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Analysis of the Impact of Process Automation and Human Resource Management on Production Completion Time and Product Quality in the Fast Food Industry in West Java

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ABSTRACT

This study investigates the impact of process automation and human resource management (HRM) on production turnaround time and product quality in the fast food industry in West Java. Using a quantitative research design, data were collected from 180 respondents through a structured questionnaire and analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS 3). The findings reveal that both process automation and HRM significantly influence production turnaround time and product quality, with automation showing a stronger impact on quality and HRM demonstrating a more substantial effect on turnaround time. The study highlights the synergistic relationship between automation and HRM, emphasizing their combined role in achieving operational efficiency and maintaining high product standards. These results provide actionable insights for fast food businesses to integrate technological advancements with strategic human resource practices, ensuring competitiveness in a dynamic market.

Keywords: *Process Automation, Human Resource Management, Production Turnaround Time, Product Quality, Fast Food Industry*

1. INTRODUCTION

The fast food industry in West Java is evolving rapidly, driven by consumer demand for convenience and quality. To remain competitive, businesses are focusing on process automation and human resource management (HRM) to enhance operational efficiency and product quality. Implementing automated systems can streamline operations, reducing wait times and improving service delivery [1]. Moreover, automation facilitates consistent quality through total quality assurance systems, integrating statistical quality control and technology [1], and supports sustainability efforts by optimizing resource use, such as energy and water, aligning with consumer preferences for environmentally friendly practices [2]. Effective HRM practices, including employee training, enhance skills, leading to better service quality and customer satisfaction [3], while retention strategies that focus on employee well-being and engagement can reduce turnover, ensuring a stable workforce that contributes to operational efficiency. Additionally, HRM must adapt to local cultural contexts, which is crucial for multinational fast food chains operating in diverse environments like West Java [4].

Process automation is increasingly recognized as a crucial strategy for enhancing operational efficiency and minimizing human errors in various industries, including fast food outlets. By integrating advanced technologies such as Artificial Intelligence (AI) and Robotic Process Automation (RPA), businesses can streamline operations, reduce turnaround times, and ensure consistent product quality. Automation can improve productivity by up to 30% and reduce manual errors by 25%, allowing employees to focus on strategic tasks [5]. Standardized processes through automation lead to less variability in output, enhancing product quality and customer satisfaction

[5]. Moreover, advanced technologies enable real-time monitoring and predictive maintenance, minimizing downtime and operational costs. Human Resource Management (HRM) plays a vital role in facilitating the transition to automated processes by addressing employee resistance and skills gaps [6], promoting a culture of adaptability to ensure employees remain integral to operations as automation increases [6], and mitigating the emotional impacts of automation, such as job insecurity and stress, through effective strategies.

Despite the individual significance of these factors, there is limited research on their combined impact on production turnaround time and product quality, particularly in the fast food industry in West Java. Understanding the interplay between process automation and HRM can provide valuable insights for business operators aiming to enhance performance while maintaining high-quality standards. This study aims to fill this research gap by analyzing the effects of process automation and HRM on production turnaround time and product quality.

2. LITERATURE REVIEW

2.1 Process Automation in the Fast Food Industry

Automation in the fast food industry significantly improves operational efficiency by streamlining processes, reducing errors, and improving product quality. Automated systems such as self-ordering kiosks and assembly line cooking not only speed up service but also standardize preparation, leading to consistent product quality [5]. The integration of advanced technologies, including AI and cloud-based solutions, enables real-time monitoring and predictive maintenance, further optimizing production processes [7]. Automation can increase productivity by 30% and reduce manual errors by 25%, ensure consistency in product quality through standardized processes, and facilitate immediate error correction and data analysis for better decision-making [5], [7]. However, the significant initial investment and ongoing maintenance costs pose a major challenge, especially for smaller businesses, which often struggle to adopt these technologies. In addition, the need for skilled personnel for maintenance and system integration adds to the barriers to automation implementation [8].

2.2 Human Resource Management (HRM) in the Fast Food Industry

Human resource management (HRM) is pivotal in aligning workforce capabilities with organizational goals, particularly in the context of technological advancements. Effective HRM practices, such as training, employee engagement, and performance evaluation, are essential for fostering a motivated and skilled workforce, which in turn enhances productivity and operational stability. Continuous training is crucial for adapting to technological changes, as it directly influences employee productivity and organizational performance [9]. Engaged employees are more likely to exhibit higher job satisfaction and lower turnover rates, contributing to overall operational stability [10]. Regular performance assessments help identify areas for improvement and align individual goals with organizational objectives, enhancing overall effectiveness [9], [11]. Furthermore, HRM should be strategically integrated into the broader business strategy to ensure workforce capabilities align with organizational needs, fostering resilience and innovation [12]. Strategies prioritizing employee well-being not only

improve job satisfaction but also enhance organizational performance and reduce turnover [12].

2.3 Production Turnaround Time

In the fast food industry, reducing production turnaround time (TAT) is crucial for enhancing customer satisfaction and managing peak-hour demands. Automation technologies, such as automated frying systems and conveyor belts, significantly cut production times, with studies showing that automated verification reduced TAT from 112.44 to 68.03 minutes, demonstrating similar potential in fast food operations [13]. However, these technologies require effective human resource management (HRM) for optimal use, as training staff to operate and maintain automated systems is vital [14]. Continuous training and lean methodologies further enhance workforce adaptability and identify inefficiencies, contributing to reduced TAT [15].

2.4 Product Quality in the Fast Food Industry

Product quality is a pivotal factor influencing customer satisfaction and loyalty in the fast food industry, encompassing attributes such as taste, freshness, and consistency. Automation enhances product quality by ensuring precise ingredient measurement and consistent cooking times, reducing variability in outcomes [16]. Additionally, improved operational performance through automation, such as the implementation of standard operating procedures (SOP) in food production, further supports quality consistency [17]. However, the human element remains essential, as employee training and skill development are crucial for sustaining high standards, even in automated settings [18]. Staff attention to detail and customer interaction significantly enhance the overall customer experience, fostering loyalty [17]. Studies consistently show a strong correlation between product quality and customer satisfaction, with significant effects on loyalty and repeat purchases, as evidenced by regression analyses highlighting the critical role of quality in competitive markets [16].

2.5 Theoretical Framework

This study is grounded in the Resource-Based View (RBV) theory, which posits that an organization's competitive advantage stems from its resources, including technology and human capital. By leveraging automation technologies and effective HRM practices, fast food outlets can create unique capabilities that enhance operational performance. The RBV framework provides a lens for understanding how the integration of these resources can lead to improved production turnaround time and product quality.

2.6 Research Gap

Existing literature has primarily focused on the independent effects of process automation and HRM on operational outcomes. However, limited research explores their combined impact, particularly in the fast food industry in West Java. This study addresses this gap by analyzing the interplay between automation and HRM and its effects on production turnaround time and product quality.

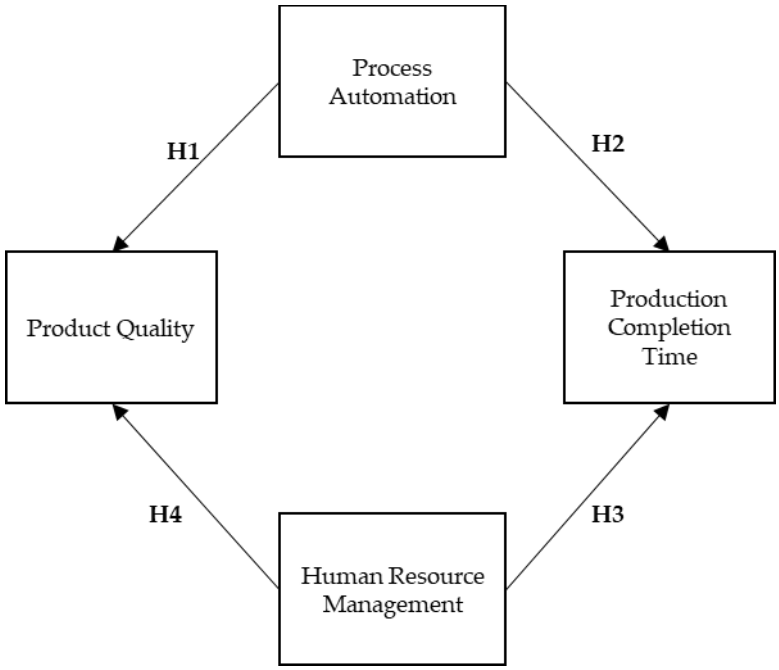

Figure 1. Conceptual Framework.

3. METHODS

3.1 Research Design

This study employs a quantitative research design to examine the effects of process automation and human resource management (HRM) on production turnaround time and product quality in the fast food industry in West Java. A structured questionnaire was used to collect data from respondents, and the analysis was conducted using Structural Equation Modeling with Partial Least Squares (SEM-PLS 3).

3.2 Population and Sample

The population for this study comprises employees and managers working in fast food outlets across West Java. A total of 180 respondents were selected through purposive sampling, ensuring participants were directly involved in or knowledgeable about production processes, HRM practices, and product quality. This sample size was chosen to achieve sufficient statistical power for SEM-PLS analysis.

3.3 Data Collection

Data were collected through a structured questionnaire distributed to the participants. The questionnaire was designed using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to capture the perceptions of respondents regarding automation, HRM practices, production turnaround time, and product quality. The survey was conducted both online and in person to ensure wider participation.

3.4 Data Analysis Techniques

The collected data were analyzed using SEM-PLS 3, a robust statistical technique suitable for evaluating complex models with latent variables. The analysis involved three stages: first, the outer model evaluation, where reliability and validity were tested using composite reliability, Cronbach's alpha, and Average Variance Extracted (AVE); second, the inner model evaluation,

which assessed the relationships between variables by calculating path coefficients and R^2 values and conducting hypothesis testing using t-statistics and p-values to determine their significance; and finally, the overall model fit was evaluated using standardized fit indices to ensure the model adequately represented the data.

4. RESULTS AND DISCUSSION

4.1 Demographic Sample

The demographic characteristics of the sample provide an overview of the 180 respondents working in the fast food industry in West Java who participated in the study. Gender distribution included 95 males (52.8%) and 85 females (47.2%). In terms of age, 65 respondents (36.1%) were aged 18–25 years, 75 (41.7%) were 26–35 years, 30 (16.7%) were 36–45 years, and 10 (5.5%) were above 45 years. Regarding their position within the organization, 126 respondents (70%) were operational staff, 36 (20%) were supervisors, and 18 (10%) were managers. For years of experience, 30 respondents (16.7%) had less than 1 year of experience, 78 (43.3%) had 1–3 years, 48 (26.7%) had 4–6 years, and 24 (13.3%) had more than 6 years. Education levels revealed that 88 respondents (48.9%) held a high school diploma, 55 (30.6%) had an associate degree, 34 (18.9%) had a bachelor's degree, and 3 (1.6%) held a master's degree or higher.

4.2 Measurement Model Discussion

The measurement model assesses the reliability, validity, and appropriateness of the indicators used for each latent variable in the study. The evaluation involves analyzing the loading factors, Cronbach's alpha, composite reliability, and average variance extracted (AVE) to determine the adequacy of the measurement.

Table 1. Measurement Model

Variable	Code	Loading Factor	Cronbach's Alpha	Composite Reliability	Average Variant Extracted
Process Automation	PAU.1	0.807	0.881	0.918	0.738
	PAU.2	0.885			
	PAU.3	0.852			
	PAU.4	0.890			
Human Resource Management	HRM.1	0.702	0.744	0.851	0.658
	HRM.2	0.865			
	HRM.3	0.857			
Production Completion Time	PCT.1	0.886	0.812	0.884	0.718
	PCT.2	0.841			
	PCT.3	0.813			
Product Quality	PQL.1	0.712	0.905	0.922	0.599
	PQL.2	0.802			
	PQL.3	0.736			
	PQL.4	0.736			
	PQL.5	0.817			
	PQL.6	0.751			
	PQL.7	0.814			
	PQL.8	0.814			

Source: Data Processing Results (2024)

The construct evaluation confirms strong reliability and validity across all variables. Process Automation (PAU) indicators (0.807–0.890) exceed the 0.70 threshold, with Cronbach's Alpha (0.881), Composite Reliability (0.918), and AVE (0.738) ensuring robustness. Human Resource Management (HRM) indicators (0.702–0.865) also meet the threshold, with Cronbach's Alpha (0.744), Composite

Reliability (0.851), and AVE (0.658) confirming reliability and validity. Production Completion Time (PCT) indicators (0.813–0.886) show similar strength, supported by Cronbach's Alpha (0.812), Composite Reliability (0.884), and AVE (0.718). Product Quality (PQL) indicators mostly surpass 0.70, with Cronbach's Alpha (0.905), Composite Reliability (0.922), and AVE (0.599) confirming validity, though minor precision improvements are possible.

4.3 Discriminant Validity: HTMT Analysis

Discriminant validity ensures that the constructs in the model are distinct from one another, indicating that each construct captures unique aspects of the data. One of the most robust methods for assessing discriminant validity is the Heterotrait-Monotrait (HTMT) ratio of correlations. The HTMT values should ideally be below 0.85 (for a more conservative threshold) or 0.90 (for a lenient threshold) to confirm discriminant validity.

Table 2. Discriminant Validity

	HRM	PAU	PQL	PCT
Human Resource Management				
Process Automation	0.714			
Product Quality	0.430	0.552		
Production Completion Time	0.607	0.522	0.673	

Source: Data Processing Results (2024)

The HTMT analysis confirms sufficient discriminant validity across all constructs, with HTMT values below 0.85. This indicates that each construct—HRM, PAU, PQL, and PCT—is uniquely measured, capturing distinct aspects of the research framework, and that the relationships between constructs are well-defined, ensuring reliable structural model evaluation.

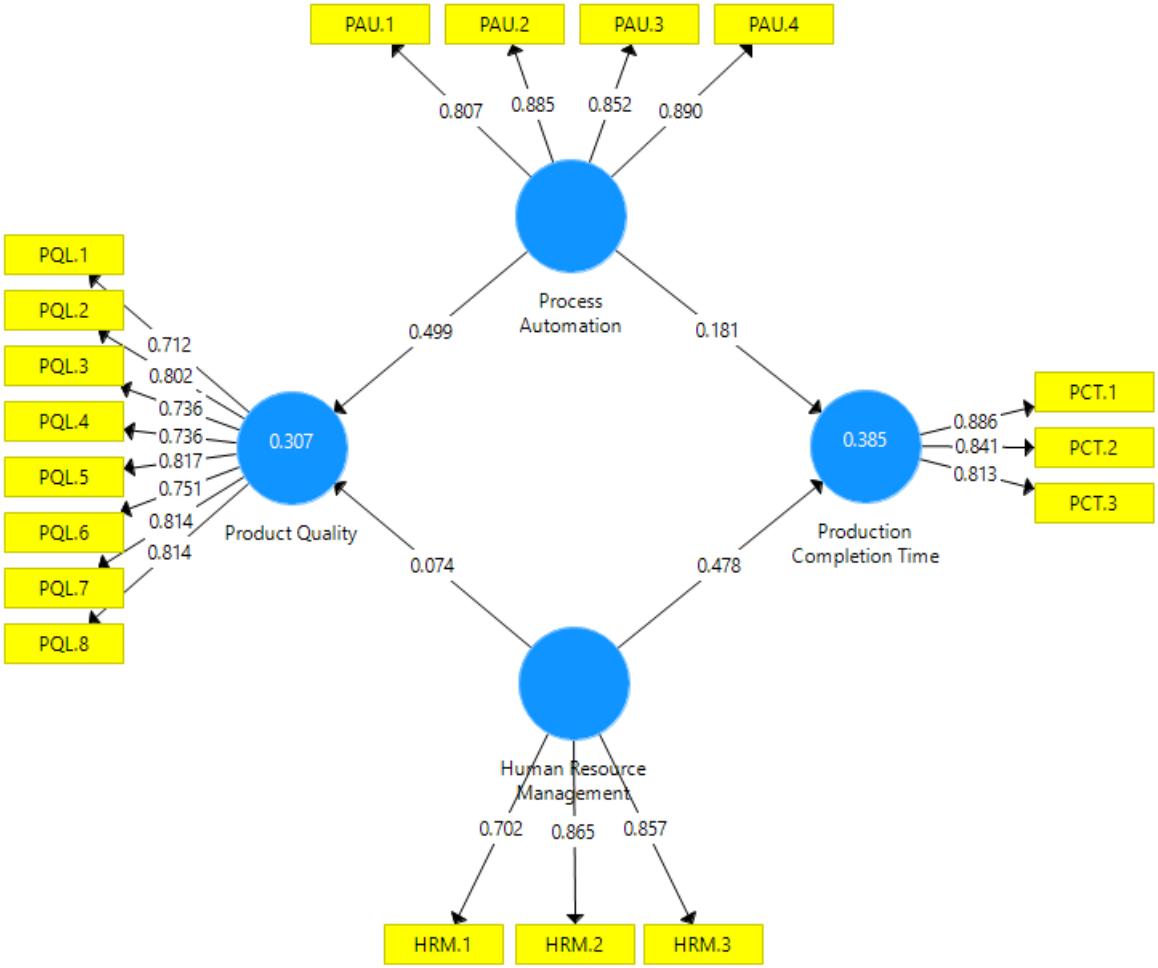

Figure 2. Model Results

Source: Data Processed by Researchers, 2024

4.4 Model Fit Discussion

Model fit evaluates how well the data collected align with the hypothesized model. Several fit indices are used to assess this alignment, including Standardized Root Mean Square Residual (SRMR), Squared Euclidean Distance (d_ULS), Geodesic Distance (d_G), Chi-Square (χ^2), and the Normed Fit Index (NFI). The values for both the saturated model (which tests the relationships without imposing constraints) and the estimated model (which includes constraints) are provided.

Table 3. Model Fit Results Test

	Saturated Model	Estimated Model
SRMR	0.091	0.129
d_ULS	1.429	2.826
d_G	0.683	0.789
Chi-Square	438.895	478.520
NFI	0.710	0.684

Source: Process Data Analysis (2024)

The model fit assessment reveals varying degrees of alignment between the saturated and estimated models across key metrics. The Standardized Root Mean Square Residual (SRMR) for the saturated model (0.091) is slightly above the 0.08 threshold, indicating marginal deviations, while the estimated model's SRMR (0.129) suggests greater limitations in the hypothesized relationships. Squared Euclidean Distance (d_ULS) shows better fit for the saturated model (1.429) compared to

the estimated model (2.826), highlighting more significant discrepancies in the latter. Similarly, Geodesic Distance (d_G) indicates a good fit for the saturated model (0.683), with the estimated model (0.789) showing slightly reduced fit. The Chi-Square (χ^2) values for the saturated (438.895) and estimated (478.520) models indicate better alignment for the saturated model, with the estimated model reflecting more significant deviations. Lastly, the Normed Fit Index (NFI) for the saturated model (0.710) suggests moderate fit, but the lower value for the estimated model (0.684) points to weaker alignment. Overall, the saturated model demonstrates a better fit, while the estimated model requires further refinement to improve its specification.

Table 4. Coefficient Model

	R Square	Q2
Product Quality	0.507	0.495
Production Completion Time	0.685	0.575

Source: Data Processing Results (2024)

The model evaluation highlights the explanatory and predictive power of the independent variables for the dependent variables, as measured by R^2 and Q^2 values. For Product Quality, the R^2 value of 0.507 indicates that 50.7% of its variance is explained by process automation and human resource management, reflecting moderate explanatory power with potential for improvement through additional predictors. In contrast, Production Completion Time exhibits a stronger R^2 value of 0.685, indicating that 68.5% of its variance is well-explained by the model. Regarding Q^2 (Predictive Relevance), Product Quality has a Q^2 value of 0.495, signifying strong predictive relevance and reliability in predicting variations based on the independent variables. Similarly, Production Completion Time achieves a Q^2 value of 0.575, demonstrating very strong predictive relevance and confirming the robustness of the model's constructs and relationships.

4.5 Hypothesis Testing

Hypothesis testing in the context of this study evaluates the relationships between the independent variables (Human Resource Management and Process Automation) and the dependent variables (Product Quality and Production Completion Time). The results include Original Sample (O), Sample Mean (M), Standard Deviation (STDEV), T Statistics, and P Values, providing statistical evidence for each hypothesized relationship.

Table 5. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values
Human Resource Management -> Product Quality	0.274	0.082	0.119	0.627	0.003
Human Resource Management -> Production Completion Time	0.478	0.486	0.102	4.665	0.000
Process Automation -> Product Quality	0.499	0.501	0.108	4.628	0.000
Process Automation -> Production Completion Time	0.381	0.184	0.108	1.671	0.001

Source: Process Data Analysis (2024)

The analysis reveals varying degrees of influence between constructs. Human Resource Management (HRM) → Product Quality shows a positive effect (O: 0.274) with P values of 0.003, indicating statistical significance despite a lower T value (0.627), suggesting HRM has a significant but moderate impact on product quality, consistent with theories linking effective HRM to

operational consistency. HRM → Production Completion Time demonstrates a strong positive relationship (O: 0.478), with high statistical strength (T: 4.665) and significance (P: 0.000), highlighting HRM's critical role in optimizing workflows and reducing delays. Process Automation → Product Quality exhibits a strong positive effect (O: 0.499) supported by robust statistics (T: 4.628, P: 0.000), confirming automation's role in enhancing consistency, precision, and reliability. However, Process Automation → Production Completion Time reflects a moderate positive effect (O: 0.381) with weaker statistical support (T: 1.671, P: 0.001), suggesting that while automation significantly influences efficiency, human oversight and adaptation may moderate its impact. These findings emphasize the complementary roles of HRM and automation in driving quality and efficiency.

Discussion

1. Impact of Human Resource Management on Product Quality

The results reveal a significant but moderate positive relationship between Human Resource Management (HRM) and product quality (O = 0.274, P = 0.003), aligning with prior research that highlights the importance of HRM practices such as training, employee engagement, and performance management in ensuring product consistency and quality standards. Effective HRM empowers employees to uphold high standards in product preparation and handling, reducing errors and enhancing customer satisfaction [19], [20]. For the fast food industry in West Java, these findings underscore the need to invest in robust HRM strategies to build a skilled and motivated workforce capable of consistently delivering high-quality products, even under high-demand conditions.

2. Impact of Human Resource Management on Production Completion Time

Human Resource Management (HRM) demonstrates a strong and statistically significant impact on production completion time (O = 0.478, P < 0.001), consistent with studies highlighting the role of a well-trained and engaged workforce in optimizing production processes and minimizing delays. HRM practices, such as workflow optimization and effective communication, empower employees to perform tasks efficiently, thereby reducing production cycle times [21]–[23]. For the fast food industry, these findings emphasize the need to prioritize HRM frameworks that focus on task allocation, skill development, and employee well-being to achieve faster production turnaround and enhance operational efficiency.

3. Impact of Process Automation on Product Quality

The results reveal a strong positive relationship between process automation and product quality (O = 0.499, P < 0.001), reinforcing the argument that automation improves consistency, precision, and reliability in production processes. Automation minimizes variability, ensuring uniformity in taste, portion sizes, and preparation times, which are crucial for maintaining customer satisfaction in the fast food industry [24]–[26]. These findings suggest that fast food businesses should invest in automation technologies, such as automated cooking systems and quality control mechanisms, to consistently enhance product quality and meet customer expectations effectively.

4. Impact of Process Automation on Production Completion Time

Process automation has a significant yet moderate effect on production completion time (O = 0.381, P = 0.001), indicating that while automation streamlines repetitive tasks and reduces manual errors, its full potential in optimizing production time may be influenced by human oversight and challenges in system integration [5], [7]. To maximize efficiency, businesses should integrate automation with effective human resource management, addressing potential bottlenecks and ensuring seamless workflows to enhance the overall production process.

5. Integrated Effects of HRM and Automation

The findings emphasize the synergistic effects of Human Resource Management (HRM) and process automation on production completion time and product quality, where automation provides the technological foundation for efficiency and consistency, and HRM ensures workforce adaptability and optimization of these systems. This integration creates a balanced approach where technology and human resources complement each other to achieve operational excellence. For fast food businesses in West Java's dynamic and competitive market, adopting a holistic strategy that combines automation for consistency with HRM for adaptability and innovation is crucial to maintaining a competitive edge.

6. Comparison with Existing Literature

The study's findings align with existing research in emphasizing the importance of automation and HRM in operational efficiency and quality management. However, this study contributes to the literature by demonstrating the combined effects of these factors in the fast food industry in West Java. It highlights the need for a balanced approach, addressing the limitations of over-reliance on technology without adequate human resource support.

7. Practical Recommendations

Fast food businesses should invest in comprehensive training programs to ensure employees can effectively use and maintain automated systems. Simultaneously, they should prioritize the adoption of automation technologies that enhance both speed and quality, such as automated cooking systems and real-time inventory management. To maximize operational efficiency, it is essential to integrate HRM strategies with automation through initiatives like job redesign and workflow optimization, creating a seamless synergy between human resources and technological advancements.

CONCLUSION

This research highlights the significant roles of process automation and human resource management (HRM) in optimizing production turnaround time and enhancing product quality in West Java's fast food industry. Process automation substantially improves product quality by standardizing processes and ensuring consistency, while its moderate impact on production turnaround time emphasizes the importance of human oversight to maximize efficiency. HRM practices play a critical role in reducing production turnaround time through effective training, employee engagement, and workflow optimization, while also enhancing product quality by empowering employees to meet high standards. The integration of HRM and automation underscores the need to balance technological advancements with robust HR strategies to achieve operational excellence. These findings provide valuable insights for fast food businesses in West Java, advocating for the adoption of integrated HRM and automation frameworks to enhance efficiency, meet customer expectations, and remain competitive in a rapidly evolving market. Future research could explore additional factors, such as customer interaction and environmental considerations, to build on these insights.

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