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Project Risk Management Practices and Organisational Performance in Manufacturing Firms: Evidence from SOSOMA Industries, Rwanda

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Abstract: *Manufacturing firms increasingly deliver change through projects executed under operational, financial, technical, regulatory, supply-chain, and market-related risk. This study examined the effect of stage-based project risk management (PRM) practices — planning, implementation, monitoring, and evaluation — on the organisational performance of SOSOMA Industries, a manufacturing and agro-processing firm in Rwanda. Anchored on Contingency Theory, Systems Theory, the Resource-Based View, and the PMBOK framework, it adopted a quantitative explanatory design. A census of 67 staff in project-execution and risk-management functions was surveyed using a structured questionnaire and documentary review, achieving a 100% response rate. Data were analysed in SPSS using descriptive statistics, Pearson correlation, and multiple regression. All four PRM stages correlated positively and significantly with organisational performance ($p < .01$), and the model explained 87.4% of the variance ($R^2 = .874$). Monitoring exerted the strongest effect ($\beta = .414$), followed by planning ($\beta = .297$) and implementation ($\beta = .193$); evaluation was positive but non-significant ($\beta = .120$). Performance gains are driven primarily by continuous monitoring and upfront planning, whereas evaluation appears to operate as an indirect, learning-oriented mechanism. Firms under similar constraints should institutionalise integrated, lifecycle-based risk governance, prioritising real-time monitoring, early-warning systems, and accountability for planned responses.*

Keywords: *Risk, Monitoring, Planning, Performance, Manufacturing, Rwanda*

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1. Introduction

Manufacturing firms increasingly deliver strategic change through projects — capacity expansion, technology upgrades, and process improvement — undertaken in environments characterised by operational, financial, technical, regulatory, supply-chain, and market-related uncertainty (Anton & Nucu, 2020; Gordon, Loeb, & Tseng, 2009; Otieno, Ogutu, Ndemo, & Pokhariyal, 2020). Because such projects are capital-intensive and time-bound, their exposure to disruption can compromise not only project-level outcomes but also the wider performance of the organisations that undertake them (Kerzner & Saladis, 2017). Global standards issued by the Project Management Institute (PMI, 2000, 2017, 2021) and the International Organization for Standardization (ISO, 2021) accordingly frame project risk management (PRM) as a structured lifecycle process spanning risk identification, assessment, response planning, implementation, monitoring, and evaluation, rather than a single technical control activity. Empirical work in industrialised economies has repeatedly linked mature risk-management systems to higher project success rates,

stronger cost and schedule performance, and greater organisational resilience.

In developing-country settings, however, risk management is frequently informal, fragmented, and weakly integrated into strategic decision-making (Mthiyane, van der Poll, & Tshehla, 2022), leaving firms exposed to cost overruns, delays, and quality failures. This vulnerability is particularly acute in African manufacturing, where currency volatility, import dependency, energy constraints, and regulatory unpredictability compound execution risk and complicate the translation of capital investment into sustained performance. In Rwanda, manufacturing has been positioned as a pillar of economic transformation, with firms progressively investing in capital-intensive projects to expand production capacity, modernise technology, and improve operational efficiency. The extent to which these investments translate into performance gains, however, depends substantially on how risk is governed throughout the project lifecycle.

SOSOMA Industries, a manufacturing and agro-processing firm producing fortified food products in Rwanda, illustrates this challenge. The firm competes in a quality-sensitive and price-sensitive market and undertakes recurring projects in production-line improvement, capacity expansion, quality enhancement, and supply-chain optimisation — all exposed to raw-material volatility, food-safety compliance demands, and logistical constraints. Despite this project intensity, empirical evidence on how PRM practices at SOSOMA Industries, or comparable Rwandan manufacturers, relate to organisational performance remains limited. Existing studies tend to treat risk management as a generic managerial task or to examine isolated lifecycle stages in isolation from one another, and much of the available Rwandan evidence, including work on planning- and implementation-stage practices, is drawn from public-sector and development-project settings rather than manufacturing (Uwase & Habumuremyi, 2020; Kayitesi, 2019). *However, what remains underexamined is whether, and to what extent, planning-, implementation-, monitoring-, and evaluation-stage PRM practices jointly and separately shape organisational performance in a manufacturing firm operating under Rwanda's structural constraints.*

This study addresses that gap by examining the effect of stage-based PRM practices on the organisational performance of SOSOMA Industries. The general objective was to investigate the effect of project risk management practices on organisational performance at SOSOMA Industries. Specifically, the study sought to: (i) examine the effect of planning-stage PRM practices on organisational performance; (ii) determine the effect of implementation-stage PRM practices on organisational performance; (iii) analyse the effect of monitoring-stage PRM practices on organisational performance; and (iv) evaluate the effect of evaluation-stage PRM practices on organisational performance. Correspondingly, four null hypotheses were tested, each proposing that the relevant PRM stage has no statistically significant effect on organisational performance at SOSOMA Industries.

Addressing this gap matters because the presence of risk-management activity does not, by itself, demonstrate that it improves organisational outcomes. Much existing work evaluates PRM against project-level criteria — cost, time, scope, and quality — rather than the broader operational, financial, and strategic performance of the organisation, and treating the four PRM stages as functionally interchangeable obscures which stage actually drives organisational outcomes and where scarce managerial attention and resources are best directed.

The study contributes to theory by testing an integrated, lifecycle-based conceptualisation of PRM — combining Contingency Theory, Systems Theory, the Resource-Based View, and the PMBOK framework — against firm-level organisational performance rather than project-level success metrics alone, in a manufacturing context that has received limited empirical attention in Rwanda. Practically, it offers SOSOMA Industries and comparable firms empirical grounds for prioritising investment across the risk-management lifecycle rather than treating risk governance as a single, undifferentiated managerial task.

2. Literature Review

2.1 Theoretical Foundations

This study draws on four complementary theoretical perspectives. Contingency Theory holds that organisational effectiveness depends on the fit between managerial practices and situational conditions, implying that PRM practices must be adapted to SOSOMA Industries' specific exposure to raw-material, demand, and production-system variability rather than applied as a standardised template. Systems Theory conceives of organisations as interdependent subsystems in which weaknesses at one stage propagate across the whole (von Bertalanffy, 1968), suggesting that inadequate planning or weak monitoring can generate cost inefficiencies and production disruption elsewhere in the organisation. The Resource-Based View (RBV) treats valuable, difficult-to-imitate organisational capabilities as a source of sustained competitive advantage (Barney, 1991; Teece, 2018),

positioning integrated PRM as a strategic capability — rather than a compliance requirement — that supports resource optimisation and production continuity. Finally, the PMBOK framework (PMI, 2000, 2017, 2021) operationalises risk management into standardised, measurable procedural components — identification, analysis, response planning, implementation, and monitoring — providing the empirical basis for the stage-based indicators used in this study. Read together, these perspectives frame PRM as an adaptive, interdependent, and capability-driven system whose cumulative, lifecycle-wide effectiveness, not any single stage in isolation, is expected to shape organisational performance outcomes.

2.2 Operational Definitions of Key Constructs

To ensure conceptual clarity, Table 1 defines the constructs used throughout the study.

Table 1. Operational definitions of key constructs

Construct	Operational definition
Project risk management	A systematic, ongoing managerial process of identifying, examining, responding to, monitoring, and evaluating uncertainties that may affect project objectives (PMI, 2017).
Planning-stage PRM	Techniques used prior to project execution to identify, evaluate, prioritise, and plan responses to probable risks, aligning resources and stakeholder expectations with organisational objectives (Kerzner & Saladis, 2017).
Implementation-stage PRM	The execution of pre-planned risk responses and management of newly emerging risks during project execution, emphasising adaptive control and timely intervention (Hillson, 2024).
Monitoring-stage PRM	The continuous process of tracking identified risks, assessing mitigation effectiveness, detecting deviations, and implementing corrective action as the project progresses (ISO, 2018).
Evaluation-stage PRM	Post-project assessment of risk responses, documentation of lessons learned, and incorporation of findings into future projects and organisational policy (PMI, 2017).
Organisational performance	The degree to which an organisation achieves its strategic, operational, and financial goals; treated here as a multidimensional, cumulative construct rather than a project-level outcome (Norton, 1996).

2.3 Planning-Stage Risk Management and Organisational Performance

Planning-stage PRM is the foundational stage of risk governance, in which organisations identify, assess, and develop responses to potential uncertainties before project execution, typically through risk registers, probability-impact assessment, contingency planning, and resource allocation aligned to identified risks. Enterprise-level evidence links systematic, planning-oriented risk governance to improved firm performance, particularly where risk practices are integrated into broader strategic decision-making rather than treated as a stand-alone compliance exercise (Anton & Nucu, 2020; Gordon, Loeb, & Tseng, 2009; Otieno, Ogutu, Ndemo, & Pokhariyal, 2020). In Rwanda, planning-stage risk-management approaches have been associated with improved coordination and resource efficiency in development-project settings (Uwase & Habumuremyi, 2020), while risk-management practices more broadly have been linked to organisational performance in the Rwandan insurance sector (Nkundabagenzi & Habimana, 2021). This Rwandan evidence, however, originates predominantly from public-sector, development, and financial-services settings rather than manufacturing, leaving open the question of whether planning-stage practices translate into organisational performance in an industrial firm such as SOSOMA Industries.

2.4 Implementation-Stage Risk Management and Organisational Performance

Implementation-stage PRM operationalises planned mitigation strategies through real-time execution: enforcing risk responses, identifying emerging risks, communicating risk information across functional units, and taking timely corrective action when deviations occur. In manufacturing systems, this stage is critical because production outcomes depend on machinery reliability, labour coordination, supply-chain continuity, and quality-assurance mechanisms (Kayitesi, 2019). Evidence from Rwanda indicates that structured project-management practices, including the execution of planned responses to risk, are positively associated with project performance in donor-funded and health-sector programmes (Niyonkuru, 2020; Munyaneza, 2018), while research on construction projects in Kigali shows that risk-management practices — including implementation-stage controls — are associated with stronger project performance (Kayitesi, 2019). Firms in advanced industrial economies increasingly draw on real-time monitoring systems and predictive analytics to strengthen implementation-stage control, whereas many manufacturing firms in developing economies continue to rely on managerial discretion and informal control mechanisms, which may produce less consistent implementation outcomes (Mthiyane, van der Poll, & Tshehla, 2022). Rwandan evidence on this stage remains concentrated in construction, health, and donor-funded project environments, limiting its explanatory power for manufacturing risk-management dynamics.

2.5 Monitoring-Stage Risk Management and Organisational Performance

Monitoring-stage PRM is a continuous control and feedback process — periodic risk review, risk-register updates, use of key risk indicators, variance analysis, and structured reporting — that supports managerial decision-making by detecting deviations before they escalate (PMI, 2017). Global evidence associates systematic risk-management practices, including monitoring, with stronger firm-level outcomes, partly mediated through innovation in business processes (Al-Nimer, Abbadi, Al-Omush, & Ahmad, 2021). Comparable evidence from East Africa's telecommunications sector links structured monitoring and evaluation of projects to improved organisational performance even in resource-constrained contexts (Kiage & Namusonge, 2016). Advanced industrial economies increasingly rely on integrated digital monitoring systems and automated risk dashboards for real-time visibility, whereas many manufacturing enterprises in developing economies continue to depend on periodic manual reporting, which may limit the speed and precision of risk detection (Mthiyane et al., 2022). As with the planning and implementation stages, the available Rwandan evidence remains concentrated outside continuous manufacturing production systems, where operational risks such as supply-chain disruption, machine downtime, and quality fluctuation are frequent and immediate.

2.6 Evaluation-Stage Risk Management and Organisational Performance

Evaluation-stage PRM institutionalises organisational learning by converting project and operational experience into structured knowledge for future decision-making, through post-project risk review, documentation of lessons learned, and feedback into subsequent planning and operational cycles (PMI, 2017; Kayitesi, 2019). Evidence from Kenyan construction firms shows that systematic post-project risk-evaluation practices significantly improve managerial learning, decision-making, and firm performance (Mberia, Omare, & Ronoh, 2025), while broader East African evidence links structured monitoring-and-evaluation frameworks to long-term improvements in organisational effectiveness through better feedback loops and knowledge retention (Kiage & Namusonge, 2016). Post-project risk-management review has similarly been examined as a mechanism for organisational learning in other contexts (Altugsemanur, 2023). Transferability of this evidence, however, depends on the extent to which organisations maintain structured knowledge-management systems and durable institutional memory; many manufacturing firms in developing economies, including Rwanda, apply evaluation processes inconsistently because operational pressures tend to prioritise production continuity over rigorous post-project learning (Mthiyane et al., 2022).

Across the four stages, a consistent pattern emerges: empirical attention to PRM in Rwanda and comparable developing-country settings has grown but remains concentrated in construction, public-infrastructure, donor-funded, and financial-services contexts rather than continuous manufacturing. Whether the relative importance of planning, implementation, monitoring, and evaluation observed in those settings holds in a manufacturing and agro-processing firm — with its distinct profile of raw-material volatility, food-safety compliance, and import dependency — is therefore an open empirical question this study addresses.

2.7 Research Gap, Conceptual Framework, and Hypotheses

Three gaps emerge from this review. First, the empirical literature remains predominantly focused on project-level success indicators — cost, schedule, and quality — with limited attention to how PRM practices shape broader organisational-performance outcomes such as productivity, operational efficiency, and strategic effectiveness. Second, PRM is typically studied as a set of

discrete, functionally distinct activities rather than as a cohesive, interconnected lifecycle system, which obscures the cumulative and interacting contribution of each stage to organisational outcomes. Third, the available empirical evidence is concentrated in construction, public infrastructure, and donor-funded development projects, both globally and within Rwanda, leaving manufacturing firms — and agro-processing firms specifically — under-represented despite their distinctive risk profile of raw-material volatility, food-safety compliance, and import dependency.

Building on Contingency Theory, Systems Theory, the RBV, and the PMBOK framework, the study conceptualises project risk management as a lifecycle-based independent construct comprising four analytically distinct but interrelated dimensions — planning-stage, implementation-stage, monitoring-stage, and evaluation-stage PRM — each hypothesised to exert a direct effect on organisational performance, the dependent construct, operationalised through operational efficiency, cost control, financial-loss minimisation, strategic alignment, decision-making effectiveness, and organisational resilience. Accordingly, the study tested the following null hypotheses:

H_{01}: Planning-stage project risk management practices have no statistically significant effect on organisationalperformance at SOSOMA Industries

H_{02}: Implementation-stage project risk management practices have no > statistically significant effect on organisational performance at SOSOMA Industries.

H_{03}: Monitoring-stage project risk management practices have no statistically significant effect on organisational performance at SOSOMA Industries.

H_{04}: Evaluation-stage project risk management practices have no statistically significant effect on organisational performance at SOSOMA Industries.

3. Methodology

3.1 Research Design

The study adopted a quantitative explanatory research design to investigate the effect of stage-based project risk management practices on organisational performance at SOSOMA Industries. The design was appropriate because the study sought to explain the causal relationship between planning-, implementation-, monitoring-, and evaluation-stage PRM practices and organisational performance, using correlation and multiple regression analysis to establish the direction, magnitude, and statistical significance of these relationships.

3.2 Population, Sample, and Sampling Procedure

The target population comprised all 67 SOSOMA Industries staff directly or indirectly involved in project execution and risk-management functions, spanning project management, operations, finance, procurement, engineering, internal audit, risk and compliance, and senior and middle management. Given the small and manageable size of this population, a census approach was used: all 67 employees were included in the study rather than a probability sample, which minimised sampling error and ensured that all functional perspectives within the organisation were represented in the quantitative analysis (Table 2).

Table 2. Target population by functional category (N = 67)

Category of respondents	Population (N)	Sampling technique
Project management staff	9	Census
Operations staff	18	Census
Finance department	7	Census
Procurement staff	6	Census
Engineering department	10	Census
Internal audit staff	4	Census
Risk and compliance unit	5	Census
Senior and middle management	8	Census
Total	67	Census

Source: Field data (2025).

3.3 Variables and Measurement

The independent construct, project risk management practices, was conceptualised as a lifecycle-integrated system operating across four interdependent stages. Planning-stage PRM (PSPRM) was measured through systematic risk identification, formal risk assessment, documentation of mitigation and contingency plans, risk-informed resource allocation, and stakeholder participation. Implementation-stage PRM (ISPRM) was measured through execution of planned risk responses, timely identification of emerging risks, responsiveness to disruptions, interdepartmental risk communication, and corrective action during execution. Monitoring-stage PRM (MSPRM) was measured through continuous risk tracking, risk-register updates, escalation of deviations, use of monitoring tools, and management review of risk status. Evaluation-stage PRM (ESPRM) was measured through post-project risk review, documentation of lessons learned, use of evaluation findings, implementation of recommendations, and integration of lessons into subsequent practice. All items were measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), with composite dimension scores computed by averaging item responses.

The dependent construct, organisational performance, was operationalised as a multidimensional index measuring perceived operational efficiency, cost control, financial-loss minimisation, strategic alignment, decision-making effectiveness, and organisational resilience, also measured on a five-point Likert scale and aggregated into a composite organisational-performance index (Table 3).

Table 3. Operationalisation of study variables

Construct	Dimension	Indicators	Scale
Project risk management (independent)	Planning-stage (PSPRM)	Risk identification; risk assessment; mitigation/contingency documentation; risk-informed resource allocation; stakeholder participation	5-point Likert
	Implementation-stage (ISPRM)	Execution of risk responses; emerging-risk identification; response to disruptions; risk communication; corrective action	5-point Likert
	Monitoring-stage (MSPRM)	Continuous risk tracking; risk-register updates; deviation reporting/escalation; monitoring tools; management review	5-point Likert
	Evaluation-stage (ESPRM)	Post-project review; lessons-learned documentation; use of findings; implementation of recommendations; integration into practice	5-point Likert
Organisational performance (dependent)	—	Operational efficiency; cost control; financial-loss minimisation; strategic alignment; decision-making effectiveness; organisational resilience	5-point Likert

The regression model tested was specified as:

$$OP_i = \alpha_0 + \alpha_1 PSPRM_i + \alpha_2 ISPRM_i + \alpha_3 MSPRM_i + \alpha_4 ESPRM_i + \varepsilon_i$$

where OP is organisational performance; PSPRM, ISPRM, MSPRM, and ESPRM are the planning-, implementation-, monitoring-, and evaluation-stage PRM composite scores; α_0 is the intercept; α_1–α_4 are regression coefficients; and ε is the error term.

3.4 Data Collection Instruments and Procedure

Data were collected using a structured, self-administered questionnaire as the primary quantitative instrument, complemented by documentary review of internal organisational records (project reports, risk registers, audit findings, and management evaluations) to support triangulation and reduce reliance on perceptual data alone (Creswell & Creswell, 2018; Yin, 2018). Prior to full administration, the instrument was piloted at Kinazi Cassava Plant — a manufacturing and agro-processing enterprise with operational characteristics comparable to

SOSOMA Industries — to assess clarity, relevance, sequencing, and reliability; a different site was used for piloting to avoid contaminating the main-study responses. Respondents were informed of the study's purpose, assured of anonymity, and provided informed consent before questionnaire administration; the researcher was available to clarify items during self-administration, and completed instruments were reviewed for completeness before data entry (Babbie, 2020).

3.5 Validity and Reliability

Content validity was established through review of relevant theoretical and empirical literature and expert assessment of the instrument to ensure adequate coverage of the four PRM dimensions and organisational performance. Construct validity was supported through multi-item Likert-scale measures derived from established literature. Internal-consistency reliability was assessed using Cronbach's alpha, with a coefficient of 0.70 or above considered acceptable (Gliem & Gliem, 2003). All constructs met this threshold, with alpha coefficients ranging from .817 to .902 and an overall instrument alpha of .885, indicating good to excellent internal consistency (Table 4).

Table 4. Reliability assessment (Cronbach\'s alpha)

Construct	Items	α	Interpretation
Planning-stage PRM (PSPRM)	5	.842	Good
Implementation-stage PRM (ISPRM)	5	.871	Good
Monitoring-stage PRM (MSPRM)	5	.894	Good
Evaluation-stage PRM (ESPRM)	5	.817	Good
Organisational performance	6	.902	Excellent
Overall instrument	26	.885	Good

3.6 Data Analysis

Data were coded, cleaned, and analysed using SPSS. Descriptive statistics (means and standard deviations) summarised respondent perceptions of PRM practices and organisational performance. Pearson product-moment correlation was used to assess the strength and direction of bivariate relationships among the study constructs, and multiple linear regression was used to test the combined and independent effects of the four PRM dimensions on organisational performance and to test the study's hypotheses. Composite indices derived from Likert-scale items were treated as continuous variables for the purposes of parametric analysis, following convention in comparable organisational-behaviour research (Creswell & Creswell, 2018). Statistical significance was evaluated at the conventional 5% threshold, and model fit was assessed using R^2, adjusted R^2, and the F-statistic.

3.7 Ethical Considerations

Participants were fully informed of the study's purpose and their rights, including the voluntary nature of participation and the right to withdraw at any stage without consequence. Informed consent was obtained prior to data collection, no personal identifiers were retained, and responses were anonymised to protect confidentiality. The study was conducted in accordance with the host university's institutional research-ethics requirements and adhered to principles of honesty, transparency, and integrity throughout data collection, analysis, and reporting.

4. Results and Discussion

4.1 Response Rate

All 67 questionnaires distributed to the census population were completed and returned, yielding a 100% response rate. This complete response minimises non-response bias and indicates strong institutional cooperation, providing a robust dataset for the descriptive and inferential analyses that follow.

4.2 Demographic Characteristics

Respondents were predominantly aged 30–39 years (71.6%), with 16.4% aged 20–29 and 11.9% aged 40 and above; this concentration reflects respondents in their peak working and managerial years. Females comprised 55.2% of respondents and males 44.8%, consistent with the gender composition of SOSOMA Industries' project- and risk-related departments. Most respondents (83.6%) had 1–5 years of organisational experience, 10.4% had more than six years, and 6.0% had less than one year, indicating that

the sample was drawn predominantly from staff with sufficient organisational tenure to assess the firm's risk-management practices and performance.

4.3 Descriptive Statistics of Study Constructs

Table 5 summarises respondents' perceptions of the four PRM dimensions and organisational

performance. Implementation-stage practices recorded the highest composite mean (M = 3.73), followed by evaluation-stage practices (M = 3.72) and monitoring-stage practices (M = 3.60), while planning-stage practices recorded the lowest composite mean (M = 3.29) and the widest spread of responses (SD range 1.27–1.35). Organisational performance was rated favourably overall (M = 3.98), with financial-loss minimisation (M = 4.10) and management decision-making (M = 4.05) rated most positively, and cost control (M = 3.88) rated comparatively lowest. Within planning-stage practices specifically, documentation of mitigation and contingency plans was rated highest (M = 3.48) while risk-informed resource allocation was rated lowest (M = 3.13), suggesting that identified risks are not yet fully translated into resourcing decisions. Within implementation-stage practices, execution of planned mitigation measures and effective team response to disruptions were rated highest (M = 3.79 each), while prompt identification of emerging risks was comparatively weaker (M = 3.64). These patterns indicate that SOSOMA Industries has more firmly embedded reactive and execution-oriented risk practices than upstream, resource-allocation-linked planning practices — a distinction that is important for interpreting the regression results in Section 4.

Table 5. Descriptive statistics of study constructs (N = 67)

Construct	Min.	Max.	M	SD
Planning-stage PRM (PSPRM)	1	5	3.29	1.32
Implementation-stage PRM (ISPRM)	2	5	3.73	1.13
Monitoring-stage PRM (MSPRM)	2	5	3.60	0.83
Evaluation-stage PRM (ESPRM)	2	5	3.72	0.80
Organisational performance (OP)	3	5	3.98	1.00

Source: Field data (2025).

4.4 Correlation Analysis

Pearson correlation analysis (Table 6) showed that all four PRM dimensions were positively and significantly correlated with organisational performance at the 1% level. Planning-stage practices showed the strongest bivariate association with performance ($r = .78$, $p < .001$), followed by evaluation-stage ($r = .72$), implementation-stage ($r = .71$), and monitoring-stage practices ($r = .69$). Inter-construct correlations among the four PRM dimensions ranged from .56 to .74, indicating that the dimensions are complementary and tend to be implemented together, while remaining below the conventional 0.80 threshold associated with problematic multicollinearity — supporting their joint inclusion in the regression model.

Table 6. Pearson correlation matrix

	OP	PSPRM	ISPRM	MSPRM	ESPRM
OP	1	.779**	.711**	.694**	.719**
PSPRM		1	.627**	.740**	.623**
ISPRM			1	.736**	.559**
MSPRM				1	.739**
ESPRM					1

***Correlation is significant at the 0.01 level (two-tailed). N = 67 for all pairs.*

4.5 Regression Analysis

Multiple linear regression was used to assess the combined and independent effect of the four PRM dimensions on organisational performance. The model summary (Table 7) shows a strong overall relationship ($R = .935$), with the four

predictors jointly explaining 87.4% of the variance in organisational performance ($R^2 = .874$; adjusted $R^2 = .866$). The small gap between R^2 and adjusted R^2 indicates that the model's explanatory power is not artificially inflated by the number of predictors. The ANOVA results confirm that the overall model is highly statistically significant, $F(4, 62) = 107.72$, $p < .001$, indicating that the observed relationship between PRM practices and organisational performance is very unlikely to have occurred by chance.

Table 7. Regression model summary and ANOVA

Model	R	R^2	Adj. R^2	SEE	F	df	Sig.
1 (PSPRM, ISPRM, MSPRM, ESPRM → OP)	.935	.874	.866	.320	107.72	4, 62	< .001

Predictors: (Constant), PSPRM, ISPRM, MSPRM, ESPRM. Dependent variable: organisational performance (OP).

Table 8 presents the standardised and unstandardised regression coefficients for each PRM dimension. The fitted equation was: OP = 0.382 + 0.228(PSPRM) + 0.204(ISPRM) + 0.365(MSPRM) + 0.169(ESPRM). All four coefficients were positive, indicating that improvements in each PRM dimension are associated with higher organisational performance; however, their statistical significance and relative magnitude varied. Monitoring-stage practices recorded the largest standardised coefficient and the strongest statistical significance ($\beta = .414$, $t = 4.27$, $p < .001$), followed by planning-stage practices ($\beta = .297$, $t = 2.94$, $p = .005$) and implementation-stage practices ($\beta = .193$, $t = 2.38$, $p = .020$). Evaluation-stage practices had the smallest and only non-significant coefficient ($\beta = .120$, $t = 1.80$, $p = .077$).

Table 8. Regression coefficients

Predictor	B	SE	β	t	Sig.
(Constant)	.382	.267	—	1.434	.157
Planning-stage PRM (PSPRM)	.228	.078	.297	2.936	.005
Implementation-stage PRM (ISPRM)	.204	.086	.193	2.381	.020
Monitoring-stage PRM (MSPRM)	.365	.085	.414	4.274	< .001
Evaluation-stage PRM (ESPRM)	.169	.094	.120	1.800	.077

Dependent variable: organisational performance (OP).

4.6 Hypothesis Testing Summary

Table 9 summarises the hypothesis-testing outcomes. Hypotheses H_{01}, H_{02}, and H_{03} were rejected, providing statistical support for a significant positive effect of planning-, implementation-, and monitoring-stage PRM practices on organisational performance. H_{04} could not be rejected at the 5% significance level: although evaluation-stage practices showed a positive coefficient, the effect was not statistically significant once the other three dimensions were controlled for.

Table 9. Hypothesis testing summary

Hypothesis	Predictor	β	t	p	Decision
H_{01}	Planning (PSPRM)	.297	2.936	.005	Rejected
H_{02}	Implementation (ISPRM)	.193	2.381	.020	Rejected
H_{03}	Monitoring (MSPRM)	.414	4.274	< .001	Rejected
H_{04}	Evaluation (ESPRM)	.120	1.800	.077	Not rejected

Significance threshold: $p < .05$.

4.7 Discussion

The findings are discussed below in relation to each of the study's four objectives, followed by a synthesis of their theoretical and practical implications.

Planning-stage PRM. The first objective examined planning-stage PRM. Although planning was only moderately embedded — with risk-informed resource allocation its weakest element (Section 4.3) — it had the strongest bivariate correlation with organisational performance (r = .78) and a positive, statistically significant regression effect (β = .297, p = .005), leading to rejection of H_{01}. This is consistent with Rwandan evidence linking structured risk-planning to improved coordination and resource efficiency in development projects (Uwase & Habumuremyi, 2020) and with evidence linking risk-management practices more broadly to organisational performance in Rwanda's financial-services sector (Nkundabagenzi & Habimana, 2021). The result extends this evidence to a manufacturing and agro-processing context, suggesting that even moderately embedded planning can meaningfully support performance once identification and contingency-planning routines are in place.

Implementation-stage PRM. The second objective addressed implementation-stage PRM. The regression results confirmed a positive, statistically significant effect on organisational performance (β = .193, p = .020), leading to rejection of H_{02}, though its unique contribution was smaller than that of planning and monitoring. This aligns with Rwandan evidence that structured execution practices are positively associated with project performance in donor-funded and health-sector programmes (Niyonkuru, 2020; Munyaneza, 2018) and with construction-sector evidence from Kigali linking risk-management practices, including implementation controls, to stronger project outcomes (Kayitesi, 2019). The comparatively smaller coefficient suggests that, at SOSOMA Industries, the benefit of implementation may depend on the quality of upstream planning and downstream monitoring rather than functioning as an independent driver of performance.

Monitoring-stage PRM. The third objective examined monitoring-stage PRM, which emerged as the strongest predictor in the model (β = .414, t = 4.27, p < .001), leading to rejection of H_{03}. This is consistent with global evidence linking systematic risk-management practices, including monitoring, to stronger firm-level outcomes (Al-Nimer et al., 2021), with East African evidence that structured monitoring and evaluation improve organisational performance even in resource-constrained environments (Kiage & Namusonge, 2016), and with the broader argument that advanced project-management practice is positively associated with organisational performance (Skibniewski & Chan, 2023). Because risks identified during planning evolve during execution and new risks emerge unexpectedly, the capacity to detect deviations and respond in real time appears particularly consequential for converting risk-management effort into performance in a manufacturing setting such as SOSOMA Industries.

Evaluation-stage PRM. The fourth objective evaluated evaluation-stage PRM, which recorded a positive but statistically non-significant regression effect (β = .120, p = .077); H_{04} could not be rejected at the 5% level. This contrasts with evidence from Kenyan construction firms, where post-project risk-evaluation practices were significantly associated with firm performance (Mberia, Omare, & Ronoh, 2025), and with East African evidence linking monitoring-and-evaluation frameworks to long-term performance gains (Kiage & Namusonge, 2016). The divergence may reflect this study's operationalisation of evaluation as a discrete stage assessed jointly with three strongly correlated dimensions, which can attenuate a single predictor's unique contribution even where its bivariate association is positive and non-trivial (r = .72). It is also consistent with the view that evaluation functions mainly as a knowledge-generating mechanism whose benefits are realised indirectly, through improvements to subsequent planning, implementation, and monitoring cycles (Altugsemanur, 2023) — an interpretation that remains plausible rather than confirmed, given the cross-sectional design.

Theoretical implications. Taken together, the findings offer differentiated support for the study's integrated conceptual framework. Consistent with Systems Theory (von Bertalanffy, 1968), the very high combined explanatory power of the model (R^2 = .874) indicates that organisational performance at SOSOMA Industries is better understood as a function of an interconnected risk-governance system than of any single risk-management activity. Consistent with Contingency Theory, the uneven pattern of effects across stages — strongest for monitoring, weakest for evaluation — suggests that the performance contribution of PRM depends on which lifecycle stage is most tightly coupled to real-time operational conditions. Consistent with the RBV (Barney, 1991; Teece, 2018), the results support treating integrated PRM as a dynamic organisational capability rather than a compliance requirement, since its performance contribution manifests cumulatively across stages rather than through isolated procedural compliance. The PMBOK framework (PMI, 2000, 2017, 2021) provided a workable basis for translating these theoretical constructs into measurable, stage-specific indicators suitable for empirical testing in a manufacturing setting.

Practical and managerial implications. For SOSOMA Industries and comparable firms, continuous monitoring — risk tracking, register updates, escalation, and management review — offers the largest marginal return on risk-

management investment and should be prioritised alongside, not instead of, upfront planning. Because implementation depends on the quality of both planning and monitoring, managers should assign clear ownership, timelines, and follow-up for executing planned risk responses rather than treating implementation as self-executing. Although evaluation showed no significant direct effect, firms should still treat post-project review as an investment in the quality of future planning and monitoring cycles.

5. Conclusion and Recommendations

5.1 Conclusion

This study examined the effect of stage-based project risk management practices on the organisational performance of SOSOMA Industries, a manufacturing and agro-processing firm in Rwanda. Planning-, implementation-, and monitoring-stage PRM practices each had a positive and statistically significant effect on organisational performance, while evaluation-stage practices showed a positive but statistically non-significant direct effect once the other three dimensions were controlled for. Collectively, the four PRM dimensions explained 87.4% of the variance in organisational performance, underscoring that performance outcomes at SOSOMA Industries are substantially shaped by the systematic management of project risk across the lifecycle rather than by isolated risk-management activities. Monitoring-stage practices made the single strongest contribution, followed by planning and implementation, indicating that continuous, real-time oversight of risk is at least as important as — and in this study more influential than — upfront risk planning. The study concludes that project risk management functions most effectively as an integrated, lifecycle-based governance system, and that firms seeking performance gains from PRM investment should not treat its four stages as functionally equivalent or interchangeable.

5.2 Recommendations

For SOSOMA Industries. Management should strengthen continuous risk monitoring by maintaining updated risk registers, conducting regular risk reviews, developing early-warning indicators, and ensuring timely escalation of emerging risks to responsible personnel, given the strong and significant effect of monitoring-stage practices ($\beta = .414$, $p < .001$). The organisation should also institutionalise systematic risk identification, assessment, and contingency planning ahead of project execution, with particular attention to translating identified risks into resource-allocation decisions — the weakest-rated planning practice in this study. Accountability for executing planned risk responses should be strengthened by assigning a designated owner, defined actions, timelines, and follow-up mechanisms to each major identified risk. Post-project reviews should be reinforced by systematically documenting lessons learned and formally communicating findings to teams responsible for subsequent planning and implementation, so that planning, implementation, monitoring, and evaluation function as a connected organisational risk-learning cycle rather than as independent activities.

For industry and policy stakeholders. Industry associations and relevant government institutions should encourage manufacturing enterprises to adopt structured, lifecycle-wide project risk-management procedures, with capacity-building initiatives placing particular emphasis on risk tracking, early-warning systems, reporting, and timely corrective action, consistent with the strong performance contribution of monitoring found in this study. Sector-support programmes should promote staff training in risk assessment, response planning, monitoring techniques, and post-project learning to strengthen the practical application of risk-management systems across Rwanda's manufacturing sector.

5.3 Limitations and Future Research

This study is subject to limitations that qualify its findings and point to avenues for future research. First, the cross-sectional design captures relationships at a single point in time and cannot establish whether evaluation-stage practices contribute to performance indirectly or with a time lag; longitudinal designs are needed to examine how PRM practices, and organisational learning in particular, influence performance over time. Second, the single-firm case-study design, while enabling contextual depth, limits the generalisability of findings beyond SOSOMA Industries; future studies should examine multiple manufacturing firms across Rwanda's industrial sector to test the generalisability of the observed patterns. Third, the model did not incorporate potential moderating or mediating factors such as organisational culture, leadership style, technological capability, or firm size; incorporating these factors would help clarify the conditions under which PRM practices are more or less strongly associated with organisational performance. Finally, because the dependent and independent variables were both measured through self-reported perceptions, common-method variance cannot be fully ruled out; future studies could strengthen causal inference by triangulating perceptual data with objective performance indicators drawn from financial and operational records.

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