Modelling Antecedents Influencing Business Performance of Agro-Processing Manufacturing Firm in Zimbabwe: A Structural Modeling Approach

Miston Mapuranga
Department of Business Management and Economics iYunivesithi Walter Sisulu, South Africa
mmapuranga@wsu.ac.za

Abstract
The agro-processing manufacturing sector constitutes a critical engine of economic growth and employment generation in Zimbabwe, yet its business performance has been undermined by a confluence of structural, technological, and managerial challenges. This study investigates the antecedents influencing the business performance of agro-processing manufacturing firms in Zimbabwe, drawing on the Technology, Innovation, People and Systems (TIPS) philosophy and grounded in Resource-Based View (RBV) theory, Systems Theory, the Balanced Scorecard, and Michael Porter's Five Forces Model. Four key constructs are examined as antecedents of business performance: technological capability (TC), organisational innovation (OI), human capital (HC), and knowledge management systems (KMS). A descriptive, quantitative, cross-sectional survey design was adopted, with data collected from 220 employees of Zimbabwe's leading agro-processing manufacturer using a structured, self-administered questionnaire. Data were analysed using IBM SPSS (version 24) for descriptive statistics and SmartPLS 3.0 for Partial Least Squares Structural Equation Modelling (PLS-SEM). Nine hypotheses were tested. The results confirm that KMS positively and significantly influences OI ($\beta = 0.327$, $p < 0.05$) and HC ($\beta = 0.462$, $p < 0.001$); HC positively and significantly influences OI ($\beta = 0.471$, $p < 0.001$); OI positively and significantly influences business performance ($\beta = 0.234$, $p < 0.05$); and HC exerts the strongest significant positive effect on business performance ($\beta = 0.987$, $p < 0.001$). TC yielded positive but statistically insignificant effects on both OI and business performance. These findings confirm that OI and HC are the primary performance drivers in this agro-processing context, while providing nuanced theoretical and practical insights for manufacturing firms navigating Zimbabwe's turbulent economic environment.

Keywords: Agro-processing; business performance; human capital; knowledge management systems; organisational innovation; technological capability; Zimbabwe; PLS-SEM; TIPS philosophy.

Introduction
The manufacturing sector occupies a strategic position in Zimbabwe's economic development trajectory. The Confederation of Zimbabwe Industries (CZI, 2016) reports that the sector has experienced severe deindustrialisation over the past two decades, with capacity utilisation declining sharply from a peak of approximately 57% in 2011 to alarming lows, driven by foreign direct investment (FDI) shortfalls, liquidity crises, infrastructural deterioration, and intensified competition from imported goods (Gadzikwa, 2013). In this hostile macro-environment, understanding the internal antecedents that enable manufacturing firms to sustain competitive performance assumes both scholarly and practical urgency.

The agro-processing subsector, which transforms raw agricultural commodities into value-added food and beverage products, is particularly critical. It maintains strong backward linkages with Zimbabwe's agricultural sector (which previously supplied 63% of manufacturing inputs) and forward linkages with domestic consumption markets (CZI, 2015). Firms like National Foods Pvt Ltd, the case organisation in the present study, have demonstrated an ability to sustain operations through periods of extreme economic distress, raising important questions about the organisational capabilities, innovation practices, human capital strategies, and knowledge management systems that underpin their resilience and performance.

Despite growing scholarly interest in manufacturing performance in developing countries, the extant literature on Zimbabwean agro-processing firms remains underdeveloped, particularly with respect to the Technology, Innovation, People and Systems (TIPS) philosophy, an integrative framework that emphasises the synergistic application of technological capability, organisational innovation, human capital, and knowledge management systems for sustainable business performance (Mapuranga, 2017). As Metters and Verma (2008) posit, a study of manufacturing firms within existing global business activities could yield real-world implications for adopting efficient business practices through the use of technology, innovation, people, and knowledge management systems to sustain business performance.

This study therefore investigates the antecedents of the business performance of agro-processing manufacturing firms in Zimbabwe, using National Foods Pvt Ltd as the unit of analysis. Four antecedents are examined: technological capability (TC), organisational innovation (OI), human capital (HC), and knowledge management systems (KMS). Nine hypothesised direct relationships are tested using PLS-SEM. The study contributes to theory by extending and validating the TIPS philosophy in a resource-constrained agro-processing context, and to practice by providing evidence-based recommendations for manufacturing managers and policymakers in Zimbabwe and comparable emerging-economy settings.

2. Literature Review

2.1 Theoretical Framework

The study is anchored in four complementary theoretical frameworks. Resource-Based View (RBV) theory (Wernerfelt, 1984; Barney, 1991) provides the foundational premise that a firm's competitive advantage and superior performance derive from its possession of valuable, rare, inimitable, and non-substitutable (VRIN) internal resources, including technological capabilities, human capital, innovative capacity, and knowledge assets. As Kozlenkova, Samaha and Palmatier (2014) confirm, RBV provides an important framework for explaining and predicting the basis of a firm's performance. In the agro-processing context, TC, OI, HC, and KMS collectively constitute the strategic resources that National Foods Pvt Ltd leverages to gain a competitive advantage.

Systems Theory (Furst-Bowe, 2002) complements RBV by conceptualising the firm as an open, dynamic system in which all key processes are dynamically interrelated. This perspective is particularly germane to understanding how TC, OI, HC, and KMS interact and co-produce business performance outcomes rather than operating as independent antecedents. The Balanced Scorecard framework (Kaplan & Norton, 1996) further enriches the theoretical architecture by providing a multidimensional performance measurement lens encompassing financial, customer, internal process, and learning and growth perspectives, a framework directly applicable to the business performance construct in this study. Finally, Porter's Five Forces Model (1979) contextualises the competitive landscape in which agro-processing manufacturers must navigate, highlighting the strategic imperative to leverage internal TIPS capabilities to counter external competitive forces from rivals, substitute products, and powerful buyers and suppliers.

2.2 Empirical Literature Review

2.2.1 Technological Capability

Technological capability (TC) is defined as the set of knowledge, skills, experience, and ability to select technologies, set up, operate, assimilate, sustain, advance, and extend new values to processes and products in a dynamically changing manufacturing environment (Zahra & Nielsen, 2002). In agro-processing firms, TC encompasses the capacity to deploy and upgrade production machinery, integrate digital quality management systems, adopt food safety technologies, and continuously improve operational processes. Coombs and Bierly (2006) confirm that TC has a significant positive influence on organisational performance through its effects on operational efficiency, product quality, and market responsiveness.

Isobe, Makino and Montgomery (2008) found that technological capabilities positively and significantly influence firm performance in manufacturing contexts, particularly in terms of market share growth, cost reduction, and customer satisfaction. However, the relationship is moderated by the firm's capacity to invest in technology upgrading, a capacity severely constrained in Zimbabwe's investment-depressed manufacturing environment (CZI, 2016). Garcia-Muina and Navas-Lopez (2007) further demonstrate that TC delivers superior business results primarily when combined with organisational innovation and human capital development, reinforcing the integrative logic of the TIPS philosophy.

2.2.2 Organisational Innovation

Organisational innovation (OI) is defined as the process of introducing new or improved goods, services, or processes (Zimstats, 2015). Damanpour (1991) identifies OI as a meta-level capability that encompasses product, process, market, and administrative innovations — all of which contribute to enhanced competitiveness and superior performance. In the agro-processing context, OI manifests in new product development, process optimisation, supply chain innovation, and the introduction of digital management practices that improve operational efficiency and customer responsiveness.

García-Morales, Jiménez-Barrionuevo and Gutiérrez-Gutiérrez (2012) confirm that organisational innovation positively influences firm performance through its effects on organisational learning, knowledge creation, and adaptive capability. Gunday and Dutton (2011) similarly find that all dimensions of OI product, process, marketing, and organisational yield significant positive effects on firm performance across manufacturing sectors. For Zimbabwean agro-processing firms operating in a resource-constrained and volatile macroeconomic environment, innovation represents a particularly consequential performance lever, enabling them to derive competitive advantage from endogenous capabilities rather than imported inputs or external capital (Matekenya & Moyo, 2022).

2.2.3 Human Capital

Human capital (HC) refers to the ability, knowledge, skills, innovation, and experiences of employees and managers, as well as the firm's values, culture, and philosophy (Edvinsson & Malone, 1997). In knowledge-intensive manufacturing contexts, HC constitutes the primary driver of organisational learning, innovation capability, and operational excellence. Employees' technical competencies, leadership skills, and collective experience represent the most renewable and developable source of competitive advantage for manufacturing firms in emerging economies where access to capital and technology is constrained.

Deku (2014) established a significant positive relationship between human capital development and the performance of manufacturing firms in Ghana, demonstrating that investment in employee training, skill upgrading, and leadership development yields measurable improvements in operational efficiency, customer satisfaction, and financial performance. Oke, Walumbwa and Myers (2012) similarly confirm that human resource policies oriented towards innovation — including skills development, performance management, and knowledge sharing — generate significant positive effects on organisational performance, particularly in dynamic and uncertain environments characteristic of Zimbabwe's manufacturing sector.

2.2.4 Knowledge Management Systems

Knowledge management systems (KMS) refer to deliberate efforts to manage an organisation's workforce knowledge, achieved through the use of information and communication technology (ICT), the management of social processes, or the structuring of culture and people management practices (Hislop, 2013). In manufacturing firms, effective KMS enable the systematic capture, storage, retrieval, and application of operational knowledge, best practices, process improvements, and customer insights, all of which contribute to enhanced decision-making, innovation capacity, and business performance.

Alavi and Leidner (2001) confirm that KMS positively influence firm performance by enabling organisational members to locate, share, and apply knowledge that would otherwise be fragmented or lost. In the specific context of agro-processing manufacturers in developing economies, KMS are particularly consequential because they enable firms to retain critical operational knowledge despite high labour turnover, to systematically capture and disseminate process improvement insights, and to build organisational memory that enhances responsiveness to market and regulatory changes (Fombad, 2009).

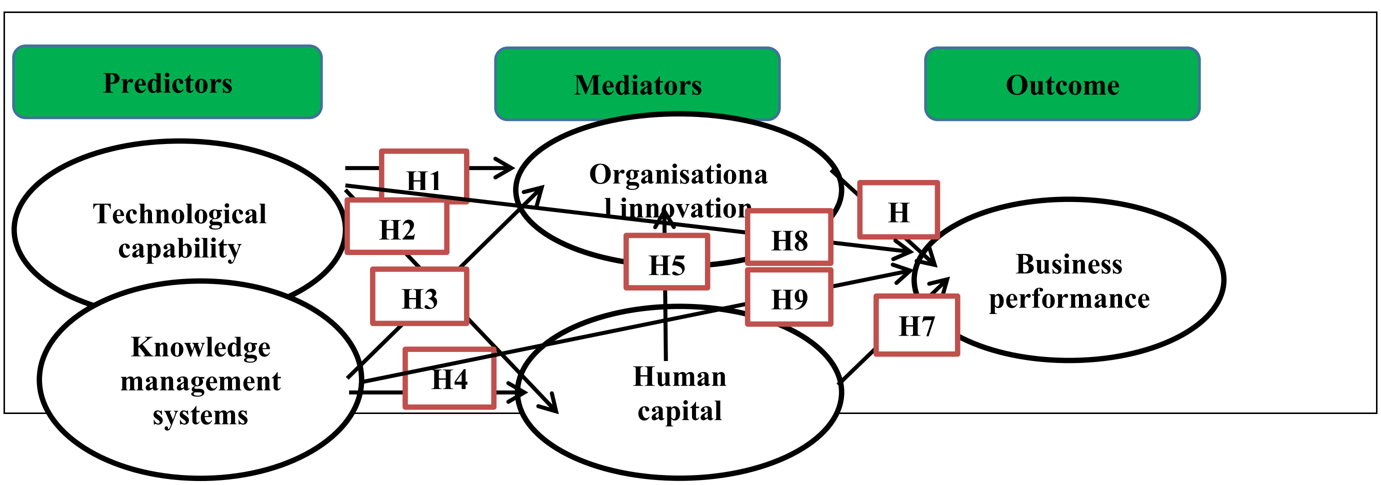
2.2.5 Business Performance

Business performance is a multidimensional construct that captures the extent to which an organisation achieves its objectives across financial and non-financial dimensions (Ion & Criveanu, 2016). In the SMME and manufacturing literature, performance has been operationalised to encompass profitability, market share growth, operational efficiency, customer satisfaction, supplier performance, and workforce competency (Mahmudova & Kovács, 2018). This study employs Zulkiffli and Perera's (2011) subjective performance measurement scale, which captures non-financial dimensions of business performance, including market share growth, sales turnover, product quality development, customer-relationship performance, and quality reputation — dimensions that are particularly relevant for agro-processing manufacturers competing on quality and reliability in Zimbabwe's constrained market.

3. Conceptual Model and Hypotheses Development

The conceptual model for this study is derived from the TIPS philosophy and the four theoretical frameworks reviewed above. As illustrated in Figure 1, TC and KMS are posited as exogenous antecedent constructs that influence OI and HC (mediating constructs), which in turn directly influence business performance (BP). TC and KMS also exert direct effects on BP. The model thus represents a complex, multi-pathway structure in which the direct effects of TC and KMS on performance are supplemented by indirect effects transmitted through OI and HC.

Figure 1: The Conceptual Model



Hypotheses development

Technological capability and organisational innovation

Organisational innovation is one of the most critical concerns for enterprises, as its role in market development and coordination is undeniable (Santos, Zawislak, Franzoni & Vieira, 2015). To drive innovation across product development, management methods, and operational practices, firms invest significantly in building technological capabilities that equip them to deploy diverse resources effectively (Zhou & Wu, 2010). Empirical evidence confirms that technological capability is a chief enabler of organisational innovation (Zehir, Acar & Tanriverdi, 2006), with IT capabilities directly influencing a firm's innovativeness (Tarafdar & Gordon, 2005), new product development (Naphat, 2008; Karsson & Ahlstrom, 1999), and innovative product launch strategies (Hsieh & Tsai, 2007). Furthermore, firms with superior technological capability consistently produce and deliver innovative products and quality services (Wang, Po Lo, Zhang & Xue, 2006), while Zhou and Wu (2010) confirm that technological capability fosters exploitation-based innovation at an accelerating rate, with strategic flexibility amplifying its explorative effects. Accordingly, H1 proposes that:

H1: *Technological capability positively influences the organisational innovation of agro-processing manufacturing firms in Zimbabwe.*

Technological capability and human capital

Technological capability plays a pivotal role in shaping human capital, as it directly influences employees' collective skills, knowledge, abilities, and competencies within an organisation (Ling & Jaw, 2006). Park (2010) highlights that human capital determines how swiftly firms assimilate advanced external knowledge and leverage learning opportunities, with larger enterprises benefiting from broader human capital pools. Empirical evidence confirms that new technology is implemented most efficiently by firms with highly educated, trained, and experienced workforces (Bartel & Lichtenberg, 1990; Siegel, Waldman & Youngdahl, 1997; Link & Siegel, 2007). Prado, Cambos and Somoza (2014) demonstrated that when technology is developed and exploited, a firm's intellectual capital is simultaneously utilised and enhanced. Basu (2014) further found a positive change in entrepreneurial skill levels following technology transfer interactions, indicating meaningful human capital development. Additionally, sectors experiencing rapid technological progress tend to employ highly educated workers who require less basic skills training (Sobankea, Adegbite, Ilori & Egbetokun, 2013). Accordingly, H2 proposes that:

H2: *Technological capability positively influences human capital/people management of agro-processing manufacturing firms in Zimbabwe.*

Knowledge management system and organisational innovation

Knowledge management has become an indispensable organisational imperative as markets grow increasingly competitive and innovation rates rise phenomenally, with firms now competing fundamentally on the basis of knowledge (Evans, 2003). Empirical evidence consistently confirms that knowledge management systems (KMS) positively relate to organisational innovativeness, with Kor and Maden (2013) demonstrating that knowledge management processes improve innovation in firms, and Buheji, Al-Hasan, Thomas and Melle (2015) establishing a strong and significant correlation between organisational development practices and knowledge management in driving innovation. Chaston (2012) further confirms that KMS enhances innovation by transforming how organisations manage stakeholders and conduct work. Hua, Horng and Sun (2009) found a strong association between knowledge sharing, team culture, and service innovation performance, while Abdi and Senin (2015) confirmed that knowledge management directly influences organisational innovation in automotive manufacturing. Yang (2006) and Brockman and Morgan (2003) similarly demonstrate that knowledge integration, innovative information use, and shared interpretation improve new product performance and innovativeness. Accordingly, H3 proposes that:

H3: *Knowledge management systems positively influence the organisational innovation of agro-processing manufacturing firms in Zimbabwe.*

Knowledge management systems and human capital/people management

Knowledge management systems (KMS) play a pivotal role in developing and improving human capital, as organisations continuously strive to enhance workforce knowledge through organisational knowledge creation to gain a competitive advantage (Sohrabi, Tabatabaei, Hajifarajzadeh & Aqdam, 2015). Leibowitz and Hopkins (2004) confirm that KMS is closely associated with human capital strategy for achieving organisational success, while Sanaad (2016) establishes that human capital is a key factor influencing the execution of knowledge management. Empirical evidence demonstrates that knowledge management develops personnel, grows sales, satisfies clients, and accomplishes firm success (Edvardsson & Durst, 2013; López-Nicolás & Meroño-Cerdán, 2011). Zaman, Mahtab, and Rizvi (2014) further confirmed that knowledge management is a key component of human resource management, while Sohrabi et al. (2015) found a positive relationship between KMS and human capital, indicating that implementing effective knowledge management processes contributes meaningfully to human capital development. Omotayo (2015) reinforces that knowledge residing in people is an integral pivot of organisational success. Accordingly, H4 proposes that:

H4: *Knowledge management systems positively influence human capital/people management of agro-processing manufacturing firms in Zimbabwe.*

Human capital/ people management and organisational innovation

Human capital is widely recognised as a primary driver of organisational innovation, as firms that invest in attracting, retaining, and developing exceptional employees build competitive advantages that are difficult for rivals to replicate (Boxall & Macky, 2009). Organisational innovation plays an immense role in structural capital and maintains a superior association with human capital (Bontis, 1999), while innovation itself is critical across diverse industries competing in dynamic environments (Al-Halak, Al-Karaghouli, Ghoneim & Koufopoulos, 2010). Souleh (2014) established that human capital management, through competency and knowledge management, significantly influences organisational innovativeness, while Jegede, Ilori, Olorunfemi and Oluwale (2016) confirmed a positive association between human capital and organisational innovation in the Nigerian mining industry. Santos-Rodrigues, Faria, Cranfield and Morais (2013) further demonstrated that human capital positively relates to organisational innovation in Portuguese SMEs, with employee commitment to the innovation process emerging as the most consequential human capital factor. Accordingly, H5 proposes that:

H5: *Human capital management positively influences organisational innovation of agro-processing manufacturing firms in Zimbabwe.*

Organisational innovation and Business performance

Organisational innovation is universally recognised as a key component of firm survival, success, and sustainable competitive advantage, ultimately driving superior business performance (Cho & Pucik, 2005; Jimenez & Sanz-Valle, 2011; Johannessen, 2008). Tajuddin, Ibrahim and Ismail (2015) confirmed that innovation is significantly and positively related to organisational performance in the Malaysian construction industry, while Kemp, Folkeringa, De Jong and Wubben (2003) established that innovation policy positively influences the innovative input of small firms. Abdi and Ali (2013) further demonstrated that both administrative and technical innovation are positively related to business performance in the telecommunications industry. Gunday, Ulusoy, Kilic and Alpkan (2011) similarly found positive innovation effects on firm performance across manufacturing industries, and Salim and Sulaiman (2011) confirmed that innovation positively relates to firm performance among Malaysian SMEs. Hassan, Shaukat, Nawaz and Naz (2013) additionally established a positive effect of innovation types on organisational performance. Accordingly, H6 proposes that:

H6: *Organisational innovation positively influences the business performance of agro-processing manufacturing firms in Zimbabwe.*

Human capital and business performance

Human capital is a vital invisible asset that drives economic growth and business performance in an increasingly competitive global environment (Itami, 1987; Huang & Liu, 2005). Substantial empirical evidence confirms a consistent positive association between human capital and business performance across industries and contexts. Agarwala (2003) establishes that human capital directly influences organisational competitiveness, while Bontis and Fitzenz (2008) demonstrate that high-quality employees drive productivity, longevity, and economic growth. Thai et al. (2011) confirmed a significant relationship between people management and business performance in IT firms, and Tvornik and McGiven (1997) established that skill development, training, creativity, and employee competence improve firm performance. Samad (2013) further identified employee competency and creativity as the primary human capital factors influencing business performance, while Awan and Sarfraz (2013) confirmed that human capital investments strongly relate to firm performance, with employee satisfaction mediating this relationship. Marimuthu, Arokiasamy, and Ismail (2009) similarly found that financial performance is positively affected by human capital considerations. Accordingly, H7 proposes that:

H7: *Human capital positively influences the business performance of agro-processing manufacturing firms in Zimbabwe.*

Technological capability and business performance

Technological capability (TC) constitutes a strategic resource that enables organisations to gain a competitive advantage and accomplish higher levels of business performance in today's increasingly competitive environment (de Almeida Guerra & Camargo, 2016; Radzi, Shamsuddin & Nahab, 2017). Ortega (2009) confirms that TC facilitates organisational innovation and raises firm productivity, while Latip, Salleh, Habidin and Sapengin (2014) demonstrate that TC creates competitive advantage across supply chains, ultimately improving organisational performance. Tsai (2004) established a strong positive relationship between TC and business performance, a finding corroborated by Wang, Lo, Zhang, and Xue (2006), who found that firms with greater refinement capability possess superior reconfiguration capability. Kylaheiko, Jantunen, Puumalainen, Saarenketo and Tuppura (2011) further confirmed positive associations between TC and innovation-based growth and internationalisation performance, while Khan and Haleem (2008) demonstrated that TC significantly reduces production costs and improves product quality. Ahmad, Othman and Lazim (2015) similarly highlight TC's critical role in industrial development and performance enhancement. Accordingly, H8 proposes that:

H8: *Technological capability positively influences the business performance of agro-processing manufacturing firms in Zimbabwe.*

Knowledge Management Systems and Business Performance

Knowledge management (KM) is widely recognised as a critical driver of organisational performance and one of the most important resources for organisational survival and prosperity (Bousa & Venkitachalam, 2013; Teece, Pisano & Shuen, 1997). Effectively managing and utilising knowledge enables organisations to derive full strategic value from their knowledge assets, ultimately improving business performance. Treacy and Wiersema (1995) found that knowledge management practices are positively related to firm performance, while Wang, Hult, Ketchen, and Ahmed (2009) confirmed that a knowledge management orientation improves business performance. Darroch (2015) further demonstrated that knowledge management capability enables organisations to use resources more efficiently, innovate, and perform better. Wang and Huynh (2014) established that quality management systems moderate the relationship between knowledge management implementation and organisational performance, while Lee and Choi (2003) confirmed that knowledge management processes are chief determinants of organisational creativity. Quink (2008) additionally found a positive relationship between knowledge management infrastructure, processes, and organisational performance. Accordingly, H9 proposes that:

H9: *Knowledge management systems positively influence the business performance of agro-processing manufacturing firms in Zimbabwe.*

4. Research Methodology

4.1 Research Philosophy and Design

This study is situated within the positivist research paradigm, which holds that social reality exists independently of the researcher and can be investigated through systematic empirical observation and measurement (Creswell & Creswell, 2018).

A descriptive quantitative cross-sectional survey design was adopted to examine the hypothesised relationships among the five research constructs. This design is appropriate for characterising the distribution and co-variation of the study variables across a representative sample of manufacturing employees, for testing directional hypotheses, and for producing findings that contribute to the generalisable theoretical understanding of agro-processing performance antecedents (Leavy, 2023).

PLS-SEM, implemented through SmartPLS 3.0 (Ringle, Wende & Becker, 2015), was selected as the primary analytical technique. PLS-SEM is particularly appropriate for this study because it can accommodate the complex, multi-path structural model, does not require multivariate normality of the data, and is well-suited to predictive research objectives (Hair, Risher, Sarstedt & Ringle, 2019). Regression analysis using IBM SPSS (version 24) was conducted as a supplementary analytical method to validate and triangulate the PLS-SEM findings.

4.2 Population, Sampling, and Data Collection

The target population comprised management staff and employees of National Foods Pvt Ltd, Zimbabwe's leading agro-processing manufacturer, which has operated continuously through more than two decades of economic turbulence, making it a particularly instructive case for investigating performance antecedents. Purposive and convenience sampling were employed, reflecting the restricted access conditions characteristic of manufacturing research in developing countries (Sekaran & Bougie, 2010). A total of 250 questionnaires were distributed, of which 220 were returned and valid for analysis, yielding a response rate of 88%.

The structured self-administered questionnaire comprised six sections. Section A captured demographic information. Section B measured TC (7 items adapted from Zahra & Nielsen, 2002). Section C measured OI (9 items adapted from Damanpour, 1991 and Zimstats, 2015). Section D measured HC (8 items adapted from Vidotto, Ferenhof, Selig & Bastos, 2017). Section E measured KMS (4 items adapted from Vidotto et al., 2017). Section F measured business performance (12 items adapted from Zulkiffli & Perera, 2011). All substantive items employed a five-point Likert scale. A pilot study of 30 respondents validated instrument reliability prior to full deployment.

4.3 Measurement Instrument

A pilot test of 30 respondents validated the questionnaire using Cronbach's alpha and item-to-total correlation analyses. Items with outer loadings below 0.50 were refined or removed. Ethical clearance was obtained from The Da Vinci Institute, with voluntary participation, informed consent, confidentiality, and respondent anonymity maintained throughout the study. Participants were assured of full confidentiality, and no unauthorised individual had access to the data.

5. Results

5.1 Sample Demographics

Of the 220 valid respondents, the sample was predominantly male (64%), consistent with the gender profile of Zimbabwe's manufacturing sector. The dominant age cohort was 41–50 years (65%), followed by 51–60 years (9%), reflecting the experienced and tenured nature of the workforce. In terms of educational attainment, 53% of respondents held diplomas, followed by postgraduate qualifications (16%), national certificates (13%), and other qualifications (18%). In terms of tenure, 43% had worked with the organisation for 11–15 years, and 37% for 6–10 years, reflecting a highly experienced, organisationally embedded workforce. The majority of respondents (69%) occupied core business (production) positions, followed by supervisors (16%), artisans (12%), middle managers (2%), and senior managers (1%). These demographics are summarised in Table 1 below.

Table 1: Sample Demographics (N = 220)

Demographic Variable	Category	Frequency (%)	n
1. Gender			
Gender	Male	64.00%	141
	Female	36.00%	79
2. Age Group			
Age Group	18–30 years	12.00%	26
	31–40 years	13.00%	29
	41–50 years	65.00%	143
	51–60 years	9.00%	20
	Above 60 years	1.00%	2
3. Education Level			
Education	National Certificate	13.00%	29
	Diploma	18.00%	40
	Diploma (other)	53.00%	117
	Postgraduate	16.00%	35
4. Tenure			
Tenure	0–5 years	9.00%	20
	6–10 years	37.00%	81
	11–15 years	43.00%	95

	Over 15 years	11.00%	24
5. Position			
Position	Senior Manager	1.00%	2
	Middle Manager	2.00%	4
	Supervisor	16.00%	35
	Artisan	12.00%	24
	Core Business	69.00%	152

Note: N = 220 respondents from National Foods Pvt Ltd, Zimbabwe. Source: Researcher's own (2017).

5.2 Descriptive Statistics

Descriptive analysis revealed generally positive orientations across all five constructs. Regarding technological capability, the highest mean was 4.39 (Item TC5) and the lowest was 4.20 (Item TC6), with standard deviations ranging from 0.542 to 0.661, indicating reasonable agreement among respondents. For organisational innovation, the highest mean was 4.47 (Item OI5) and the lowest was 3.98 (Item OI9), with standard deviations ranging from 0.491 to 0.681. Human capital recorded means ranged from 3.93 (Item HC8) to 4.54 (Item HC1), reflecting strongly positive perceptions of employee competency and organisational development. Knowledge management systems ranged from 3.39 (Item KMS1) to 4.30 (Item KMS2), with the lower KMS1 score (Mean = 3.39, SD = 1.064) suggesting greater variability in respondents' ease of using the knowledge management system's content creation functions. Business performance ranged from 3.84 (Item BP7) to 4.33 (Item BP11), confirming that the organisation is generally performing well across market, operational, and customer relationship dimensions.

5.3 Measurement Model Assessment

5.3.1 Reliability Assessment

The measurement model demonstrated satisfactory psychometric properties across all five constructs. As shown in Table 2, Cronbach's alpha values ranged from 0.783 (HC) to 0.934 (BP), all exceeding the 0.70 threshold recommended by Hair et al. (2019). Composite reliability (CR) values ranged from 0.787 (HC) to 0.944 (BP), all exceeding the 0.70 criterion. TC achieved the highest CR of 0.932, reflecting excellent internal consistency across its six retained measurement items. These results confirm that all constructs are measured with acceptable to excellent reliability.

Table 2: Reliability Assessment of Study Constructs (N = 220)

Code	Construct	Items	Cronbach's α	CR
TC	Technological Capability	6	0.912	0.932
OI	Organisational Innovation	7	0.856	0.891
HC	Human Capital	4	0.783	0.787
KMS	Knowledge Management Systems	4	0.782	0.816
BP	Business Performance	12	0.934	0.944

Note: α = Cronbach's alpha; CR = Composite Reliability. Values ≥ 0.70 indicate acceptable reliability (Hair et al., 2019). TC = Technological Capability; OI = Organisational Innovation; HC = Human Capital; KMS = Knowledge Management Systems; BP = Business Performance.

5.3.2 Convergent Validity Assessment

Convergent validity was assessed through Average Variance Extracted (AVE) values, outer loadings, and item-to-total correlations. As shown in Table 3, all constructs achieved AVEs at or above the 0.45 threshold used in this study (Fraering & Minor, 2006), with TC achieving an AVE of 0.968, indicating excellent convergent validity. OI (AVE = 0.544), KMS (AVE = 0.527), and BP (AVE = 0.562) all confirmed adequate convergent validity. HC recorded a borderline AVE of 0.451, which is acknowledged as a measurement limitation reflecting the multidimensional nature of human capital perceptions in resource-constrained manufacturing settings.

Table 3: Convergent Validity — Outer Loading Ranges and AVE (N = 220)

Code	Construct	Item Range	Outer Loading Range	AVE	Assessment
TC	Technological Capability	TC1–TC6	0.519–0.848	0.968	Excellent
OI	Organisational Innovation	OI1–OI9	0.548–0.698	0.544	Adequate
HC	Human Capital	HC4–HC7	0.504–0.692	0.451	Adequate
KMS	Knowledge Management Systems	KMS1–KMS4	0.519–0.822	0.527	Adequate
BP	Business Performance	BP1–BP12	0.540–0.870	0.562	Adequate

Note: AVE values ≥ 0.50 confirm convergent validity (Fornell & Larcker, 1981). Constructs with AVE ≥ 0.70 are classified as Excellent; AVE between 0.45–0.70 as Adequate. TC = Technological Capability; OI = Organisational Innovation; HC = Human Capital; KMS = Knowledge Management Systems; BP = Business Performance.

5.3.3 Discriminant Validity Assessment

Discriminant validity was assessed using the Fornell–Larcker criterion (Table 4). All construct square roots of AVE (diagonal values) exceeded their highest inter-construct correlations, confirming adequate construct distinctiveness. The highest off-diagonal correlation was observed between KMS and OI (r = 0.673), which remained below KMS's √AVE of 0.726, confirming discriminant validity. These findings are consistent with the theoretical expectation that TC, OI, HC, KMS, and BP are conceptually and empirically distinct constructs.

Table 4: Fornell–Larcker Criterion for Discriminant Validity (N = 220)

	TC	**OI**	**HC**	**KMS**	**BP**
TC	***0.984***				
OI	0.597	***0.738***			
HC	0.517	0.510	***0.671***		
KMS	0.684	0.673	0.600	***0.726***	
BP	0.346	0.398	0.338	0.367	***0.750***

Note: Bold italic diagonal values represent the square root of AVE (√AVE). Off-diagonal values are inter-construct correlations. Discriminant validity is supported when √AVE exceeds all inter-construct correlations in the same row and column (Fornell & Larcker, 1981). TC = Technological Capability; OI = Organisational Innovation; HC = Human Capital; KMS = Knowledge Management Systems; BP = Business Performance.

HTMT ratios were additionally computed to corroborate discriminant validity findings (Table 5). All HTMT values were below the conservative 0.90 threshold (Henseler, Ringle & Sarstedt, 2015), with the highest ratio recorded between KMS and HC (0.723). These results collectively confirm that all five constructs demonstrate satisfactory discriminant validity.

Table 5: Heterotrait–Monotrait (HTMT) Ratio for Discriminant Validity (N = 220)

	TC	**OI**	**HC**	**KMS**	**BP**
TC	1.000				
OI	0.631	1.000			
HC	0.581	0.548	1.000		
KMS	0.723	0.718	0.650	1.000	
BP	0.381	0.432	0.381	0.405	1.000

Note: HTMT values < 0.90 indicate satisfactory discriminant validity (Henseler, Ringle & Sarstedt, 2015). TC = Technological Capability; OI = Organisational Innovation; HC = Human Capital; KMS = Knowledge Management Systems; BP = Business Performance.

5.4 Structural Model Assessment and Hypothesis Testing

5.4.1 Model Fit

The structural model's overall explanatory power was assessed through R^2 values. The model explained 69% of the variance in business performance ($R^2 = 0.69$, Adjusted $R^2 = 0.51$), confirming substantial predictive relevance (Hair et al., 2019). The global goodness-of-fit (GoF) statistic, calculated using the Tenenhaus, Vinzi, Chatelin and Lauro (2005) formula, was 0.434, exceeding the 0.36 threshold proposed by Khojasteh and Lo (2015), indicating a strong overall model fit.

5.4.2 Path Modelling Results

Table 6 presents the structural model results for all nine hypothesised relationships. Five of the nine hypotheses were positive and significant, confirming the majority of the conceptualised pathways.

Table 6: Structural Model Results — Hypothesis Testing (N = 220)

TC → OI	**H1**	0.117	1.449	0.147	**Positive but insignificant**
TC → HC	**H2**	0.142	1.188	0.235	**Positive but insignificant**
KMS → OI	**H3**	0.327	3.440	0.001	**Positive and Significant**
KMS → HC	**H4**	0.462	4.844	0.000	**Positive and Significant**
HC → OI	**H5**	0.471	5.727	0.000	**Positive and Significant**
OI → BP	**H6**	0.234	2.053	0.040	**Positive and Significant**
HC → BP	**H7**	0.987	5.435	0.000	**Positive and Significant**
TC → BP	**H8**	0.069	1.987	0.324	**Positive but insignificant**
KMS → BP	**H9**	0.055	0.600	0.548	**Positive but insignificant**

Note: Path coefficients (β) represent standardised estimates from PLS-SEM. T-statistics > 1.96 indicate significance at the 5% level. Significance is assessed using bias-corrected bootstrapping (5,000 subsamples). TC = Technological Capability; OI = Organisational Innovation; HC = Human Capital; KMS = Knowledge Management Systems; BP = Business Performance.

6. Discussion of Findings

The structural model results produce a theoretically instructive picture of how the TIPS philosophy's four antecedent constructs jointly shape business performance in Zimbabwe's agro-processing manufacturing sector.

The non-significant relationships of TC on both OI (H1: $\beta = 0.117$, $p = 0.147$) and business performance (H8: $\beta = 0.069$, $p = 0.324$) are the most theoretically consequential findings. These results challenge the assumption that technological capability automatically generates either innovation or performance gains in resource-constrained manufacturing contexts. In Zimbabwe's prevailing macroeconomic environment — characterised by liquidity constraints, unreliable electricity, and limited FDI — the transformative power of technology appears to be attenuated by structural barriers that prevent firms from fully operationalising their technological assets. This finding is consistent with Mustafa and Yaakub's (2018) argument that technology adoption in SMEs and manufacturing firms in developing economies is frequently undermined by inadequate finance, infrastructure, and digital skills.

The significant positive effect of KMS on OI (H3: $\beta = 0.327$, $p = 0.001$) and HC (H4: $\beta = 0.462$, $p < 0.001$) establishes KMS as a critical enabler of both organisational innovation and human capital development in the agro-processing context. When employees have effective access to organisational knowledge — including process documentation, best practices, and customer insights — they are better positioned to generate innovative ideas, improve operational processes, and enhance their own competencies. Alavi and Leidner (2001) and Ooi (2015) both confirm that KMS positively influence firm performance by enabling effective knowledge sharing and organisational learning, supporting these findings.

The strongest antecedent-mediator relationship in the model is between HC and OI (H5: $\beta = 0.471$, $p < 0.001$), confirming that human capital is the primary driver of organisational innovation in this context. Employees who are competent, well-trained, and experienced are more likely to generate process improvements, develop new product variants, and identify operational efficiencies. This finding resonates with García-Morales et al.'s (2012) evidence that organisational learning and human capital development are the most consequential drivers of innovation performance, and with Oke et al.'s (2012) demonstration that human resource policies oriented towards skills development yield significant dividends in innovation and performance.

OI's significant positive effect on business performance (H6: $\beta = 0.234$, $p = 0.040$) confirms that agro-processing firms which successfully innovate in products, processes, and management practices achieve measurably superior performance outcomes. This is consistent with Damanpour's (1991) meta-analytic findings and with Gunday and Dutton's (2011) evidence across manufacturing sectors. The finding that HC exerts by far the strongest direct effect on business performance (H7: $\beta = 0.987$, $p < 0.001$) reinforces the theoretical centrality of human capital as a performance driver in contexts where technological and financial resources are constrained. When employees are skilled, motivated, and organisationally committed, business performance improves through enhanced productivity, quality, and customer responsiveness — capabilities derived from people rather than technology.

The non-significant effects of KMS on business performance (H9: $\beta = 0.055$, $p = 0.548$) suggest that KMS generates its primary performance benefits indirectly — through its effects on OI and HC — rather than through a direct pathway to business performance. This indirect logic is theoretically coherent and suggests that investment in KMS should be evaluated not through direct performance metrics but through its enabling effects on innovation and human capital development.

The regression analysis corroborates these findings, with TC ($\beta = 0.180$, $p = 0.018$) and OI ($\beta = 0.165$, $p = 0.025$) emerging as significant predictors, KMS recording a negative regression coefficient ($\beta = -0.300$, $p = 0.004$), and HC remaining insignificant in the regression model — a divergence from the PLS-SEM results attributable to multicollinearity between HC and KMS (VIF = 2.355 and 2.405 respectively). The overall model R^2 of 0.69 confirms that the four antecedents collectively account for approximately 70% of the variance in business performance.

7. Managerial Implications

The validated structural model provides agro-processing manufacturing managers and policymakers with evidence-based guidance for performance enhancement under resource-constrained conditions.

First and most consequentially, human capital investment is the highest-priority performance lever for agro-processing manufacturing firms in Zimbabwe. The dominant HC–BP effect ($\beta = 0.987$) establishes that investment in employee competency development, leadership training, and team-based knowledge sharing delivers the most direct and reliable performance improvements. Management should prioritise structured skills development programmes, performance management systems that reward knowledge sharing and innovation, and succession planning that preserves critical operational knowledge across employee tenure cycles.

Second, KMS investment should be evaluated primarily through its enabling effects on innovation and human capital development. The evidence that KMS positively and significantly influences both OI (H3) and HC (H4) demonstrates that well-designed knowledge management systems — including operational knowledge repositories, best-practice documentation systems, and structured knowledge transfer processes — provide measurable indirect performance benefits by empowering employees and facilitating innovation.

Third, the non-significant effect of TC on business performance in this context carries a strategic advisory implication: agro-processing managers should ensure that technology investments are accompanied by robust training, knowledge management, and innovation support systems that enable employees to fully exploit the value of new technologies. Technology deployment without commensurate investment in human capital and KMS may generate limited performance returns, as the present findings confirm.

Fourth, policymakers and industry associations should prioritise initiatives that alleviate the structural barriers constraining TC effectiveness, including reliable power supply, affordable digital infrastructure, FDI facilitation, and access to technology financing, to create conditions in which technological capability can translate more effectively into innovation and performance outcomes for Zimbabwe's agro-processing sector.

8. Conclusion

This study investigated the antecedents influencing the business performance of agro-processing manufacturing firms in Zimbabwe, using National Foods Pvt Ltd as the case organisation and PLS-SEM as the primary analytical method. Of the nine hypothesised relationships, five were positive and significant. Human capital emerged as the most powerful direct performance driver (H7: $\beta = 0.987$, $p < 0.001$), while organisational innovation also exerted a significant positive effect on performance (H6: $\beta = 0.234$, $p = 0.040$). Knowledge management systems positively and significantly influenced both organisational innovation (H3) and human capital (H4), establishing KMS as a critical enabler that operates through indirect pathways to performance. Technological capability's effects were positive but statistically insignificant, reflecting the constraining influence of Zimbabwe's macroeconomic environment on TC's transformative potential.

The study advances the scholarly literature by providing the first quantitatively validated evidence on the TIPS philosophy's antecedent relationships in a Zimbabwean agro-processing manufacturing context, by confirming the centrality of human capital and organisational innovation as primary performance drivers in resource-constrained settings, and by demonstrating that KMS generates performance benefits primarily through its enabling effects on OI and HC. Methodologically, the study demonstrates the value of PLS-SEM for testing complex multi-path models in manufacturing research under conditions of non-normal data distribution and moderate sample sizes.

For practitioners, the study provides a validated performance blueprint: invest in human capital as the primary performance lever; deploy KMS to amplify innovation and competency development; and ensure that technology investments are embedded in human capital and knowledge management support systems that enable their value to be fully realised.

9. Limitations and Future Research

This study carries several limitations that define a productive agenda for future research. The cross-sectional design precludes causal inference and cannot track the evolution of TIPS antecedents and performance over time. Longitudinal panel studies across multiple agro-processing firms would enable stronger causal claims and capture the dynamic interplay between capability development and performance.

The restriction of the sample to a single firm (National Foods Pvt Ltd) limits the generalisability of the findings to other agro-processing manufacturers and to other manufacturing subsectors in Zimbabwe. Comparative multi-firm studies spanning multiple subsectors and organisational sizes would test the model's boundary conditions. The borderline AVE of the HC construct (0.451) represents a measurement limitation that future studies should address through scale refinement and contextualisation for the Zimbabwean manufacturing environment. Finally, the model does not account for potentially important moderating variables — including macroeconomic instability, electricity supply reliability, competitive intensity, and firm size — that may condition the strength of the TIPS antecedent–performance relationships.

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