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Factors That Boost the Technological Capability of Malaysian Food Manufacturing Industry

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Abstract: The increasing urbanization of the world has created new issues and challenges for the modern food industry to meet customers' changing demands. To address these issues, these firms need to invest in technological capability development. This study examines factors that affect the technological capability of food manufacturing firms. A large-scale survey of a sample of 270 food manufacturing firms in Malaysia was conducted. Structural equation modeling was used to evaluate the observed variables. The result shows that organizational innovation fully mediates the relationship between organizational learning and technological capability. Overall, the findings suggest that food manufacturing firms in Malaysia that want to enhance their technological capability should focus on developing and implementing organizational innovation practices, in addition to other strategies and practices that aim to promote organizational learning and innovation. This research contributes to the development of related theories and has practical implications for the stakeholders in the food manufacturing industry.

Keywords: knowledge management; organizational learning; organizational innovation; technological capability; structural equation modeling; KBV theory; absorptive capacity theory

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1. Introduction

The increasing urbanization of the world has created new challenges for the modern food industry as consumers demand higher quality, safety, and variety in their food products. To meet these demands, the manufacturing of food has become more diverse and complex, requiring the adoption of new innovative processing technologies. There has been a focus on improving the efficiency, safety, and stability of food products in a healthier way [1].

In Malaysia, the food manufacturing sector is one of the key industries that contribute to economic and social growth. Malaysia managed to double its export value over the last ten years. However, Malaysia heavily relies on imported food products as the local production is insufficient to cater to the country's ever-growing population. Malaysia is a net importer of food, with processed food imports totaling MYR 20 billion [2] and about 24% of the total food supply in the country is imported [3]. Therefore, this is an issue of grave concern as it affects food security and sustainability, as evidenced by what happened in Singapore when the COVID-19 outbreak hit. Singapore imports nearly 90% of the food it consumes locally, and as the 2020 global lockdown disrupted supply chains, it induced panicked consumer behavior and worsened food insecurity for vulnerable communities as their incomes declined [4]. Malaysia is committed to implementing the 2030 Agenda for Sustainable Development; hence, efforts must be focused on creating a food production system that is sustainable, enhances productivity, and increases output, all while ensuring that food is abundant, safe, reasonably priced, and nutritious.

Food manufacturing firms in Malaysia face a number of challenges, including competition, food safety and quality, sustainability, cost, and market opportunities [5]. To address

these issues, it is important for these firms to invest in technological capability development. By implementing technological solutions, a firm can streamline its operations, automate tasks, and improve the accuracy and speed of its processes. This can lead to significant cost savings and increased output, which can translate into increased profitability and competitiveness [6,7]. By adopting these technologies, food manufacturing firms in Malaysia can improve their production processes, increase efficiency, reduce costs, improve the safety and quality of their products, reduce their environmental impacts, and expand their market opportunities [8,9]. Overall, investing in technological capability development can help food manufacturing firms in Malaysia stay competitive, improve their sustainability, and meet the evolving needs of consumers.

Based on Grant's [10] theory on the firm's knowledge and Cohen and Levinthal's [11] theory on absorptive capacity, this study proposed knowledge management and organizational learning as the antecedents of technological capability. Organizational innovation is used as the mediator for both variables.

Previous studies highlighted that a firm's technological capability developed over time and accumulated through its past experiences [12,13]. Through the knowledge management process, firms that can accumulate their technological knowledge will have the enhanced ability to employ new technologies in their operations and product development processes [14]. In other words, knowledge management helps the firm improve its technological capability.

Ultimately, ineffective knowledge management practices can result in a loss of competitive advantage, decreased efficiency, and reduced innovativeness, all of which can have significant consequences for a firm's sustainability. Without proper knowledge management, knowledge assets can become obsolete and ineffective, hindering efficient decision making and problem solving. In addition to this, if knowledge is not shared across the firm's levels, valuable insights and expertise may be lost, resulting in missed opportunities and decreased productivity. Empirical studies have demonstrated the positive impact of knowledge management on firms' competitive advantage, underscoring the importance of effective knowledge management in contemporary firms [15–17].

Moreover, past works of literature also conducted studies that look at organizational learning and technological capability. Organizational learning plays a crucial role in an organization's ability to develop and enhance its technological capability. Failing to invest in effective learning practices can limit an organization's ability to enhance its technological capabilities and adapt to dynamic market environments, ultimately hindering growth and competitiveness [18,19]. Therefore, it is essential for organizations to prioritize organizational learning to stay competitive and ensure they can adapt to rapidly changing market environments.

In this study, organizational innovation is used as the mediator in the framework. Mixed research findings suggest that the relationship between organizational learning and technological capability is not straightforward [20,21]. For instance, merely "learning by using" is insufficient to develop technological capability; instead, knowledge flows and organizational learning must be supported through the integration of other aspects [22]. Additionally, the sources of learning, including internal, local, and global sources, are continually evolving as firms' technological capabilities progress [23].

Despite the wealth of literature in the field, there is a lack of studies that investigate the development of technological capability. Given the rising importance of technology in the food manufacturing industry, there is an essential need to identify the antecedents of the technological capability of the firms. To fill this gap, the current study analyzes the multi-dimensional relationship between knowledge management, organizational learning, organizational innovation, and technological capability and examines how knowledge management and organizational learning processes impact the organizational innovation and technological capability of the firm.

2. Review of the Literature

2.1. Underpinning Theories

The current study is founded on the knowledge-based theory of the firm and absorptive capacity theory to develop a new theoretical framework to investigate the antecedents of technological capability. KBV determines the characteristics of knowledge that have important implications for the competitive advantage of the firm [10]. On the other hand, absorptive capacity has been defined as "the ability of a firm to recognize the value of new external information, assimilate it and apply it for business purposes [11]. Zahra and George [24] further develop our understanding by describing absorptive capacity as a set of organizational routines required to identify and utilize knowledge. These perspectives have a common ground in that they both suggest the enhancement of a firm through knowledge as a sustainable competitive advantage.

According to the KBV theory, a firm's knowledge base is a critical factor in its competitiveness and success in the market. Knowledge is regarded as a very unique strategic resource that can produce increasing returns and does not degrade over time like traditional economic productive factors do. Knowledge resources are particularly important to ensure that competitive advantages are sustainable, as these resources are difficult to imitate and are the foundation for sustainable differentiation. In this context, knowledge management (KM) is known as a tool to manage knowledge resources [25]. The KBV theory suggests that effective knowledge management is essential for a firm to fully leverage its knowledge base and achieve its strategic goals. Effective knowledge management allows organizations to create new knowledge, acquire knowledge from external sources, and use knowledge to create value, which can improve technological capabilities and increase competitiveness.

On the other hand, absorptive capacity is defined as the firm's capacity to assimilate and use the knowledge transferred [11]. There can be too little as well as too much technological learning taking place in firms. The absorptive capacity theory explains organizational learning by focusing on an organization's ability to recognize the value of new knowledge, assimilate it, and apply it to commercial ends. According to this theory, an organization's absorptive capacity is the key determinant of its ability to learn and absorb new knowledge and technologies. Organizations with high absorptive capacity can effectively recognize, assimilate, and apply new knowledge, while those with low absorptive capacity may struggle to do so.

2.2. Technological Capability

In the literature, technological capability is defined in a variety of ways. A further categorization of these definitions into three approaches is proposed. Firstly, the structural method derives a firm's technological capability from investment, production, and linkage [26]. Lall's elaboration on technological capability has been used as a framework for evaluating technological capability [27–29]. In the second approach, technological capability is considered as a process that looks at the firm's technical capability from one phase to another to generate the capability's dynamic. Desai [30] defined technological capability as a firm's ability to acquire, use, imitate, and develop technological innovation.

Bell and Pavitt [31] define technological capability as a firm's ability to develop and manage technological change. These resources include skills, knowledge, experience, and institutional structures and links. Figueiredo [32] further added that it is the interrelated human capital, technology infrastructure, and organizational structures that can perform technological activities. The intangible features help the firm promote its products and increase its productivity. Many scholars have recently adopted this idea of technological capability [7,33–36]. In addition to the firm's ability to acquire, adapt, and modify existing technologies, technological capability refers to the ability to use its technological knowledge and skills to create new products and processes and to improve existing technology so that new knowledge and skills can be generated. The mere presence of an activity does not make it a competence; only outstanding and mature procedures and skills can be regarded as a technological capability [37].

In a nutshell, technological capability is a firm's abilities, knowledge, technologies, and structures utilized to invent, adapt, and develop new products and processes. Notably, technological capability goes beyond combining intangible assets into a firm's advanced technology. Managing the internal tangible technology base and intangible resources, as well as external network links, is also part of technological capability. Technological capability is sophisticated, invisible, durable, and cannot be replaced, and therefore is an asset for sustainable competitive advantage. The current period of globalization and the economy has caused economic instabilities everywhere. Hence, technological capacity is vital for any firm's technological advancement.

Technological capability has been unanimously seen as one of the most important strategic resources that enable firms to establish their long-term competitive advantage. Since technological capability is made up of technological knowledge, production skills, trade secrets, and invaluable patterns, it is hard to be imitated by competitors. Without technological capability, R&D investment per se could not provide a sustainable competitive advantage to the firm because such investment can also be easily replicated by competitors [38]. However, when the technological capability is incorporated, this intangible asset is embedded within the firm and is developed through "learning by doing"; hence, it cannot be transferred across firms or copied by rivals. Without similar experiences, competitors are unlikely to understand or replicate the firm's technological capability.

2.3. Knowledge Management and Technological Capability

Nowadays, the source of wealth creation and performance has changed to intellectual capital, and knowledge has become a valuable asset. Gone are the days when financial capital and labor force were considered the criteria for a firm's progress. Knowledge management recognized the importance of knowledge as a critical asset for a firm. It is an essential determinant of a firm's success. Knowledge management helps a firm ensure that information and intellectual assets are being appropriately utilized by transforming them into value by identifying the 'right knowledge' to be used at the 'right time' [15]. Through the systematic management of this social capital, the competitive advantage of the firm is created. Eventually, knowledge management facilitates organizations to adapt to market requirement and improve efficiency and innovativeness [18]. The process of developing technological capability involved knowledge at some level, and it necessitated adopting knowledge management. Effective knowledge management also allows organizations to use their knowledge to create value for the organization, which can improve their technological capabilities by allowing them to achieve a competitive advantage in the market.

Many studies have been conducted to examine the elements that influence the development of technological capability. However, limited evidence investigates the direct effect of knowledge management on technological capability. A study that investigates the firm technological capability of a manufacturing industry in Thailand confirmed a positive association between knowledge acquisition, knowledge assimilation, knowledge transmission, and knowledge application with technological capability development [39]. In addition to this, through a qualitative interpretive approach, another study found that a prior knowledge base and technological know-how is significant in accumulating a firm's technological capability [40]. Firms with effective knowledge management systems can create new knowledge by leveraging their internal resources and expertise. This can allow them to develop new technologies or improve existing ones, which can improve their technological capabilities. A similar study supported this argument and concluded that a firm's prior knowledge base and effort towards intense learning must be rapidly increased to acquire technological capability in developing countries [41]. Based on these arguments, the following hypothesis is proposed for this study:

H1. *Knowledge Management has a significant direct effect on technological capability.*

2.4. Organizational Learning and Technological Capability

Organizational learning is a dynamic process of distributing, explaining, and transforming information into new knowledge and more effective organizational action [42]. The process of organizational learning acts as a catalyst for organizational change and knowledge sharing within the firm; thus, it is a strategic tool for organizational renewal. In addition to this, organizational learning also serves as a tool for the detection of errors in the firm during operation or when responding to environmental changes and correcting them by reorganizing the structure [43]. Organizational learning can help organizations adapt to changing market conditions and customer needs, which can improve their technological capability by allowing them to respond to changing demands in a timely and effective manner. Organizational learning is linked to technological capability; technological capability is a process of accumulating technical knowledge [44]. Since it is not only composed of individuals' knowledge and skills but also the organization and purpose, it all requires learning and assimilation [29]. When an organization can effectively learn and apply new knowledge, it can improve its technological capabilities and increase its competitiveness in the market.

Several studies have attempted to establish the linkage between organizational learning and firm technological capability. A study examined how multinational companies contribute to the local industry's technological capability and found that local suppliers improve their technological capability by learning through backward linkages. The investment by multinational companies' subsidiaries is an essential source of knowledge acquisition for these local suppliers' capability building [45]. In the same vein, another study proved that apart from imports of highly complex products, investment in learning, immigration, and the number of technical experts is among the essential elements of developing technological capability [46]. The international immigration factor helps in attracting brain gain and increases the productivity of a firm. Finally, the training of talents, cooperative relationships, and knowledge distribution are among the significant factors that affect technological capability [47]. Based on these arguments, this study seeks to propose the following hypothesis:

H2. *Organizational learning has a significant direct effect on technological capability.*

2.5. Organizational Innovation and Technological Capability

Organizational innovation is the implementation of a new organizational method in a firm's practices, workplace organization, or external relationships [48]. It is a change in method for managerial practice that is new at the point of adoption. Furthermore, organizational innovation is also posited as a wide array of activities that include programs, services, devices, systems, or policies meant to facilitate and achieve the firm's innovation outputs [49]. It is how the firm can identify a problem and collect related information to create new ideas so that a viable solution to the issue can be explored.

In the food manufacturing industry, organizational innovation may receive inadequate attention compared to technical innovation, which refers to the development of new products or processes [50]. This is because the food manufacturing industry may place a greater emphasis on technical innovation due to the competitive nature of the industry, which could make it more difficult for organizational innovation to receive the same level of attention and resources. However, organizational innovation is important because it can have a significant impact on the technological capability of a firm. This is because both organizational and environmental factors influence a firm's innovation efforts, and organizational innovation can create an environment that is conducive to the development of new technologies [51]. In addition, the overall innovation performance of food manufacturing firms is influenced by organizational innovation, which can help firms meet customer demand, develop new organizational practices, improve external relationships, and enhance innovation activity [52]. Finally, this study argues that the development of technological capability depends on the adoption of organizational innovation through nurturing an environment that encourages the adoption and use of new technologies. By

encouraging employees to experiment with new technologies and approach problems in new ways, an organization can foster a culture of innovation that supports the development of technological capability. As a result, integrating organizational innovation helps a firm stay at the forefront of technological development and be better able to adapt to changing market conditions [53]. Hence, the following hypothesis is proposed:

H3. *Organizational innovation has a significant direct effect on technological capability*.

2.6. Mediating Effect of Organizational Innovation

Innovation is assumed to be a process of achieving technological capabilities as it is considered an activity that promotes technical change. However, in many large firms, innovation fails not because they merely lack technological knowledge but because the major problem arises in the organization itself [54]. These factors can include the organization's culture, structure, processes, and leadership. For example, an organization with a risk-averse culture may be less likely to pursue innovative ideas, while an organization with a rigid structure may struggle to implement new processes or technologies. For innovation to be successful, an organization needs to have a supportive environment that encourages and enables innovation to take place. This can involve creating a culture that values and rewards innovation, as well as establishing processes and structures that support the development and implementation of new ideas.

Research has shown that KM can have a positive impact on organizational innovation. For example, Sesay et al. [55] found that KM provides a foundation for research and analysis activities, which can support the development of new ideas and innovations. Similarly, Breznik [56] found that KM can trigger a firm's innovation activities by providing access to information and expertise that can be used to generate new ideas. By managing knowledge effectively, organizations can better support their innovation efforts and stay competitive in the market.

A vast amount of literature has explored the link between organizational learning and firm innovation. A strong dedication to learning, open-mindedness, and a common objective lead to increased innovation in firms [57]. Furthermore, learning plays a key role because it allows individuals to improve their skill set to generate and implement organizational innovation. Learning allows the firm to establish innovative organizational methods for external relations, decision making, and diverse business activities [51].

The importance of the organizational innovation construct has traditionally been outlined as being essential for a firm's survival and effective performance. Thus, it seems important to establish whether knowledge management and organizational learning can be considered an antecedent of organizational innovation and, consequently, to confirm whether organizational innovation acts as a mediating variable in the knowledge management, organizational learning, and technological capability linkage. Given these arguments, this study proposes that the relationships between knowledge management and organizational learning with technological capability are mediated by organizational innovation. As a result, the following hypotheses are proposed:

H4. *Organizational innovation mediates the relationship between knowledge management and technological capability*.

H5. *Organizational innovation mediates the relationship between organizational learning and technological capability*.

The proposed framework for this study is presented in Figure 1. The independent variables are knowledge management and organizational learning; organizational innovation is the mediating variable; and technological capability is the dependent variable.

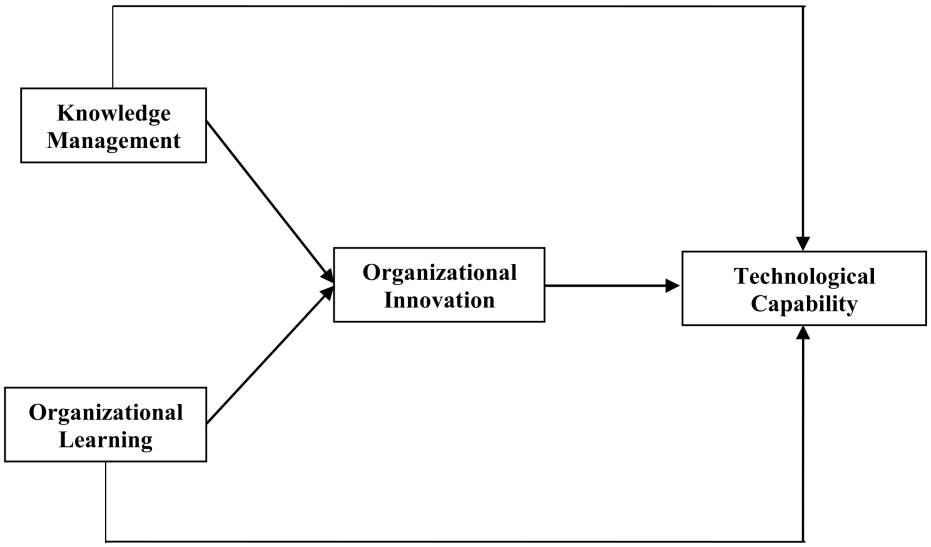

Figure 1. The conceptual framework.

3. Methods

3.1. Sample and Procedure

The study's target population is based on the Federation of Malaysian Manufacturers (FMM) Directory of Malaysian Industries 49th Edition. The Federation of Malaysian Manufacturers (FMM) is the largest private sector economic organization in Malaysia, comprising more than 3000 manufacturing and industrial service companies of varied sizes. After scrutinizing the list, the total number of food manufacturing firms that were listed in the directory is 388 firms.

After obtaining the total population of the food manufacturing firms that were listed in the directory, the sample size for this study was determined. The sample size was drawn from the table for determining sample size by Krejcie and Morgan [58]. The table can be utilized if the population size is known. Hence, according to Kriejcie and Morgan's sample determination, 191 firms were required as the sample. In addition to this, Hair et al. [59] proposed the minimum sample size of 100 to 150 to ensure a stable maximum likelihood estimation (MLE) solution. However, to minimize error in sampling and to take care of the non-response rate issue, Cohen et al. [60] suggested doubling the sample size. As such, we decided to use all 388 food manufacturing firms as the target sample for this research. We contacted the executive level and above employees of the firms as the respondents. Questionnaires were distributed to all 388 firms, of which 270 (69.6%) were returned after having been completed. Table 1 provides the demographic information of the participating firms in the survey.

Table 1. Demographic profiles.

Demographic	Categories	F	%
Firm Size	≤75 employees	189	70.0
	75 ≤ 200 employees	56	20.7
	≥200 employees	25	9.3
Firm Age	≤3 years	75	27.8
	3 ≤ 10 years	120	44.4
	11 ≤ 20 years	50	18.5
	≥20 years	25	9.3

3.2. Measures

The data were obtained using structured questionnaires (refer to Table S1). We incorporated items from previous pieces of literature for the indicated constructs of knowledge management (KM) [61], organizational learning (OL) [62], organizational innovation (OI) [63], and technological capability (TC) [64]. The instruments were developed to collect data on the determinants of the technological capability of food manufacturing firms. The items for these constructs were derived from past research since they were frequently used and had an established original composite reliability value of more than 0.7 [59]. The use of a scale with a midpoint, such as a five-point Likert scale with responses ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree", will be more accurate and allows respondents to express their opinions [65,66].

To ensure the reliability and validity of the measures, a pilot test and exploratory factor analysis (EFA) were done before the field study. The dimensions of previous research may not be the same, especially if the present study is undertaken in different industries and environments [67]. In addition to this, the issue of common method variance, where systematic measurement error can lead to bias in the relationship between variables, may occur when the same person provides measures for both exogenous and endogenous variables. One technique for addressing this issue is the Harman single-factor test, which involves performing an exploratory factor analysis by loading all variables into one single factor and examining the unrotated factor solution [68]. In this study, the total variance extracted when all items were constrained to one factor was 44.66%, which was below the suggested threshold of 50%. Therefore, it was concluded that the collected data were free from the threat of common method bias.

This study applied structural equation modeling (SEM) to investigate the causal influence of organizational characteristics on the technological capability of manufacturing firms. This is a popular method with a wide variety of applications in many different research fields. SEM allows the researcher to assess the individual constructs, mediating and moderation effects, as well as the fitness of the overall model simultaneously [67]. Furthermore, confirmatory factor analysis in SEM improves the validity and reliability analysis of the observed variables by considering the correlated measurement errors among the response items [69,70].

4. Results

The reliability analysis was conducted to verify the instruments' reliability for the constructs of knowledge management, organizational learning, organizational innovation, and technological capability. Cronbach's alpha was greater than 0.7 for all constructs, according to Table 2. A Cronbach's alpha score higher than 0.6 indicates that the instruments are reliable and should therefore be utilized in future research [67].

Table 2. The reliability assessment for all constructs.

Construct	No. of Items	Cronbach's Alpha
Technological Capability	11	0.922
Knowledge Management	8	0.795
Organizational Learning	14	0.775
Organizational Innovation	11	0.909

The measures of the skewness and kurtosis for every component are presented in Table 3. The results show that all constructs' scores are normally distributed. Since the maximum likelihood estimator (MLE) algorithm is robust to skewed data, research must establish that the skewness value for all items does not depart from normality. Skewness values in the range of −1.5 to 1.5 are acceptable for a sample size greater than 200 [67,71].

Table 3. The assessment of normality for every component.

Variable	Min	Max	Skewness	c.r.	Kurtosis	c.r.
TC16	1.000	5.000	−0.114	−0.762	−0.676	−2.266
TC15	1.000	5.000	−0.324	−2.173	−0.403	−1.350
TC12	1.000	5.000	−0.103	−0.688	−0.789	−2.646
TC11	1.000	5.000	−0.444	−2.977	−0.010	−0.033
TC8	1.000	5.000	−0.034	−0.231	−0.060	−0.203
OI14	1.000	5.000	−0.159	−1.066	−0.501	−1.679
OI8	1.000	5.000	0.059	0.397	−0.494	−1.657
OI7	1.000	5.000	−0.138	−0.927	−0.439	−1.472
OI6	1.000	5.000	−0.371	−2.488	−0.379	−1.270
OI3	1.000	5.000	−0.223	−1.494	−0.530	−1.776
OI2	1.000	5.000	−0.225	−1.512	−0.462	−1.550
OI1	1.000	5.000	−0.109	−0.732	−0.738	−2.476
OL22	1.000	5.000	−0.222	−1.492	−0.506	−1.698
OL21	1.000	5.000	−0.756	−5.069	0.309	1.037
OL20	1.000	5.000	−1.016	−6.814	1.024	3.435
OL13	1.000	5.000	−0.265	−1.775	−0.327	−1.098
OL2	1.000	5.000	−0.262	−1.756	−0.246	−.826
KM8	1.000	5.000	−0.196	−1.315	−0.644	−2.161
KM7	1.000	5.000	−0.699	−4.692	0.207	0.696
KM6	1.000	5.000	−0.646	−4.330	0.271	0.908
KM3	2.000	5.000	−0.714	−4.786	0.114	0.382
Multivariate					62.605	16.549

The study needs to validate the measurement model of all latent constructs in the model for unidimensionality, validity, and reliability before modeling the structural model and executing the structural equation modeling (SEM). Confirmatory factor analysis (CFA) is a statistical technique used to assess the validity of a measurement model, which represents the relationships between observed variables and latent constructs. In CFA, all the constructs are pooled together and analyzed at once using a double-headed arrow [69]. The goal is to achieve both convergent and construct validity, which may require modifying or deleting items in the model one at a time until satisfactory fitness indexes are achieved. Figure 2 depicts the final measurement model.

The assessment for construct validity is shown in Table 4. The particular latent construct is considered valid if its fitness indices achieve the required construct validity level [59].

Table 4. The fitness indices for the measurement model.

Category	Fit Index	Index Value	Comments
Absolute Fit	RMSEA	0.085	The required level is attained
Incremental Fit	CFI	0.900	The required level is attained
Parsimonious Fit	ChiSq/df	2.953	The required level is attained

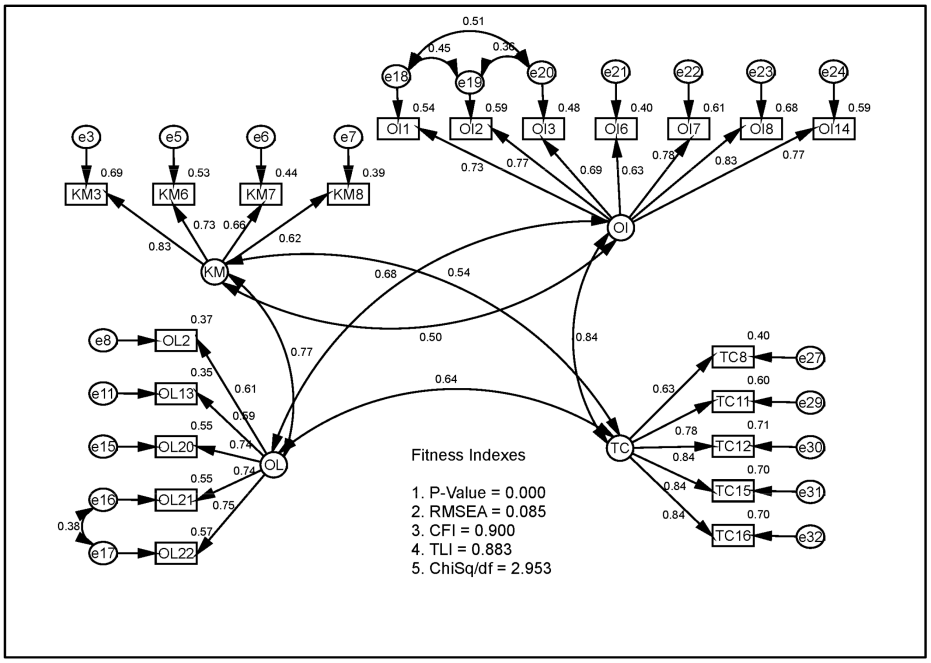

Figure 2. The final measurement model for pooled-CFA combining all the constructs.

Furthermore, the study must assess the convergent validity and reliability using the average variance extracted (AVE) and composite reliability (CR) values. If the construct's AVE is greater than the 0.5 thresholds, it has achieved convergent validity. However, if the CR value is higher than 0.6, the AVE value of 0.4 can be accepted, suggesting that the construct has established convergent validity [72]. To evaluate the composite reliability, the CR needs to be computed, and its value should exceed the 0.6 thresholds to be considered reliable [73,74]. The AVE and CR for all constructs are summarized in Table 5. When the requirements for unidimensionality, validity, and reliability for the measurement model are fulfilled, this CFA model may be processed for analysis in the structural equation modeling.

Figure 3 depicts the estimated results of modeling the inter-relationship among the constructs. The model has an R2 value of 0.73. Overall, the model is good since it was able to capture 73% of the information on the endogenous construct by integrating certain exogenous constructs in the model. At the same time, most fitness indices are appropriate since the values met the required level and the factor loading for all items are satisfactory (above the required 0.6). This model indicates that 73% of technological capability could be estimated by using three exogenous constructs, namely knowledge management, organizational learning, and organizational innovation, while 47% of organizational innovation could be measured using knowledge management and organizational learning.

Table 6 depicts the estimated direct effect between constructs. Organizational learning has a statistically significant direct impact on organizational innovation. The direct effect of organizational innovation on technological capability is also statistically significant. However, statistical analysis for the present study supported the hypothesis that organizational innovation has a statistically significant direct impact on technological capability (H3). However, the hypotheses about the direct effects of knowledge management (H1) and organizational learning (H2) on technological capability were not supported.

Table 5. The summary for AVE and CR.

Construct	Items	Factor Loading	CR (above 0.6)	AVE (above 0.5)
KM	KM3	0.83	0.805	0.511
	KM6	0.73		
	KM7	0.66		
	KM8	0.62		
OL	OL2	0.61	0.818	0.479
	OL13	0.59		
	OL20	0.74		
	OL21	0.74		
	OL22	0.75		
OI	OI1	0.73	0.897	0.556
	OI2	0.77		
	OI3	0.69		
	OI6	0.63		
	OI7	0.78		
	OI8	0.83		
	OI14	0.77		
TC	TC8	0.63	0.890	0.621
	TC11	0.78		
	TC12	0.84		
	TC15	0.84		
	TC16	0.83		

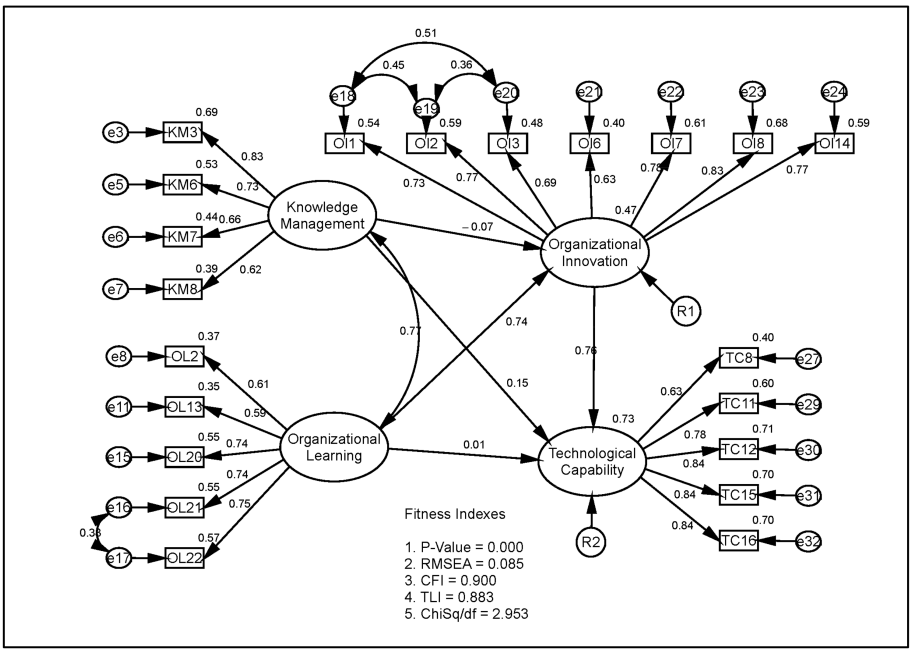

Figure 3. Structural model of knowledge management, organizational learning, organizational innovation, and technological capability.

Table 6. The regression path coefficient and its significance.

Construct	Path	Construct	Estimate	*p*-Value	Result
Organizational Innovation	←	Knowledge Management	−0.07	0.552	Not Sig
Organizational Innovation	←	Organizational Learning	0.76	0.001	Sig
Technological Capability	←	Knowledge Management	0.15	0.106	Not Sig
Technological Capability	←	Organizational Learning	0.01	0.958	Not Sig
Technological Capability	←	Organizational Innovation	0.76	0.001	Sig

We intended to test further whether organizational innovation mediates the relationship between knowledge management, organizational learning, and technological capability. To examine the mediation effect of organizational innovation in the relationship between knowledge management and technological capability, and between organizational learning and technological capability, the study employed the procedure [69], as shown in Figures 4 and 5.

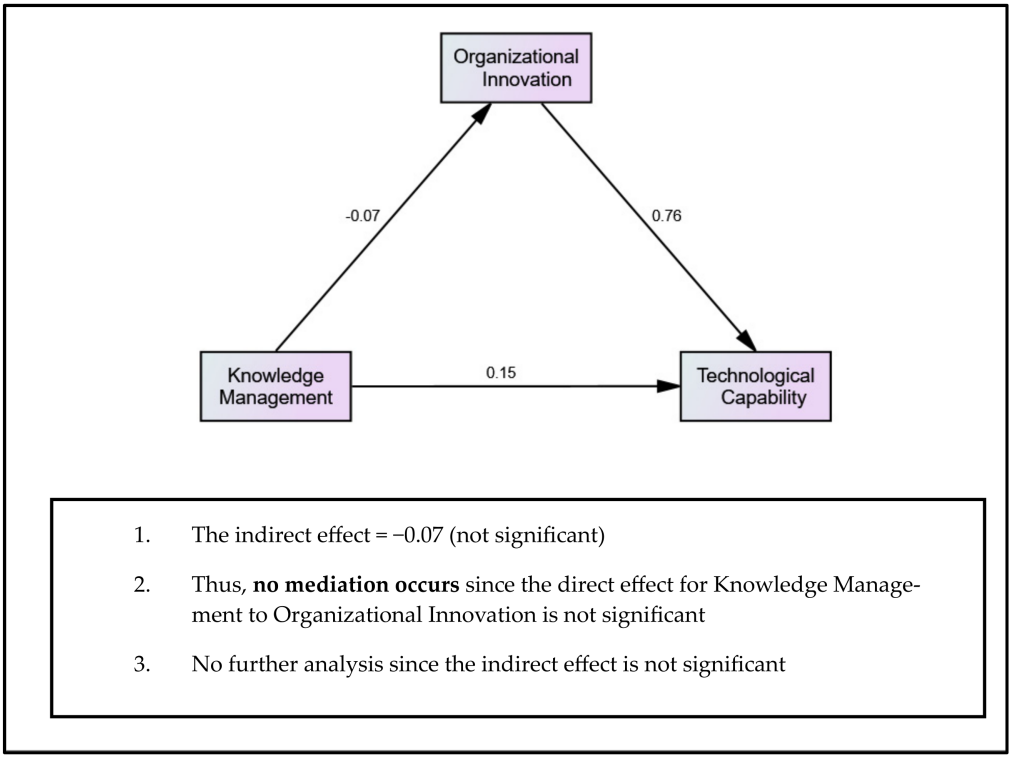

Figure 4. The mediation testing procedure for KM—OI—TC.

The result of hypothesis testing in Figure 4 indicated that organizational innovation does not mediate the relationship between knowledge management and technological capability since the direct relationship between knowledge management and organizational innovation is not significant. Therefore, H4 is not supported.

The result of hypothesis testing in Figure 5 indicated that organizational innovation mediates the relationship between organizational learning and technological capability. Furthermore, the type of mediation here is complete mediation since the direct effect is insignificant. Hence, H5 is supported.

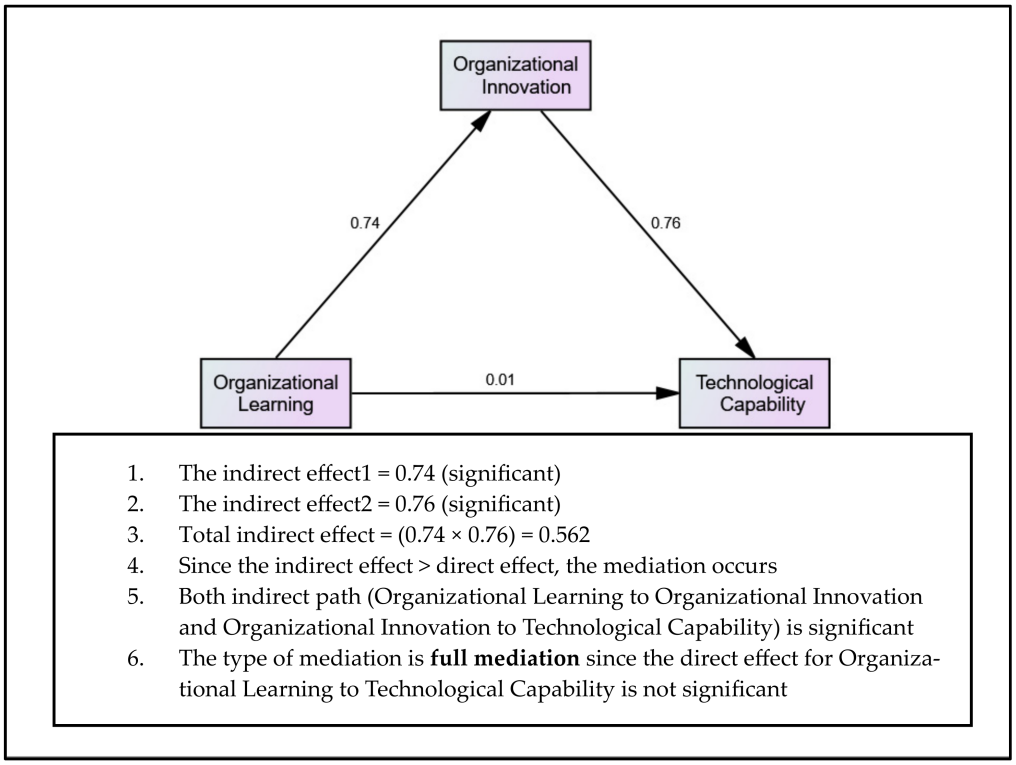

Figure 5. The mediation testing procedure for OL—OI—TC.

5. Discussion

Based on the result, we found that organizational innovation plays a significant role in the development of a firm's technological capability, whereas organizational learning and knowledge management have a limited impact on the firm's technological capability. This is demonstrated by the fact that organizational innovation fully mediates the relationship in the framework. In other words, this study suggests that the ability of food manufacturing firms in Malaysia to learn and absorb new knowledge may not have a direct impact on their technological capability. Nevertheless, it could influence their ability to introduce new ideas, processes, products, or services that improve their technological capability.

As noted, organizational innovation is the process by which a firm can identify problems and gather data to create new solutions. Organizational innovation practices that facilitate the absorption and integration of new knowledge may be critical for the development of the firm's technological capability. Firms that can learn and innovate effectively may be more likely to develop and improve their technologies, while those that are not able to do so may struggle to keep pace with their rivals in the industry. This finding aligns with absorptive capacity theory, which states that a firm's ability to learn and innovate depends on its ability to absorb and integrate new knowledge from external sources [75].

On the other hand, the limited effect of knowledge management practices in Malaysian food manufacturing firms may be the explanation for the weak association between knowledge management and technological capability. Additional factors must be taken into account, such as the lack of executive leadership, and the shortage of skilled labor, as well as other resources that are more important in the context of Malaysian food manufacturing setting [76–79]. Food manufacturing firms in Malaysia may face constraints on their resources, such as funding and time, that could limit their ability to invest in knowledge management systems [80,81]. Additionally, previous scholars had mentioned that the Malaysian manufacturers are struggling to find and hire skilled professionals, such as engineers or technologists, who could contribute to the development of new technologies or processes [82]. Consequently, this hinders the firm's ability to learn and innovate.

In this perspective, the firm's knowledge management practices might still be beneficial for other purposes, such as increasing the efficiency and productivity of its employees, but they might not contribute to the firm's technological capability [83]. This result is in line with the knowledge-based view (KBV) theory of the firm. According to KBV theory, a firm's knowledge assets, such as its technological knowledge, are a key source of competitive advantage and a key determinant of the firm's performance. However, KBV theory also suggests that the impact of knowledge assets on performance depends on the firm's ability to create, share, and apply these assets effectively [84].

In a nutshell, this study illustrates how critical organizational innovation is for boosting the technological capability of food manufacturing firms in Malaysia. The findings imply that organizational learning and knowledge management may not directly influence a firm's technological capability. Nevertheless, they may be useful in helping to bring new ideas, processes, products, or services that enhance a firm's technological capability through organizational innovation. The findings also highlight the necessity for food manufacturing firms in Malaysia to have strong organizational innovation strategies in order to remain competitive in the market.

6. Conclusions

Technological capability of food manufacturing firms is critical to improving productivity and eventually contributing to national economic growth and sustainability. This study explored the development of the technological capability of the Malaysian firms by identifying factors that may boost a firm's technological capability. In this study, we found that organizational innovation fully mediated the relationship between organizational learning and technological capability. Overall, the findings suggest that food manufacturing firms in Malaysia that want to enhance their technological capability should focus on developing and implementing strong organizational innovation practices, in addition to other strategies that aim to promote organizational learning and innovation.

6.1. Theoretical and Practical Implications

This study provides some theoretical implications. From a knowledge-based view (KBV) perspective, we suggest that knowledge management practices alone may not have a significant impact on the technological capability of food manufacturing firms in Malaysia, as the impact of knowledge assets on a firm depends on its ability to create, share, and apply them effectively. In addition to this, we explored the development of absorptive capacity theory and supported the premise that a firm's ability to learn and innovate depends on its ability to absorb and integrate new knowledge from external sources. In addition to this, our study expands the body of literature by suggesting a framework on the factors affecting a firm's technological capability.

Our findings also suggest substantial practical implications that may be useful for the food manufacturing industry. Managers of the food manufacturing firms in Malaysia must focus on developing and implementing organizational innovation practices to enhance their technological capability, such as finding opportunities for new technological development, introducing new technologies or processes, and implementing strategies to absorb and integrate external knowledge. Furthermore, industry stakeholders, such as policymakers, trade associations, and industry leaders, may want to consider ways to support the development and implementation of these practices within the industry, such as through funding programs, training initiatives, or regulatory frameworks. Additionally, other factors such as leadership style and market conditions should be considered to better understand the challenges and opportunities facing these firms and develop strategies and practices to improve their technological capability.

6.2. Limitation and Suggestion for Future Research

Despite its contribution, this study has several limitations that need to be considered by future researchers. Firstly, it is imperative to note that the relationship between knowledge

management, organizational learning, organizational innovation, and technological capability is complex and multifaceted. Thus, future research must consider this limitation to gain a more comprehensive understanding of the factors affecting technological capability.

Secondly, while the findings of this study provide valuable insights into the technological capability of food manufacturing firms in Malaysia, they cannot be generalized to other industries or even other manufacturing firms. Therefore, future research should involve firms from different industries to explore industry-specific characteristics and their relationship with technological capability. Furthermore, it is recommended that future research be conducted in other countries. This would provide insights into how these relationships may vary across different contexts, allowing for more nuanced and comprehensive recommendations for firms and policymakers seeking to promote technological capability and innovation.

Finally, although the potential common method bias was addressed by using Harman's single factor test, future studies could attempt to obtain more objective and robust data from multiple informants, nested within operating units and levels, across the firms. Having only one respondent for each variable did not allow the study to test within group agreement. This could be an important issue because different employees may have different perceptions about their organizational environment [85] (Klein and House, 1995).

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su15086365/s1, Table S1: List of constructs indicators.

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