

Contributing Factors of Production Performance in the Food Processing Industry

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Abstract— *The main purpose of this study is to determine the factors that can contribute to the production performance in the food industry. This study can help to identify the contributing factors towards the production performance. Five factors were identified based on the past literature. 100 food processing manufacturers with the majority coming from small and medium industries (SME) have been selected. The purposive sampling technique has been selected for this study with the total number of usable questionnaires received being from 80 respondents. The collected data was analysed using SmartPLS 3.0 to test the relationships between the independent variables and the dependent variable of the study. The results showed that the Total Quality Management (TQM), Lean Management (LM), and Hazard Analysis and Critical Control Point (HACCP) significantly influenced the production performance. The practical implications of these outcomes are further discussed in the study.*

Keywords— *Production Performance, Total Quality Management, Lean Manufacturing, Halal Standard Practice, Hazard Analysis and Critical Control Point*

1. Introduction

Food processing industry has been one of the highest sectors contributing to employment and the country's exports. Therefore, this industry is no longer a small industry due to its contribution to the economy and its ability to give good prospects in the world's food market [1]. The industry is evolving day by day, and achieving effectiveness and efficiency is the ultimate objective in operation management. Conclusively, the organisations in this industry must consider implementing radical, incremental innovations or changes to gain competitive advantages. Production is one of the essential functions of the organisation. The production performance of an organisation is determined by the strengths and weaknesses of the

organisation [2] and an inefficient manufacturing process may lead to production loss and a decrease of productivity in the organisation [3].

Total Quality Management (TQM), Lean Manufacturing (LM), Halal Standard Practices (HSP), and Hazard Analysis and Critical Control Point (HACCP) are the factors that were identified as practices which may influence production performance improvement in many manufacturing industries. They give advantages in cost, quality, productivity, flexibility, and quick response, and enable an organisation to monitor and control product safety in the production process, and establish a good reputation. Moreover, the recognition as a Halal Standard Practice (HSP) business gives assurance in term of safety, hygiene, and quality performance to consumers, especially Muslims [4]. However, many of today's organisations suffer from high number of defects, a lot of waste, and inconsistency of product output levels during the production process. Consequently, forecasting has become a difficult task for the production manager and there is often a failure to determine the quantity of the output as well as the performance of the organisation.

There are many practices available that can be implemented in the organisation's production process, but to what extent do these practices affect the production performance? The past studies of production performance amongst the food processing industries in Malaysia are inadequate [5]. Therefore, there is a need to conduct a study in the particular industry. This paper is structured with a literature review on the production performance, Total Quality Management (TQM), Lean Management (LM), Halal Standard Practice (HSP), and Hazard Analysis and Critical Control Point

(HACCP) being discussed in the next section and the influences of these variables are illustrated in the conceptual model. An empirical study using a survey has been conducted to attest to the proposed conceptual model and this is followed by the conclusion and recommendations at the end of this paper.

2. Literature Reviews

2.2 Production Performance

The production performance is important to an organisation due to it helping to give an understanding and evaluation of the condition of the organisation; whether it is moving towards its objectives and is in line to achieve its goals or not. A study by [6] stated that production is defined as the step-by-step transforming of raw material into a semi-complete or complete product by a process to give benefit to the consumer or user. To simplify, production is also defined as a process by which goods and services are created. According to [7], production can be explained as measuring the transformation of a stated amount of labour and capital into the specified volume of goods.

2.3 Total Quality Management (TQM)

During the past two decades, many organisations have implemented total quality management (TQM) programmes. A strategy of high quality leads to a sustainable competitive advantage. Total quality management has been discussed as a practice to increase quality and improve the competitiveness of the organisations. A study by [8] stated that total quality management is an integrated management philosophy and set of practices that emphasises continuous improvement, meeting customer requirements, reducing rework, long range thinking, increased employee involvement and teamwork, process redesign, competitive benchmarking, team-based problem solving, constant measurement of results, and closer relationships with suppliers. TQM is an approach to management that can be characterised by its principles, practices, and techniques. According to [9], three different major categories can be classified by the total quality management practice. The three categories are customer satisfaction, continuous improvement, and making the organisation as a total system. A study by [5] stated that, TQM is an approach to improving the

quality of goods and services through continuous improvement of all processes, customer driven quality, excellence in production without defects, and target on improvement of the processes. According to [10], total quality management is an integrative philosophy of management for continuously improving the quality of the products and processes to achieve customer satisfaction. According to [10], TQM includes all activities relating to quality in a company, such as quality design and development, quality control and maintenance, quality improvement, and quality assurance.

2.4 Lean Management (LM)

Lean management, also known as lean manufacturing or lean production, is often simplified as lean. According to [11], lean is the optimal way of producing goods through the removal of waste. Lean manufacturing is the system which aims for the elimination of the waste from the system with a systematic and continuous approach. According to [12], to remain on top in the evolving global market, many organisations have been trying to decrease the total cost and wastes across their supply chain. Hence, the impact of lean practices on the businesses' success cannot be denied. Organisations are able to be more flexible and more profitable due to lean techniques and tools. [13] suggested that an organisation can achieve good operational performance, increase value-adding activities, and simplify the production process by practicing lean in the organisation. Furthermore, an efficient application of lean manufacturing principles and tools would also promote a low non-value added time, waste, and associated costs.

2.5 Halal Standard Practices (HSP)

In Malaysia, the Halal food certification (HFC) is important in the food industry. A study by [14] stated that research on halal food certification normally focused on consumer purchase behaviours [15], willingness-to-pay [16], awareness or perceptions [17], and level of confidence [18]. Halal food production research, however, has commonly studied the attributes, reasons, readiness, and perceptions of the HFC. According to [11], scholars have yet to analyse a more significant investigation on the HFC, in particular,

its association with improved production performances. Based on [11], the halal food certificate is deployed by food companies as a tool to achieve a sustainable competitive advantage. In that paper, it has been mentioned that food companies are aggressively producing and selling homogeneous products, whilst competing in an extremely competitive, highly volatile, and saturated market. Hence, if the food companies wish to have a good competitive advantage, they should emphasise their halal food certification to attract more customers by increasing their confidence towards the products. The halal food certificate is derived based on the application of the halal standard practice [19]. In order to achieve the halal food certificate, the organisation must comply with the halal standard practice. Based on the literature review, the halal standard practice has same implication or effect as the halal food certificate.

2.6 Hazard Analysis and Critical Control Point (HACCP)

A study by [20] stated that this practice had been developed by the Pillsbury Corporation in the 1960s and focuses on safety and quality management. According to [21], nowadays, the economic situation and global market conditions have changed companies' perceptions to look for ways to increase competitiveness by improving production processes, reducing production costs, and improving product quality.

The Hazard Analysis Critical Control Point (HACCP) system is a preventative system for assuring the safe production of food products. It is based on a common sense application of technical and scientific principles to a food production process. According to [21], the HACCP practice is made up of seven important principles, which are conducting a hazard analysis, determining the critical control points (CCPs), establishing the critical limits, establishing the monitoring procedures, establishing the corrective actions, establishing the verification procedures, and establishing the record-keeping and documentation procedures. This is a systematic approach to the identification, evaluation, and control of food safety hazards.

2.7 Research Model & Hypotheses Development

Total quality management is a management principle that targets improving its processes and products, and thus its operations as cited in [22]. According to [22], TQM practices promote the organisation to meet customer expectations. Total quality management has also been viewed as a methodology that maximises the market share, productivity, and performance. Total quality management helps organisations to reduce the cost of their operations. Total quality management helps firms to reduce the scrap, rework, and cost related to poor quality, warranties, and late deliveries. A study by [10] also showed, empirically, that Chinese manufacturing firms received benefits from the TQM implementation. For example, inventory, defect rate, and waste were found to be reduced. Other than that, [10] also stated that the implementation of TQM in Chinese firms improved quality and productivity, and reduced cost. Lastly, a previous study by [23] showed that TQM can significantly improve inventory and product quality. Therefore, the following hypothesis has been formulated.

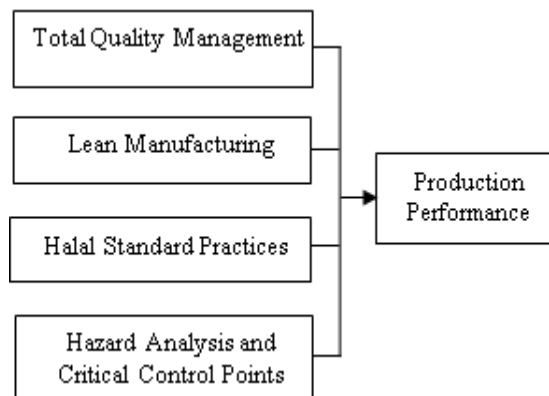


Figure 1. Research Model

H1. Total quality management have positive impact on production performance.

According to [24] Deming chain reaction model help improves in performance engender from the impacts of quality, in forms of reduction in waste of materials, labour and machine operating times. In the literature of [25], lean production is usually shown to be related with improvements in operational performance owing to the benefits, which hail from the improvements in labour productivity, quality and lead time, cycle-time and

manufacturing costs. As cited in [26], lean manufacturing practices are believed to have a positive relationship with operational performance because it is widely considered to be a potentially powerful approach to enhance better operational performance through waste elimination. A study by [27] stated that lean manufacturing can result in a huge improvement in quality. As argued [24], the application of personnel training policies results in promote labour productivity, thus have an effect on the operational performance of the organization. Supported by [24] that stated lean environment, workforce development is directed at improving production performance. This leads to the following specific hypotheses:

H2: Lean manufacturing have influence on production performance.

According to [14] explained that any form of resources made available to a firm, if used effectively and efficiently, could lead to favourable business outcomes. Thus, food companies are found ways to survive in the competition and aim to become the market leader by provide unique products to the customers. Therefore, food companies are stress on securing halal standard practices, which help the organization in offering better products to the consumers.

To support the argument, evidence from past research indicated that firms utilised various types of certification as an instrument to achieve desired business outcomes. According to [29] explained that apart from implementing halal certification as a tool to gain competitive advantage, halal certification also enables to boost the organisational performance according to the industry practitioners. Since the halal certificate derived by complying with halal standard practice, the following hypothesis is formulated:

H3. There is a positive relationship between halal standard practices and production performance.

A study by [30] stated that this program is designed to reduce or eliminate the known causes of process variation that may impact product specifications. Researcher also stated that set of quality and safety food can be expected to be produce in consistently and meet the specifications of HACCP-based

programs are also expected to produce food that meet a given set of food safety and quality specifications consistently.

From this paper, we can know that HACCP have impact on production performance. This paper also proved that HACCP have influence on production performance because it enables food premises to control hazards. Furthermore, according to [21] a strong HACCP implementation would now be vital to ensure consumer safety. After consumer safety is ensured, it means the production performance is increased and it will improve purchaser certainty and indirectly increase business performance. Therefore, the following hypothesis is formulated:

H4: Hazard analysis and critical control point have influence on production performance.

3. Research Method

This was an applied research due to it trying to solve the current problem faced by management in the work setting. Furthermore, the time horizon for the study was a cross-sectional study. It means that the data were gathered at one time only from the respondents. The unit of analysis for this study was the organisation. The study settings were non-contrived settings. The research strategy for the study was through the survey research methodologies. Self-administered questionnaires have been developed to collect the research data. This study was quantitative in nature. It quantified the problem by way of generating numerical data or data that could be transformed into usable statistics. It used measurable data to formulate the facts in the research. In this context, SmartPLS Version 3.0 has been used to analyse the data of the study.

3.2 Sample Profile

The study was conducted amongst the food processing manufacturers in Perak, Malaysia. 100 food processing manufacturers with the majority relative to small and medium industries (SME) having been selected. The purposive sampling technique has been chosen for this study. The questionnaires were distributed amongst the production/operations managers due to their knowledge and application of the practices by the personnel in the production process. The reason for the selection was based on the respondents being

able to respond or provide the desired information according to the criteria of the study. The total number of usable questionnaires received for the study were 80 respondents (80%) from the 100 questionnaires distributed in the study.

3.3 Analysis of Relationships

Measurement and structural models have been adopted in this study [32] and the measurements were established before analysing the structural model. In the measurement model, the individual loading of each item, composite, dependableness, average variance extracted (AVE), and discriminant validity were analysed. Meanwhile, the hypotheses testing associated with the objectives was analysed in the assessment of the structural model. The bootstrapping methodology was used to see the numerous levels of weights, path constants, and loadings [33].

3.4 Assessment for Measurement Model

According to [34], the reflective items of the factor loadings must be above the recommended value of 0.6. Then, for the composite reliability (CR), it must be not less than 0.7. However, according to researchers Bagozzi and Yi (1988), for the exploratory research, the composite reliability 0.6 and above is acceptable. Next, the average variance extracted (AVE) value must exceed 0.5 to be considered as accepted according to [34].

Table 1: Measurement Model Evaluation

Const ruct	No. of Items	Factor Loadings	Composite Reliability	AVE
TQM	5	0.728 – 0.843	0.894	0.629
LM	5	0.639 – 0.859	0.872	0.579
HSP	4	0.723 – 0.846	0.862	0.611
HAC CP	4	0.715 – 0.886	0.887	0.665
PP	4	0.760 – 0.876	0.901	0.696

Based on Table 1, it was clearly shown that all of the variables, which were total quality management, lean manufacturing, halal standard practices, and hazard analysis and critical control point, and the production performance factor loadings had exceeded the recommended value of 0.6. Whilst for the average variance extracted (AVE) for this study, the value was also over the

lowest limit of the recommended value, which was 0.5 and above.

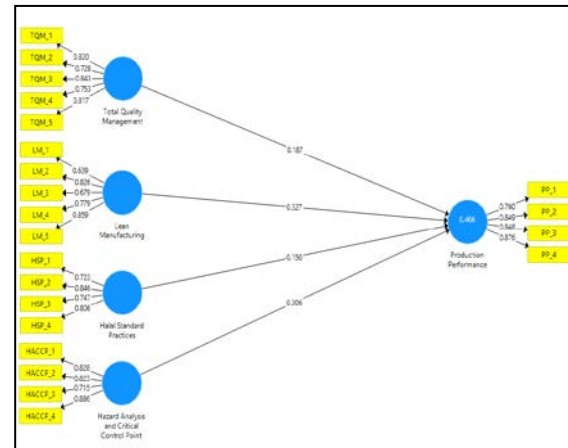


Figure 2. Measurement Model

Figure 2 showed the PLS modelling path that had been generated by SmartPLS 3.0. By referring to the figure, the independent variables for this study were total quality management, lean manufacturing, halal standard practices, and hazard analysis and critical control point whilst for the dependent variable it was production performance. Based on Figure 2, the coefficient of determination, R², for production performance was 0.466. The value of R² has suggested that 46.60% of the variance in the dependent variable, which was production performance, can be explained by the independent variables of the study, which were total quality management, lean manufacturing, halal standard practices, and hazard analysis and critical control point.

Table 2. Discriminant Validity

	(1)	(2)	(3)	(4)	(5)
HACCP	0.815				
(1)					
HSP	0.421	0.782			
(2)					
LM	0.233	0.620	0.761		
(3)					
PP	0.482	0.511	0.537	0.834	
(4)					
TQM	0.199	0.161	0.251	0.354	0.793
(5)					

The discriminate validity was measured by examining the cross loadings of each item in the constructs. The square root of the AVE for each construct greater than the inter-correlations between the constructs should indicate the model's discriminant validity [35]. The value of the discriminant validity must be higher compared to

the other correlation values amongst the variables. Table 2 showed the value of the discriminant validity for each latent variable or construct. Referring to the discriminant validity that has been made bold and highlighted. It is clearly shown that each variable had a greater value when compared horizontally and vertically. This means that each variable or construct was explained very well by its own construct only if compared to the others.

3.5 Assessment for Structural Model

The Bootstrapping test has been used to generate the T-statistics to test the significance level of the both inner and outer models. Bootstrapping is a resampling method that draws a large number of subsamples which are from the original data and estimates the model for each subsample [36]. In this study, it used larger subsamples to ensure the stability of the results. 1000 subsamples were used from the original sample of 80 with replacement to give the estimated standard errors. The results are depicted in Figure 3. The T-statistics are used to evaluate whether the path coefficients of the inner model are significant or not. A two-tailed T test was considered with 1.645 critical values of t at the significant level (p-value) of 0.05.

Table 3. Path Analysis Result

Hypo thesis	Path	Beta	Std Dev	T-Stat	Decisions
H1	TQM > PP	0.187	0.106	1.768	Supported
H2	LM > PP	0.327	0.142	2.296	Supported
H3	HSP > PP	0.150	0.101	1.485	Not Supported
H4	HACC P > PP	0.306	0.111	2.756	Supported

Note: TQM=Total Quality Management, LM=Lean Manufacturing, HSP= Halal Standard Practices, HACCP= Hazard Analysis and Critical Control Point

Table 3 showed the results of the path analysis with a positive and significant path leading from total quality management towards production performance with $\beta = 0.187$ and $t\text{-value} = 1.768^*$ ($t\text{-stats} > 1.645$), lean manufacturing towards production performance with $\beta = 0.327$ and $t\text{-value} = 2.296^{**}$ ($t\text{-stats} > 1.645$), and hazard analysis and critical control point towards production performance with $\beta = 0.306$ and $t\text{-value} = 2.756^{**}$

($t\text{-stats} > 1.645$). The remaining path, which was halal standard practices towards production performance, was found to be insignificant with $\beta = 0.150$ and $t\text{-value} = 1.485$ ($t\text{-stats} < 1.645$). Hence, H1, H2, and H4 were supported.

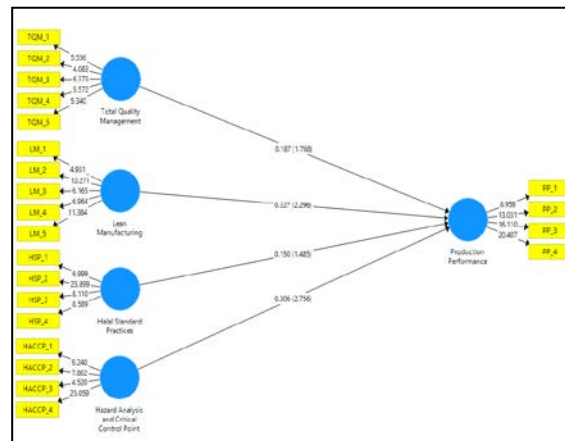


Figure 3. Structural Model

4. Discussion

Based on the data which has been analyzed, the hypothesis 1 (H1) is accepted. This is because it has exceeded the minimum significant level. The result of this study is consistent with previous studies. [37] noticed that the application of total quality management techniques affects the organizational performance in terms financial results, organizational integrity, performance capabilities, customer equity, and competitive positioning, especially when supported by clear vision and mission statements. The study found that the working norm in the production of a company is aligning towards the practices. From the start of the production line, quality factors are important for them. All of the staff took responsibility to maintain the quality of the product. A previous study by [38] supported this and revealed that total quality management practices can improve production performance, such as inventory and quality performances.

Other than that, [39] also showed that Chinese manufacturing firms could benefit from total quality management implementation. For example, inventory, defect rates, and waste were found to be reduced. Furthermore, their quality checker team always took a sample every within 40 minutes to make sure the water activity and thickness of the product are within their specifications. Other than that, all of the operators must make sure that the product is being completed according to the

standards provided. The operators must check to make sure that every product that passes through their section is of good quality. At the operator level, they have their own power to make decisions as to whether the product is in good condition or not, for as example, the texture and color of the product. This was supported by [40] who found that the implementation of total quality management in Chinese firms could improve quality and, productivity, and reduce cost. Other than that, if there is any issue arising with their customer. The top management like the production manager and general manager will directly check and find out the root cause. This result is also supported by a study from [41]. They stated that the, effective implementation of the quality management practice enables an organization to gain great performance in terms of customer satisfaction and sales and profit growth, but it greatly depends on the quality management practices which are implementation. Thus, there is enough proof to support hypothesis 1 (H1), which states that total quality management has a positive impact on production performance.

Based on the result of the finding for the hypothesis 2 (H2), lean manufacturing influences the production performance. Furthermore, the result of this study is consistent with a previous study's result. A study from [26] also concluded that lean manufacturing practices contributes significantly to all the measures of operation performance. Moreover, a higher extent of lean manufacturing implementation promotes better operation performance. Furthermore, [42] confirmed that the implementation of these practices is a powerful approach in achieving the strategic goals at the operations level. In a study by [43], they also stated that lean manufacturing bundles significantly affect the production performance such as scrap and rework costs, cycle time, labor productivity, unit manufacturing cost, and customer lead time. To some extent, the study conducted by [26] amongst various other studies concluded that this practice has helped a lot of organizations to improve their performances through waste elimination. At the operations level, several studies showed that lean manufacturing has become a powerful approach in increasing operations performance in terms of quality, inventory, delivery, productivity, and cost reduction. The researcher noticed that the respondents that from the organizations were already involved with the lean manufacturing, indirectly. Even the workers who did not received any formal training. Their top management had slowly applied lean manufacturing by restructuring the production

process like classifying their production into groups with similar processing procedures. Other than that, the management had tried to reduce the source of non-value-added excess waste like motion and movement waste. So, by the practice that has been made, it motivates he respondents to consider that importance of lean manufacturing in their organizations. According to [44], their study also aligned with the idea that excellent operational performance is achieved through the extensive use of many lean practices. They also stated that, only serious lean producers can expect better operational performance like quality, lead time, and inventory turnover. Thus, there is sufficient proof to support hypothesis 2 (H2), which states that Lean manufacturing has influence on production performance.

Based on the result in the previous chapter. The result was not similar with the hypothesis that has been stated. The result showed that, halal standard practice didoes not have any relationship between production performances. It means that, halal standard practices did not affect the production performance. On the other hand, based on the previous study, [14] stated that, the researchers have agreed that the implementation of food certification, in this case the Malaysian standard for halal food production, preparation, handling and storage (MS1500), has positively influenced operational performance. However, the result of that past research has different from the current study. The researcher in this study noticed that, the scope of the operational performance of the previous study did not focus on production performance. In the previous study, operational performance was only being measured by market share expansion, increased number of customers, impact on revenue, enhanced customer confidence, help in market entry, and increased consumer confidence. There was no relation with the improvement on production performance that leads to the reduced number of rejected and waste products. Other than that, the halal standard practice as stated by the *Jabatan Kemajuan Islam Malaysia* is focused on how to produce the products according the Shariah compliance rather than to improve production performance [45]. Thus, there is inadequate evidence to prove the hypothesis 3 (H3).

Furthermore, the results showed that hypothesis 4 (H4), which states that hazard analysis and critical control point affects the production performance, was accepted. The result from this study is found to be similar with previous studies. A previous study by [46] also showed a significant result with this

study. Based on their research, Australian firms operating in the meat industry gained benefits due to the implementation of the hazard analysis and critical control point program. The Australian firms faced a reduction in rejects, rework, out of specification products, reduction in customer complaints, improved product hygiene, improved morale, and an increase in overseas markets. Other than that, [21] reported that this practice enables a firm to increase its productivity and lower its production costs. As a result of the implementation of the hazard analysis and critical control point in Cargill, it showed that the system enabled the organization to achieved better food safety, reduced reworks and losses, a steady production process, and increased employee commitment.

In a study by [21], they stated that the hazard analysis and critical control point promotes to operational advantages that are related to better control of the process, reduced number of reworked products, minimized usage of raw materials and damaged finished products, reduced number of microbial contaminations in the products, which lead to the improved lifespan of the products, and gains in production efficiency. Every year, the organization will keep their workers updated with the hazard analysis and critical control points. Accordingly, to this activity helps to give the workers more understanding and more familiarity about this practice. This also may be the main reason this practice has become the most significant to the study. Thus, there is enough proof to support hypothesis 4 (H4), which states that the hazard analysis and critical control point has influence on production performance.

5. Conclusion

As a conclusion, the major objective of conducting this study was finding the factors that can improve the production performance amongst food manufacturers in Malaysia. Based on the study, production performance has been measured from the four major practices. The four major practices consist of total quality manufacturing, lean manufacturing, halal standard practices, and hazard analysis and critical control point (HACCP). Then, all of the practices were used are classified under independent variables to be tested with production performance as the dependent variable.

The results unveiled three practices which had aware significant impact on the production performance among food processing manufacturers in Perak. The variables that showed have significance in to this study were total quality

management, lean manufacturing and hazard analysis and critical control point (HACCP). These results were found to be consistent with the studies conducted in the past. It is suggested that for the firms to increase their focus on this practice to improve their production performances. Organizations need to take serious action on the HACCP since it has a major impact onto the production performance. In addition, firms also need to take a consideration of total quality management and lean manufacturing since it also promotes better production performance. However, for future research, aspects like new variables or variables not listed variable and the sample size need to be highlighted to for gain better results and understanding. Future researchers should also should try to obtain more data from the top management level to get better results for the study.

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