

Transformation of Noodle Processing Business Productivity through the Role of Business Managers and Innovation in Bondowoso Regency

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Abstract

Indonesia's MSME sector faces growing competition and changing consumer demands. Traditional food processors must improve operational efficiency to stay competitive. However, many still rely on conventional management methods that may not meet today's market challenges. This study examines the interrelationships between management practices, innovation adoption, and operational performance within food processing MSMEs in East Java. Using Structural Equation Modeling-Partial Least Squares (SEM-PLS), the research analyzed census data from 70 registered enterprises. Primary data were collected through validated questionnaires measuring management capabilities, innovation implementation, and performance outcomes across operational dimensions. The findings reveal significant positive relationships among all variables. Management practices demonstrate substantial direct influence on operational performance (path coefficient = 0.798, $p < 0.001$) while fostering innovation adoption (path coefficient = 0.504, $p < 0.001$). Innovation significantly enhances performance outcomes (path coefficient = 0.633, $p < 0.001$). Crucially, mediation analysis confirms innovation as a significant mediator in the management-performance relationship, explaining how managerial effectiveness translates into operational improvements. The model explains 63.6% of performance variance, with effect size analysis confirming large management effects on performance ($f^2 = 1.372$) and moderate effects on innovation ($f^2 = 0.340$). Results indicate that effective management creates environments conducive to innovation adoption, subsequently driving operational efficiency. The research establishes innovation as a critical mediating mechanism, suggesting enterprise development programs should integrate management capacity building with innovation facilitation to maximize outcomes.

Keywords: Food Processing Industry, Mediation Analysis, MSME Development, Operational Performance, Structural Equation Modeling

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1. Introduction

The contemporary business landscape in Indonesia has undergone rapid transformation. This shift is marked by strong economic growth and changing consumer demands. These factors have created many opportunities for entrepreneurs in various sectors (Bank Indonesia, 2023). At the same time, competition has become more intense, especially in the small and medium enterprise (SME) sector. Businesses must constantly adapt to survive in a saturated market (Keelson et al., 2024). Within this context, micro, small, and medium enterprises (MSMEs) have emerged as key drivers of economic development. They contribute significantly to employment, poverty reduction, and economic resilience (Wahyudi et al., 2024).

Among MSMEs, the food processing industry—particularly noodle manufacturing—shows strong potential. This sector benefits from several factors. Noodles are a culturally significant staple food, serving as an alternative to rice. Entry barriers are relatively low. Production can be scaled up, and the consumer base is expanding due to urbanization and shifting dietary habits (Ministry of Cooperatives and SMEs, 2023). The noodle market in Indonesia has grown rapidly. Per capita consumption has risen by about 15% annually. This indicates a promising market for small-scale producers (Kingwell et al., 2019).

Bondowoso Regency illustrates the broader success of Indonesian MSMEs. The region has made significant strides in encouraging entrepreneurship and supporting local economic development. Recent data show a 23% increase in

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registered micro-enterprises over the past three years. MSMEs in Bondowoso contribute around 65% to the region's gross regional domestic product (Statistics Indonesia, 2023). These developments position Bondowoso as a model for rural entrepreneurship, especially in traditional food sectors that combine local knowledge with modern business practices.

Despite these positive trends, MSMEs in the region face serious challenges. Growing competition—from both long-established firms and new entrants—puts pressure on traditional business models. Many noodle producers still use outdated management methods. They lack technological integration and rely on conventional marketing. These practices may not be enough to stay competitive (Malihah et al, 2023).

Management capabilities play a crucial role in business productivity. Many studies confirm that good management leads to better business outcomes (Bloom & Van Reenen, 2022). However, the specific ways that management affects productivity in MSMEs—especially in traditional food processing—are not well understood. This gap is especially relevant in developing countries, where MSMEs face unique challenges and opportunities.

Human resource management is a key part of business success. Research shows that strategic HR practices have a strong impact on performance across industries (Delery & Roumpi, 2021). Small businesses, which depend heavily on human capital, benefit from training and skill development programs. In food processing MSMEs, HR management is particularly important. These operations are labor-intensive, and consistent product quality is vital.

Modern business theory also emphasizes the role of innovation. For small businesses, innovation is essential to stay competitive and achieve long-term growth (Schumpeter, 2020). Innovation goes beyond technology. It includes improving processes, adapting business models, forming strategic partnerships, and using digital tools. Innovation may act as a bridge between management practices and productivity, helping small firms get better results from limited resources (Mutambik, 2024).

To succeed, MSMEs need to adopt digital tools and modern management methods. They must also develop new products and services. In food processing, innovation can improve production, quality control, packaging, distribution, and customer engagement.

This study addresses several gaps in the literature. It explores how management practices, innovation, and productivity are connected in MSMEs. Innovation is introduced as a mediating variable in the management-productivity relationship. This provides insight into how good management leads to better business performance. The study focuses on noodle processing businesses in Bondowoso. This offers valuable data from a setting that has been largely overlooked.

The theoretical contribution of this research lies in its combination of management theory, innovation studies, and MSME development. The study proposes a framework for improving productivity in small businesses. Its practical contribution includes actionable recommendations for business owners, policymakers, and support institutions.

Given the research gaps and the importance of this topic, the study investigates: “The Role of Business Management in Enhancing Productivity of Noodle Processing MSMEs in Bondowoso Regency: Innovation as a Mediating Variable.” The study aims to provide data on how management directly and indirectly affects productivity. It also explores how innovation mediates this effect in traditional food enterprises. The findings will inform both academic understanding and real-world efforts to strengthen MSMEs in Indonesia and other developing countries.

2. Literature Review

2.1. Business Management

Business management represents a comprehensive discipline encompassing the systematic coordination of planning, organizing, directing, and controlling organizational activities to achieve predetermined objectives (Truong & Nguyen, 2024). This approach involves strategic integration of various business functions to ensure optimal performance and sustainable competitive advantage. The fundamental essence lies in harmonizing diverse organizational elements into a cohesive system that delivers stakeholder value while maintaining efficiency and effectiveness.

The theoretical foundation rests upon four interconnected functional areas (Freeman & McVea, 2001). Planning establishes organizational objectives and develops strategic frameworks through extensive analysis of internal capabilities and external market conditions. Organizing arranges resources, delegates responsibilities, and creates frameworks that facilitate efficient task execution. Directing encompasses leadership aspects involving motivation, communication, and guidance to ensure alignment between individual efforts and organizational objectives. Controlling

represents monitoring and evaluation where managers assess performance, identify deviations, and implement corrective measures.

Contemporary business management emphasizes adaptive leadership and strategic flexibility in navigating complex market environments. Modern managers must possess sophisticated analytical capabilities to interpret market signals and technological trends while maintaining operational excellence. Management effectiveness can be evaluated through financial metrics, operational indicators, strategic measures, and stakeholder satisfaction metrics (Rodríguez-Espíndola et al., 2022).

The evolution of management practices has been influenced by technological advancement, globalization pressures, and changing consumer expectations (Verhoef et al., 2021). Contemporary managers must integrate digital technologies into traditional practices while maintaining human-centered leadership approaches. The increasing emphasis on sustainability has expanded management scope to include environmental stewardship and community engagement as core responsibilities.

2.2. Innovation

Innovation emerges from the Latin term "innovatus," signifying renewal and transformation, and represents the systematic process of introducing novel ideas, methodologies, products, or strategic approaches that create distinctive value propositions and sustainable competitive advantages (Santarsiero et al., 2024). In contemporary business contexts, innovation transcends mere technological advancement to encompass comprehensive organizational transformation that enables enterprises to adapt to changing market conditions, anticipate customer needs, and differentiate themselves from competitors. The strategic importance of innovation lies in its capacity to generate new revenue streams, improve operational efficiency, enhance customer satisfaction, and establish barriers to competitive entry.

The multidimensional nature of innovation requires comprehensive understanding of various innovation typologies and their strategic implications for organizational performance. Process innovation focuses on enhancing operational efficiency and quality through the development of improved production methods, workflow optimization, and system integration approaches that reduce costs while maintaining or improving output quality. This form of innovation often involves the adoption of advanced technologies, restructuring of organizational processes, and implementation of quality management systems that streamline operations and eliminate inefficiencies. Product innovation, conversely, emphasizes the creation and enhancement of goods or services to better meet customer requirements and preferences through improved functionality, design, quality, or performance characteristics (Alsaadi et al., 2025).

Beyond these fundamental categories, innovation manifests in several additional forms that collectively contribute to organizational competitiveness and sustainability. Business model innovation involves fundamental restructuring of value creation and capture mechanisms, often requiring reimagining of customer relationships, revenue streams, and operational architectures. Marketing innovation encompasses the development of novel approaches to customer engagement, brand positioning, and market penetration through creative communication strategies, distribution channel optimization, and customer experience enhancement initiatives. Human resource management innovation involves the implementation of progressive workforce management practices including talent acquisition strategies, performance evaluation systems, employee development programs, and organizational culture initiatives that maximize human capital contributions to organizational success (da Veiga et al., 2024).

Financial management innovation represents another critical dimension involving the adoption of advanced financial technologies, sophisticated analytical tools, and strategic financial planning methodologies that enhance decision-making accuracy and resource allocation efficiency. This category includes implementation of digital payment systems, automated financial reporting tools, predictive analytics for financial forecasting, and integrated financial management platforms that provide real-time visibility into organizational financial performance.

The successful implementation of innovation strategies requires organizational cultures that encourage creativity, experimentation, and calculated risk-taking while maintaining operational stability and quality standards. Organizations must develop systematic approaches to innovation management that include idea generation mechanisms, evaluation criteria for innovation opportunities, resource allocation frameworks for innovation projects, and performance measurement systems that track innovation outcomes and their contributions to organizational objectives.

2.3. Business Productivity

Business productivity represents a fundamental measure of organizational efficiency in converting inputs including labor, capital, and resources into valuable outputs (Adwi et al., 2023). This performance indicator reflects capacity to maximize output while minimizing resource consumption. The result is enhanced profitability, competitive positioning, and long-term sustainability.

Theoretical understanding rests upon three fundamental pillars providing comprehensive performance assessment (Saputra et al., 2024). Efficiency measures resource utilization optimization by comparing actual consumption against minimum requirements. Effectiveness evaluates the extent to which activities achieve predetermined objectives and strategic targets. Quality assessment examines the degree to which products meet customer expectations and industry standards.

Contemporary productivity analysis recognizes multiple influencing factors (Dantes et al., 2025). Effective management practices serve as primary drivers through strategic direction and resource allocation. Technology integration creates multiplicative effects by automating tasks and enhancing decision-making capabilities. Workforce quality encompasses employee skills, knowledge, and engagement levels directly influencing output.

Business process efficiency eliminates redundancies and streamlines workflows through systematic analysis. Effective inventory management reduces carrying costs and optimizes working capital utilization (Rodríguez et al., 2024).

Productivity measurement requires comprehensive indicator systems capturing various performance dimensions. Labor productivity examines output per employee, providing workforce efficiency insights. Capital productivity evaluates asset utilization effectiveness in generating revenue. Process productivity focuses on operational workflow efficiency in converting inputs to outputs (Isham et al., 2021).

Resource productivity analysis encompasses comprehensive evaluation of all production inputs to identify optimization opportunities. Product quality measurement assesses customer satisfaction and compliance with standards. Service delivery metrics evaluate customer service process speed, accuracy, and reliability as critical productivity outcomes.

3. Methods

3.1. Types and Research Approach

This study employs a comparative quantitative approach using Structural Equation Modeling – Partial Least Squares (SEM-PLS) analysis technique. This approach aims to examine the influence and comparison between variables such as green marketing strategies, environmental awareness, and institutional support on the readiness of green entrepreneurship among MSME actors, comparing across different business types. SEM-PLS was chosen because it can handle non-normal data, small to medium sample sizes, and complex latent variables (Hair et al., 2019).

3.2. Research Location and Population

The research was conducted in Nagari Sungai Batang, Tanjung Raya District, Agam Regency, West Sumatra. This location was selected because it has potential MSMEs based on local natural resources, such as organic coffee, bamboo crafts, and agro-tourism products, which are relevant to the concept of green entrepreneurship. The population in this study includes all active MSME actors in Nagari Sungai Batang who have been operating for at least one year and are registered in the data of the Agam Regency Cooperative Office.

3.3. Sampling Technique and Sample Size

The sampling technique used is purposive sampling with the following criteria: (a) MSME actors engaged in culinary, craft, or agro-tourism sectors; (b) having been in business for at least 1 year; and (c) willing to fill out the research questionnaire. The targeted sample size is 60 respondents, which aligns with the characteristics and accessibility of the population. This number meets the minimum requirements for SEM-PLS (5–10 respondents per indicator) for small to medium scale models (Hair et al., 2021).

3.4. Instruments and Data Collection Techniques

Data were collected using closed questionnaires with a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaires were developed based on theories and empirical journals concerning green marketing (Polonsky, 2021), environmental awareness (Sahoo, 2021), and institutional support (Wulandari & Adhiatma, 2022). The instrument consists of 5 latent constructs with a total of 20 indicators:

3.5. Statistical Analysis Framework

The analytical approach employs both descriptive and inferential statistical techniques to provide comprehensive understanding of the research phenomena. Descriptive analysis includes calculation of central tendency measures, variability indicators, and distributional characteristics for all research variables. These descriptive statistics provide foundational understanding of sample characteristics and variable distributions that inform subsequent inferential analyses.

Inferential analysis utilizes advanced statistical modeling techniques including structural equation modeling through Partial Least Squares (PLS) methodology. The PLS approach is particularly appropriate for this study given its flexibility in handling complex models with multiple constructs, its robustness with smaller sample sizes, and its capability to simultaneously examine measurement models and structural relationships. The analysis framework includes assessment of model fit indicators, path coefficient significance testing, and mediation effect evaluation through bootstrapping procedures.

The statistical analysis incorporates multiple evaluation criteria including R-square values to assess explained variance in endogenous constructs, f-square measures to evaluate effect sizes of individual predictor variables, and Q-square indicators to assess the predictive relevance of the structural model. Hypothesis testing employs significance testing of path coefficients through bootstrap confidence interval construction, providing robust foundations for drawing theoretical and practical conclusions from the empirical evidence.

4. Result and Discussions

4.1. Results

4.1.1 Respondent Characteristics

The study achieved a complete response rate from all 70 registered noodle processing business owners in Bondowoso Regency, ensuring census-level data accuracy and eliminating sampling bias.

Table 1. Respondent Profile by Gender

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	42	60%
	Female	28	40%
Age	20-30 years	14	20%
	31-40 years	36	51%
	41-50 years	18	26%
	> 50 years	2	3%
Education	Senior/Vocational High School	15	21%
	Bachelor's Degree	55	79%

Source: Processed research data, 2025

Analysis of gender distribution reveals a predominance of male entrepreneurs, with 42 respondents (60%), while females made up 40% (n = 28), reflecting prevailing gender patterns in small-scale food industries, though female participation remains notable. Most respondents were aged 31–40 years (51.4%), followed by those aged 41–50 (25.7%), 20–30 (20%), and above 50 (2.9%), indicating a concentration of business activity during peak productive years. In terms of education, 78.6% of respondents held a bachelor’s degree, while 21.4% had completed high school or vocational training. This suggests a relatively well-educated entrepreneurial population with potential for innovation and structured business development.

4.1.2 Descriptive Statistical Analysis

Descriptive analysis was conducted to provide an overview of respondent perceptions across three core variables: business management, innovation, and business productivity. These indicators collectively reflect the operational quality and strategic orientation of noodle processing businesses in Bondowoso.

Table 2. Respondent Profile by Gender

Variable	Total Score	Ideal Score	Percentage (%)	Category
Business Manager	2,460	2,800	88%	High
Innovation	1,209	1,400	86%	High
Business Productivity	2,178	2,450	89%	High

Source: Processed research data, 2025

The Business Management variable recorded an aggregate score of 2,460 out of 2,800 (88%), reflecting consistently strong capabilities in key managerial functions, including financial oversight, human resource development, and inventory and marketing management. These results indicate that respondents demonstrate sound management competencies aligned with small enterprise performance excellence.

Innovation was also rated highly, with a total score of 1,209 out of 1,400 (86%). The scores suggest that most businesses are actively adopting digital platforms, implementing flexible practices, and integrating technology to enhance efficiency and market reach. This highlights a progressive orientation among respondents despite the traditional nature of the industry.

Business Productivity emerged as the highest-scoring construct, reaching 2,178 out of 2,450 (89%). This suggests that enterprises are operating with high efficiency across input–output dimensions, including labor, capital, and service responsiveness, resulting in strong operational performance and customer satisfaction.

4.1.3 Outer Model Evaluation

The measurement model was evaluated using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 3.2.9. This approach is suitable for small sample sizes and complex models (Hamid & Anwar, 2019). The evaluation focused on three aspects: convergent validity, discriminant validity, and composite reliability, in line with standards for reflective measurement models (Hair et al., 2017; Ghozali, 2014).

4.1.3.1 Convergent Validity

Convergent validity was assessed using outer loading and Average Variance Extracted (AVE). As shown in Table 1, all item loadings exceeded the recommended threshold of 0.70, ranging from 0.727 to 0.847, confirming item reliability.

Table 3. Outer Loadings of Indicators

Variable	Indicator	Outer Loading
Innovation	IN1-IN4	0.727–0.847
Business Manager	PB1-PB8	0.703–0.794
Business Productivity	PU1-PU7	0.736–0.818

Source: Processed research data, 2025

Furthermore, all constructs met the AVE threshold (> 0.50), indicating that more than half of the variance in indicators was captured by the latent variables.

Table 4. AVE and Reliability Scores

Variable	AVE	Composite Reliability	Cronbach’s Alpha
Innovation	0.841	0.719	0.854
Business Manager	0.849	0.882	0.846
Business Productivity	0.837	0.796	0.870

Source: Processed research data, 2025

4.1.3.2 Discriminant Validity

Discriminant validity was evaluated using the cross-loading method. Each indicator showed higher correlation with its respective construct than with others, confirming satisfactory discriminant validity. For instance, IN1–IN4 loaded more strongly on Innovation than on Business Management or Productivity (Table 3 excerpt)..

Table 5. Excerpt of Cross-Loading Results

Indicator	Innovation	Business Manager	Productivity
IN1	0.847	0.348	0.217
PB2	0.304	0.705	0.574
PU2	0.242	0.556	0.796

Source: Processed research data, 2025

4.1.3.2 Composite Reliability

Composite reliability values for all constructs exceeded the threshold of 0.70, indicating strong internal consistency. Cronbach’s Alpha values also surpassed the minimum criterion of 0.60, further confirming the reliability of the measurement model.

In sum, the outer model demonstrates strong convergent and discriminant validity, as well as high internal reliability, supporting the adequacy of the measurement instruments used in this study.

4.1.4 Inner Model Evaluation

Following the validation of the measurement model, the inner model was assessed to examine the structural relationships among latent variables. The evaluation included multicollinearity testing, coefficient of determination (R^2), predictive relevance (Q^2), effect size (f^2), and hypothesis testing using bootstrapping procedures.

4.1.4.1 Multicollinearity Assessment

Variance Inflation Factor (VIF) values for all indicators ranged from 1.094 to 2.542, well below the critical threshold of 5, indicating no significant multicollinearity concerns and supporting the model’s structural integrity.

4.1.4.2 Coefficient of Determination (R^2)

The R^2 value for Innovation was 0.254, indicating that 25.4% of the variance in Innovation is explained by Business Management. Business Productivity yielded a higher R^2 of 0.636, signifying that 63.6% of its variance is accounted for by both Innovation and Business Management. These values demonstrate moderate to substantial explanatory power.

4.1.4.3 Predictive Relevance (Q^2)

Blindfolding analysis generated Q^2 values of 0.746 for Innovation and 0.364 for Business Productivity, both exceeding zero. This indicates the model possesses adequate predictive relevance for both constructs.

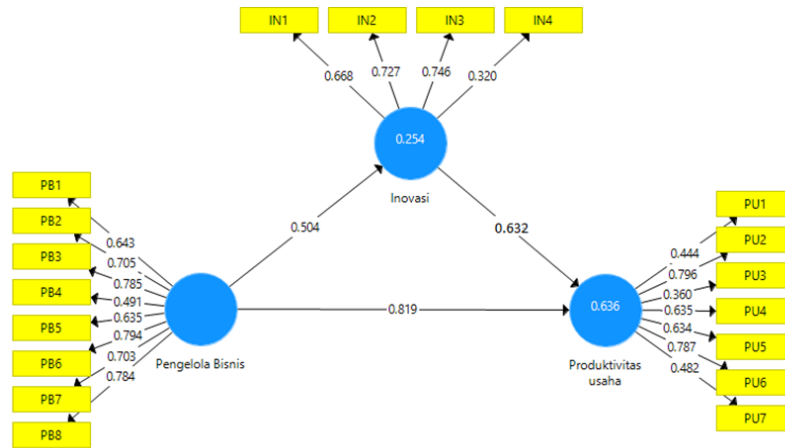


Figure 1. Inner Model

Table 6. Coefficient of Determination (R²)

Endogenous Variable	R²
Innovation	0.254
Business Productivity	0.636

Source: Processed research data, 2025

Table 7. Predictive Relevance (Q²)

Endogenous Variable	Q²	Interpretation
Innovation	0.746	Strong relevance
Business Productivity	0.364	Moderate relevance

Source: Processed research data, 2025

4.1.4.4 Effect Size (f²)

Effect size analysis revealed that Business Management has a large effect on Business Productivity (f² = 1.372) and a moderate effect on Innovation (f² = 0.340). Innovation also demonstrated a medium effect size on Business Productivity (f² = 0.401), confirming its role as a meaningful contributor.

Table 8. Predictive Relevance (Q²)

Relationship	f²	Effect Size
Business Management → Productivity	1.372	Large
Business Management → Innovation	0.340	Moderate-Large
Innovation → Productivity	0.401	Medium

Source: Processed research data, 2025

4.1.4.5 Hypothesis Testing

Bootstrapping analysis using 5,000 resamples confirmed the significance of all hypothesized paths. Path coefficients, t-statistics, and p-values are presented in Table.

Table 9. Hypothesis Testing Results

Hypothesis	Path	Coefficient	t-Stat	p-Value	Result
H1	Innovation → Business Productivity	0.632	1.723	0.000	Accepted
H2	Business Management → Innovation	0.504	8.572	0.000	Accepted
H3	Business Management → Business Productivity	0.819	16.232	0.000	Accepted
H4	Business Management + Innovation → Productivity	0.401	—	0.000	Accepted
H5	Business Management → Innovation → Productivity (mediation)	0.022	—	0.000	Accepted

Source: Processed research data, 2025

All hypotheses were supported. Notably, Innovation significantly mediates the relationship between Business Management and Business Productivity, highlighting its strategic role in enhancing enterprise performance.

4.2. Discussion

4.2.1 The Impact of Business Management on Productivity

The empirical findings demonstrate that business managers exert a positive and significant influence on the productivity of noodle processing businesses. This relationship indicates that higher levels of business management capabilities directly translate to enhanced productivity outcomes. This finding aligns with established theoretical frameworks that emphasize the crucial role of management capabilities in business performance (Bloom & Van Reenen, 2022).

In the context of Bondowoso Regency, noodle business managers serve multiple critical functions beyond mere operational execution. They function as leaders, strategic planners, and decision-makers who fundamentally determine business direction and sustainability. The managerial decisions encompassing raw material selection, production equipment utilization, and work schedule optimization significantly impact both production quantity and quality. Managers capable of designing efficient operational systems contribute directly to enhanced business productivity.

The significance of managerial effectiveness extends beyond technical operational aspects to encompass human resource management. Managers possessing strong leadership and communication competencies can effectively motivate production teams, fostering greater enthusiasm, discipline, and responsibility among workers. This aspect proves particularly vital in Bondowoso's noodle processing sector, where many businesses operate on a home-based or small-scale model, heavily relying on family teams or local workers' cohesiveness. Consequently, the manager's role as a motivator becomes instrumental in achieving optimal productivity outcomes.

4.2.2 The Relationship between Business Management and Innovation

The data analysis reveals that business managers maintain a positive and significant influence on noodle processing innovation. This relationship suggests that enhanced business management capabilities lead to increased innovation implementation within noodle processing operations. Effective business managers demonstrate superior abilities in formulating clear and structured business strategies, enabling them to establish long-term objectives and develop comprehensive operational plans for goal achievement.

Managerial decisions regarding project prioritization, budget allocation, and resource planning directly influence operational efficiency and company performance. The strategic planning capability of managers proves essential for innovation implementation, as it provides the framework within which innovative initiatives can be conceptualized, developed, and executed. This finding supports the broader literature on innovation management, which emphasizes the critical role of leadership in fostering innovative environments (Schumpeter, 2020).

The ability of managers to encourage and facilitate innovation represents a key determinant of business success in competitive markets. Managers with strong leadership, managerial, and innovative competencies create conducive environments for experimentation and improvement, leading to enhanced operational efficiency and competitive

advantage. This relationship becomes particularly relevant in traditional food processing sectors, where innovation can bridge the gap between conventional practices and modern market demands.

4.2.3 Innovation as a Driver of Business Productivity

The empirical results demonstrate that innovation exerts a positive and significant influence on noodle processing business productivity. This relationship indicates that higher levels of innovation adoption and implementation directly contribute to enhanced productivity outcomes. Innovation in business processes enables companies to achieve greater operational efficiency, reduce task completion time, and minimize waste generation (Santarsiero et al., 2024).

The implementation of new technologies and improved methodologies allows companies to streamline both production and administrative processes, resulting in overall productivity enhancement. Innovation creates opportunities for greater efficiency, improved quality, cost reduction, and market expansion. Through effective innovation implementation, companies can optimize resource utilization, increase operational speed and accuracy, and respond more effectively to evolving market demands.

The positive impact of innovation on productivity aligns with contemporary business theory, which emphasizes innovation as essential for maintaining competitiveness and achieving sustainable growth (Mutambik, 2024; Merín-Rodrigáñez et al., 2024). In the context of noodle processing MSMEs in Bondowoso, innovation serves as a critical mechanism for overcoming traditional limitations and capitalizing on emerging market opportunities. This finding supports the broader literature that recognizes innovation as a key driver of business performance in small and medium enterprises.

4.2.4 The Synergistic Effect of Management and Innovation on Productivity

The combined analysis reveals that business management and innovation collectively exert a positive and significant influence on noodle processing business productivity. This synergistic relationship suggests that the simultaneous enhancement of managerial capabilities and innovation implementation produces superior productivity outcomes compared to individual factor improvements.

The noodle processing business sector in Bondowoso Regency, as part of the broader MSME landscape, possesses substantial growth potential driven by high community noodle consumption and local ingredient availability. However, business productivity levels remain highly dependent on the interplay between effective management and innovative capacity. These elements demonstrate interconnectedness, jointly determining the effectiveness and efficiency of business operations and development.

The productivity enhancement achieved through this synergistic relationship enables businesses to meet greater market demand, strengthen competitive positioning, and improve stakeholder welfare. Capable managers create efficient operational systems, while innovation strengthens product competitiveness and facilitates market expansion. When these elements operate harmoniously, businesses can achieve rapid growth trajectories and sustainable competitive advantages (Surya et al., 2021).

4.2.5 Innovation as a Mediating Factor

A particularly significant finding emerges from the mediation analysis, which demonstrates that innovation mediates the relationship between business managers and business productivity. This mediation effect indicates that innovation serves as a crucial mechanism through which managerial capabilities translate into enhanced productivity outcomes.

Business managers influence productivity through innovation application across various operational and strategic company aspects. Innovation functions as a bridge or mediator that strengthens and accelerates the positive impact generated by business managers on productivity performance (Srećković et al., 2024). Managers capable of encouraging and facilitating innovation demonstrate greater effectiveness in enhancing efficiency, quality, and competitiveness, which directly impacts business productivity (Srećković et al., 2024).

The mediating role of innovation reflects the concrete steps taken by managers to create efficiency improvements, quality enhancements, and competitive advantages. Business managers who support and facilitate innovation can

improve operational performance and company competitiveness, ultimately resulting in increased business productivity (Tanveer et al., 2025). Innovation, as a mediator, accelerates managerial influence on productivity by providing more sophisticated, efficient, and market-relevant solutions.

This mediation relationship has important implications for management practice and policy development in the MSME sector. It suggests that management development programs should emphasize innovation capabilities alongside traditional management skills to maximize productivity outcomes. Furthermore, it highlights the importance of creating supportive environments that enable managers to implement innovative solutions effectively.

5. Conclusions

This study provides empirical evidence for the critical role of business management in enhancing productivity within noodle processing MSMEs in Bondowoso Regency. The findings confirm that effective business management practices directly and significantly influence productivity outcomes, while innovation serves as a crucial mediating mechanism that strengthens this relationship.

The research demonstrates that business managers function as strategic catalysts who drive productivity improvements through multiple pathways. Their capabilities in operational planning, human resource management, and strategic decision-making directly contribute to enhanced business performance. Furthermore, the significant positive relationship between management and innovation indicates that capable managers create conducive environments for implementing technological and process improvements (Rachman et al., 2022)..

Innovation emerges as both an outcome of effective management and a driver of productivity enhancement. The mediation analysis reveals that innovation serves as a critical bridge through which managerial capabilities translate into tangible productivity gains. This finding suggests that the management-productivity relationship operates through innovation-mediated pathways, highlighting the interconnected nature of these business dimensions.

The synergistic effect of management and innovation on productivity underscores the importance of integrated approaches to MSME development. Businesses that simultaneously strengthen managerial capabilities and foster innovation achieve superior performance outcomes compared to those focusing on individual factors. This insight has significant implications for policy development and business support programs targeting traditional food processing sectors.

These findings contribute to the theoretical understanding of MSME performance dynamics while providing practical guidance for business owners, policymakers, and support institutions. The study demonstrates that sustainable productivity enhancement in traditional food processing requires strategic integration of management development and innovation facilitation. For Bondowoso Regency and similar contexts, this research offers a framework for strengthening local entrepreneurship and economic resilience through targeted interventions that address both managerial capacity and innovative capability development.

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