.000
Financial Risks (FRs)	Pearson Correlation	-.103	.748**	1	.648**	.580**	.455**	.372**
	Sig. (2-tailed)	.260	.000		.000	.000	.000	.000
Planning Risks (PRs)	Pearson Correlation	-.096	.457**	.648**	1	.531**	.479**	.421**
	Sig. (2-tailed)	.295	.000	.000		.000	.000	.000
Construction Risks (CRs)	Pearson Correlation	-.189*	.480**	.580**	.531**	1	.492**	.463**
	Sig. (2-tailed)	.041	.000	.000	.000		.000	.000
Legal & Regulatory Risks (LRs)	Pearson Correlation	-.180	.295**	.455**	.479**	.492**	1	.758**
	Sig. (2-tailed)	.051	.001	.000	.000	.000		.000
Environmental Risks (ERs)	Pearson Correlation	-.044	.363**	.372**	.421**	.463**	.758**	1
	Sig. (2-tailed)	.635	.000	.000	.000	.000	.000	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Source: (Author, 2025)

4. Implications

These findings have four implications. First is the importance of managing construction risks. Since construction risks are significantly linked to poorer project performance, project managers and stakeholders need to prioritize mitigating construction-phase uncertainties. Strategies include rigorous quality control, timely inspections, skilled workforce training, and contingency planning, all of which improve the reliability of execution phases [47]. The second implication is on addressing legal and regulatory risks. The marginal significance of legal and regulatory risks underscores the practical importance of navigating compliance efficiently, ensuring timely permits, and proactively managing regulatory changes. Poor handling of this domain can cause delays, increase costs, and degrade quality [56]. Third is the need for integrated risk management. Strong intercorrelations among risks suggest the necessity of integrated risk management frameworks that simultaneously monitor market, financial, planning, construction, legal, and environmental risks. Isolated risk mitigation may be less effective than holistic approaches, enabling early detection and coordinated responses [63]. The last implication is on understanding non-significant risks. While market, financial, planning, and environmental risks were not statistically significant here, they should not be discounted. They may exert indirect influence through effects on budget, cash flow, schedule, or contractor performance, as documented in broader literature [56]. Future research might investigate mediation effects to reveal these subtler relationships.

5. Conclusions

The study reveals that mortgage-financed construction projects (MFCPs) in Kenya face significant risks that adversely affect their performance, particularly in terms of cost, schedule, quality, safety, and cash flow. Construction risks, especially those related to material costs, project delays, and contractor experience, have the most significant negative impact on project outcomes. Legal and regulatory risks, such as permit delays and design flaws, also marginally affect performance. Market, financial, planning, and environmental risks show negative but statistically non-significant correlations with project performance, suggesting their influence may be indirect or mediated by other factors. The strong intercorrelations among risk categories highlight the need for integrated risk management approaches rather than isolated mitigation strategies. Overall, the findings underscore the importance of proactive risk identification, assessment, and mitigation to enhance the success of MFCPs in Kenya.

6. Recommendations

The paper makes the following recommendations:

- Project managers and stakeholders should prioritize managing construction risks through rigorous quality control, timely inspections, skilled workforce training, and contingency planning.
- Legal and regulatory risks should be addressed by ensuring timely permits, strict compliance with building codes, and proactive engagement with regulatory authorities.
- Integrated risk management frameworks should be adopted to simultaneously monitor and mitigate market, financial, planning, construction, legal, and environmental risks.
- Developers should conduct thorough due diligence on land titles and regulatory requirements to minimize

legal disputes and compliance issues.

- Future research should explore the mediation effects of non-significant risks and the effectiveness of holistic risk management strategies in the Kenyan construction context.

7. Limitations

While this study provides valuable insights into the risks affecting MFCPs in Kenya, several limitations should be acknowledged. First, the research employed a cross-sectional survey, capturing data at a single point in time. This limits the ability to establish causal relationships between risk categories and project performance. Longitudinal studies would be better suited to track risk dynamics and performance outcomes over time. Second, the analysis was primarily descriptive, supplemented by risk importance indices and correlations. Although these methods highlight associations, they do not fully capture the joint or structural effects of multiple risk categories. Future research employing multivariate techniques such as regression or structural equation modelling (SEM/PLS-SEM) could provide deeper explanatory power.

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