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Management of Inventory for Firms Efficiency: A Study on the Manufacturing Industry in Johor

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Abstract: This study focused on how inventory management practices affect the efficiency of manufacturing firms. Therefore, the research objective of this study was to identify the relationship between Inventory Management Practices (IMPs) and Operational Efficiency (OE) of manufacturing firms. This research adopted four IMPs, which are Capacity Utilization (CU), Inventory Distribution Turnover (IDT), Inventory Automation (IA), and Lean Inventory (LI). This research applied quantitative approach and a survey was conducted by using questionnaire as research instrument. The questionnaires were sent through email to 500 manufacturing companies in Johor, and only 180 have been returned. A correlation analysis confirmed all four IMPs have a significant relationship with operational efficiency. It indicates that firm efficiency will improve by implementing these four inventory management practices. This research may provide a clearer view on how inventory management practices improve operational efficiency of manufacturing firms.

Keywords: Inventory Management, Manufacturing, Operational Efficiency

1. Introduction

Poor inventory management is the most common problem faced by manufacturing firms in Malaysia, including in the Johor district Chan *et al.* (2017). Poor inventory management has an impact on the efficiency of manufacturing firms. According to Aro-Gordon and Gupte (2016), inventory management can be defined as planning for the inventory management system that consists of the planning and management framework, organizational implantation, information management structure,

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and physical facility of the inventory system. Moreover, inventory management also means all the routine procedures and steps, such as assembling, procuring, managing, adjusting, and employing inventory, so as to keep the optimal level of inventory at the right volume, place, and time as well as increase output (Khan & Siddiqui, 2019). One of the major elements of supply chain management is inventory management, which strikes a balance between inventory cost and customer service or product availability (Rahim *et al.*, 2018). The main purpose of implementing inventory management is to balance the inventory investment with customer service (Heizer *et al.*, 2016).

According to Chan *et al.* (2017), the most crucial dilemma faced by a production company is how to maintain an appropriate amount of inventory. The waste that often exists in manufacturing enterprises is overproduction and underproduction (Karim *et al.*, 2018b). Overproduction refers to the fact that excessive inventory produced by a manufacturing enterprise leads to the waste of energy, resources, storage space, funds, and other aspects (Muller, 2011). Based on Waters (2008), underproduction possibly leads to a condition of stock out where even the safety stocks cannot fulfil the market demands. When market demands cannot be met by safety stocks, underproduction can lead to an out-of-stock condition. Unpredictable supply orders, unproductive workers, ineffective equipment, and manufacturing postponements will be caused by the out-of-stock condition (Karim *et al.*, 2018b). Operations and manufacturing interruptions will occur when the raw material shipping process is delayed (Chan *et al.*, 2017).

Furthermore, most manufacturing firms have to close some minor production lines and focus on the main product to barely meet domestic and foreign demands due to lack of raw materials and resources, limited production capacity, and restricted transportation (Hup Seng Industries Berhad, 2021). Moreover, deceits and mistakes can be caused by no work division and a worker's overreliance on a worker to carry out many responsibilities (Karim *et al.*, 2018a). On top of that, manual records and posted records take a long time to process. Thus, it is likely that the numbers will be lost or that the information will be recorded incorrectly. In addition, ineffective procurement keeps raw materials in a warehouse high, leading to widespread waste in a manufacturing firm. Finally, inventory loss in manufacturing enterprises is caused by theft, damage, expiration, and inventory deterioration (Chan *et al.*, 2017).

Most of the research, which is in the background of the Malaysian manufacturing industry, shows that the performance of manufacturing enterprises is determined by productivity instead of operational efficiency (Venkadasalam *et al.*, 2020). A few previous studies have been conducted to determine the inventory management problems encountered by the manufacturing enterprises in Johor (Chan *et al.*, 2017). According to previous studies, capacity utilisation (CU), stock accuracy, inventory availability, and lean manufacturing are the main practises to measure the impact of inventory management on the operational efficiencies of enterprises (Panigrahi *et al.*, 2022). This research adopts four inventory management practices which are capacity utilisation (CU), inventory distribution turnover (IDT), inventory automation (IA), and lean inventory (LI) to test how inventory management affects the manufacturing firm’s efficiency in Johor.

2. Literature Review

2.1 Overview of Manufacturing Business Performance (MBP)

Manufacturing business performance (MBP) is measured by financial performance, operations performance, business performance, economic performance, and efficiency (El-Khalil & Mezher, 2020; Moyano-Fuentes *et al.*, 2020; Nguyen *et al.*, 2021). Operational efficiency (OE) means the efficiency of a firm in transforming resources into operational results relative to other firms in the same industry

(Panigrahi *et al.*, 2022). OE refers to the competence of an enterprise to make the best use of resources and reduce investment waste by removing goods and services of low quality and improving the quality of supply (Jayawardena, 2020).

Currently, the number of enterprises that adopt total inventory management is gradually increasing. OE can be improved when firms apply the leading information technology that has been sophisticated (Zhang & Wei, 2021). Based on the study that has been conducted by Jayawardena (2020), the aim of this study is to measure the garment industry's OE in emerging economies by developing a more succinct conceptual framework. After reviewing 50 research articles that are related to the garment industry's OE in emerging economies, it is proven that inventory management is one of the elements that can have an impact on OE. Improvement in operational efficiency happens because of dynamic pricing with the motivation of controlling costs of inventory ordering and holding. Then OE brings advantages to manufacturing firms without causing any disadvantage to buyers (Stamatopoulos *et al.*, 2019). The distribution centre is an important aspect of the material handling activity of the manufacturing industry. Then, the operation of the distribution centre may account for 15% to 70% of the production cost. As such, it is vital to improve OE by regulating the logistics processes (Silva & Moresco, 2020).

2.2 Overview of Inventory Management Practises (IMPs)

It is found that the business performance of an enterprise will be improved by applying IMP. Although they are theoretically flawed (Jawabri *et al.*, 2019), their application has a positive impact on the manufacturing industry. Controlling inventory efficiently is highly essential for all manufacturing firms' operations. The physical and logical evaluation of inventory with proper data plays a vital role in presenting trustworthy inventory records. This inventory evaluation also aims to avoid too much stock and maintain the stock in a minimum state. As such, it brings the advantages, which are increasing customer loyalty and minimising operating expenses, as long as there are requirements, and then the demands of consumers will be fulfilled (Panigrahi *et al.*, 2022).

Excess inventory will cause financial problems in a business, making it more likely that the inventory will decay and be destroyed, as well as a lack of physical space. Furthermore, the critical problems of chaotic scheduling, poor follow-up of production processes, insufficient concentration, poor administration, and wrong forecast are shown because of excessive inventory. On the contrary, customer service dissatisfaction and interruption of the production process will occur due to low inventory. There is a strong correlation between IMP and operational efficiency (OE). Furthermore, this study found that the IMP of retail companies has a great influence on the OE of these retail companies (Jawabri *et al.*, 2019). Therefore, it can be assumed that IMP can also have an important impact on the OE of the manufacturing industry.

(a) Capacity utilization (CU)

Capacity Utilization (CU) refers to the ratio between the actual level of output and the continuous maximum level of output. Capacity means the highest level of output that can be achieved by any manufacturing plant in any industry through the operation of equipment and machines with adequate inputs, taking into account the typical downtime and making a standard work plan. The difference in capacity developing performance is one of the examples of fundamental standards that are used in capacity utilization computation. CU can also be defined as a measure of an enterprise's manufacturing mode that includes the entire capacity or amount of production during a given period of time (Panigrahi *et al.*, 2022).

The research that has been done by Wang *et al.* (2019) proved that CU has a positive influence on the efficiency of coal mining activities in Shandong, China. The outcome of the research is that total

coal production with capacity achieved the optimal scale to avoid underproduction or overproduction. Therefore, it can be said that CU can be one of the inventory management practises that will significantly affect the efficiency of manufacturing firms. However, a study conducted by Khan and Siddiqui (2019) shows that the efficiency of retail stores in Karachi, Pakistan is affected by the effective management of inventory. It has been proven that there is no relationship between CU and retail outlets' efficiency. It is because retail outlets do not need to purchase materials to produce goods; instead, they directly obtain the products from manufacturers and keep them in stock before selling to customers. Therefore, it can be said that CU is more suitable as the element of inventory management practises (IMP) to measure the efficiency of manufacturing firms than retail outlets. Thus, the following hypothesis was developed.

H1: There is a relationship between capacity utilisation and operational efficiency.

(b) Inventory distribution turnover (IDT)

According to a study implemented by Kwak (2019), the rate of inventory turnover can be used as one of inventory management practises (IMP) to measure the performance of the manufacturing industry. The product distribution speed of a production plant can be determined by the inventory distribution turnover (IDT). A higher rate of inventory turnover means lower costs on products that are hard to sell and move at a slow speed. Moreover, inventory turnover can be obtained from financial statements and measured in an impartial way. The inventory turnover rate represents the product flow efficiency of each production supply chain process. The competitiveness of an enterprise can be assessed by a beneficial standard, which is identifying the sales speed. Generally speaking, the inventory turnover rate is considered a signal that can effectively measure operational efficiency (OE).

The relationship between IDT and OE of the retail industry has been proven by the study by Breivik *et al.* (2021) in Norway. In fact, inventory turnover plays a very important role in gaining profit in a business environment with high competitiveness. As such, there is an assumption that IDT has a significant impact on manufacturing firms' efficiency. However, a study concludes that a manufacturing enterprise with a higher rate of IDT is not definitely a manufacturing enterprise with high OE in the context of India (Raval *et al.*, 2020). Therefore, the results of this research would probably show that IDT does not affect the OE of manufacturing firms. Some studies have proven that inventory distribution turnover (IDT) affects the performance of an enterprise. Management of inventory is helpful in measuring the influence on firms' efficiency (Panigrahi *et al.*, 2022). Therefore, the following hypothesis was developed.

H2: There is a relationship between inventory distribution turnover and operational efficiency.

(c) Inventory automation (IA)

Inventory automation (IA) can be adopted by production plants to help decrease the level and cycle time of inventory. IA is one of the inventory management practices (IMP) that helps with business performance enhancement and manufacturing expenditure reduction. Different technologies can solve the problems of effective inventory maintenance that manufacturing enterprises are now confronted with. These technologies can help improve operational efficiency (OE) with minimum manufacturing expense (Panigrahi *et al.*, 2021).

Industry 4.0's important aspects of Industry 4.0 are interoperability, connectivity, digitalisation, and visibility. Optimisation and inventory management are undergoing a transformation as a result of the rapid advancement of Industry 4.0 technology (Yuan, 2020). Productivity improvement in the manufacturing industry can help achieve social, environmental, and economic development goals by using more sophisticated and efficient technology. India is able to compete in the global steel market

because more advanced automatic control systems are used and the steel industry is open to private companies (Kaushik *et al.*, 2017). Hence, it can be said that IA has a significant effect on OE in manufacturing firms. Reducing manufacturing expenses and improving OE are the results of inventory control activities in manufacturing enterprises. Manufacturing enterprises are implementing special methods such as IA to solve associated problems of inventory management or observe the use of these methods in OE enhancement when manufacturing expenditures are decreasing (Panigrahi *et al.*, 2021). As such, the following hypothesis was developed.

H3: There is a relationship between inventory automation and operational efficiency.

(d) Lean inventory

The focus of LI is on the reduction of inventory and waste. Based on the principle of lean production, inventory is considered to be the waste that should be kept at the lowest level. An organisation that implements LI can be regarded as one with good inventory management. The outcome shows that LI is adopted by many industries to reduce inventory. Nonetheless, by conducting LI, it is proven that different types of organizations have different levels of performance improvement. The researchers discovered that manufacturing firms can gain operational advantages by implementing LI. Another research also proved that LI has a positive impact on operational performance in the manufacturing industry (Elking *et al.*, 2017).

The result of the research carried out by Khan and Siddiqui (2019) shows that there is a positive relationship between LI and the efficiency of the inventory of the retail outlets in Karachi, Pakistan. Contrarily, in the manufacturing industry setting, manufacturing plants are stimulated by LI to manufacture standard goods for fulfilling consumer needs based on the quantity of orders from retailers. Therefore, the highest level of operational efficiency (OE) in manufacturing firms can be achieved by implementing LI. A firm that conducts LI can operate with less human resources and in a smaller space. The less the inventory, the higher the efficiency of procurement, production, and distribution processes. The efficiency of enterprises can be improved by applying LI. This is because LI is helpful in the determination of the best selection priority for supply chain activity sequence, method modification, quantity specification as well as integration of suppliers and consumers. Operations processes can be enhanced by lean inventory (LI). Thus, lean inventory methods are suitable for the manufacturing industry. To meet the needs of customers, manufacturing enterprises can produce products with a certain level of quality through LI. LI serves as the best method to grow the operational strategy that must be implemented in the manufacturing industry to raise the OE of the production process to the highest level (Khan & Siddiqui, 2019). Therefore, the following hypothesis was developed.

H4: There is a relationship between lean inventory (LI) and operational efficiency (OE).

2.3 Conceptual Research Framework

This research framework of this study is shown in Figure 1. The independent variable for inventory management practices that consists of four dimensions which are capacity utilization (CU), inventory distribution turnover (IDT), inventory automation (IA) and lean inventory (LI). On the other hand, the operational efficiency (OE) of manufacturing units is the dependent variable for this research.

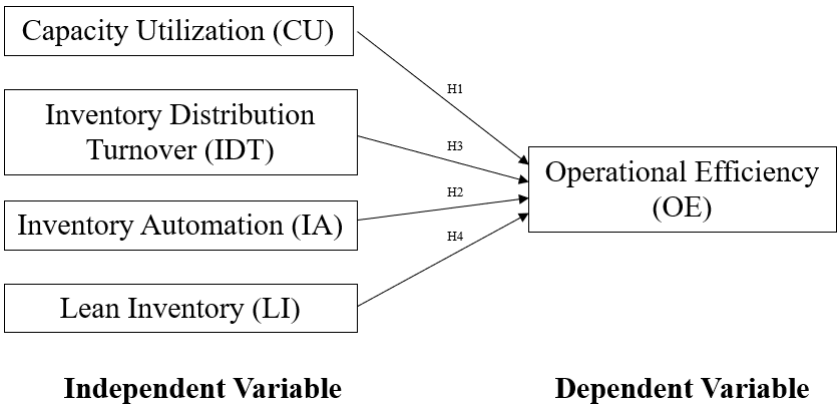

Figure 1: Research framework

3. Research Methodology

3.1 Research Design

This study applied a quantitative research design whereby a survey using questionnaire was emailed to all the potential respondents. Based on the research framework as shown in Figure 3.1, four dimensions used to measure the inventory management practices meanwhile one-dimension measure operational efficiency.

3.2 Population and Sampling

The targeted population of this research are manufacturing firms located in Johor. According to the Federation of Malaysian Manufacturers (FMM) directory, there are 500 companies are actively operating. According to the Krejcie and Morgan (1970), the minimum sample to represent the population is 217 respondents.

3.3 Research Instrument

The research applied survey method, and the questionnaires were emailed to the targeted respondents. The questionnaire was developed based on the measurement instrument from the previous studies Bragg (2011), Khan and Siddiqui (2019), Mishra, *et al.* (2022), Panigrahi et.al (2022) and Samuel (2012) which are further modified and adapted by this study. The questionnaire was developed using google form.

The questionnaire consists of 6 sections. The demographics of the respondents, which are the location of the company, the nature of the business, the department, the position in the company, and the work experience, were in Section A. Section B contained the questions related to operational efficiency (OE) of the firms, is a dependent variable for this research. Lastly, the questions related to 4 independent variables, which were capacity utilisation (CU), inventory distribution turnover (IDT), inventory automation (IA) and lean inventory (LI), were in Section C, D, E, F, respectively. A 5-point Likert scale ranging from (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree and (5) Strongly Agree was used to measure all the variables.

3.4 Reliability Analysis

Table 1 shows the results of the reliability analysis for all 5 variables. Cronbach's Alpha value of operational efficiency (OE) was 0.787, capacity utilisation (CU) was 0.821, inventory distribution turnover (IDT) was 0.854, inventory automation (IA) was 0.808, and lean inventory (LI) was 0.851. The range of the Cronbach's Alpha coefficient for all variables is between 0.787 and 0.854. These reliability test results were above the Cronbach Alpha value suggested by Nunnally and Bernstein (1994), which was 0.6. So, all items were considered reliable for this study.

Table 1: Analysis of reliability test for all variables

Variables	Cronbach's Alpha	No. of Items
Operational Efficiency (OE)	0.787	5
Capacity Utilization (CU)	0.821	5
Inventory Distribution Turnover (IDT)	0.854	6
Inventory Automation (IA)	0.808	5
Lean Inventory (LI)	0.851	4

4. Results and Discussion

The primary data collection for this study is a survey questionnaire. Data collection is based on a 5-point Likert scale was conducted between October 2022 until the end of November 2022. Researcher emailed the questionnaire to each of the company and follow-up email once a week.

4.1 Response Rate

The response rate was 180, or 36% of the respondents who answered the online survey questionnaire after 500 sets were distributed to the target respondents who work in the manufacturing industry in Johor as shown in Table 2. Based on Nulty (2008), the average response rate that can be achieved via online survey questionnaires is only 33%. On the other hand, the 180 responses were close to the sample size of 217 required for this study in order to achieve the research goal. The response rate of online survey questionnaire was showed in Table 2 and Table 3 shows the questionnaire components.

Table 2: Response rate of online survey questionnaire

Data Collection	Total
Number of distributed questionnaires	500
Number of responded questionnaires	180
Response rate	36%

Table 3: Questionnaire components

Section	Content	Data Category	Sources
A	Demographic of respondents	-	-
B	Questions related to operational. efficiency of the firms	Five-point Likert Scale	Adopted from (Panigrahi et al., 2022)
C	Questions related to capacityutilization	Five-point Likert Scale	Adopted from (Panigrahi et al., 2022) and adapted from (Khan & Siddiqui, 2019)
D	Questions related to inventory distribution turnover	Five-point Likert Scale	Adopted from Panigrahi *et al*. (2022)
E	Questions related to inventoryautomation	Five-point Likert Scale	Adopted from Panigrahi, Mishra, *et al.* (2022) and adapted from Bragg (2011); Samuel (2012)
F	Questions related to lean inventory	Five-point Likert Scale	Adopted from Khan & Siddiqui (2019)

4.2 General Information of Respondents

According to the collected data, almost half of the respondents were from manufacturing companies in Johor Bahru, with 106 (58.9%), followed by 19 respondents (10.6%) from Batu Pahat, 15 respondents (8.3%) from Kluang, 13 respondents (7.2%) from Kulai, and 8 respondents (4.4%) from Kluang. Pontian, 6 respondents (3.3%) from Muar, 4 respondents (2.2%) from Segamat and Tangkak, respectively, 3 respondents (1.7%) from Kota Tinggi, and 2 respondents (1.1%) from Mersing.

Besides, the businesses of manufacturing industry in Johor consisted of 3 (1.7%) automotive and vehicle, and pharmaceuticals, respectively, 4 (2.2%) beverages, 18 (10.0%) building materials and food processing, 2 (1.1%) ceramics, fertilizer, food processing and beverages, and packaging materials, respectively, 5 (2.8%) chemical products and equipment, respectively, 10 (5.6%) consumer products, 33 (18.3%) of electronics, electrical and instrumentation, 20 (11.1%) fabricated metal, 6 (3.3%) furniture, 1 (0.6%) glass products, leather and related products, oil and gas, and wood and wood, respectively, 14 (7.8%) machinery, 22 (12.2%) rubber and plastic products, as well as 7 (3.9%) textiles products.

Moreover, the majority of respondents, which were 128 (71.1%), worked in the production and operation department, followed by 24 (13.3%) in supply chain, 13 (7.2%) in procurement 8 (4.4%) in production control, as well as 7 (3.9%) in quality control and assurance. Furthermore, there were 50 respondents (27.8%) who held the position of manager, including 38 respondents (21.1%) as directors, 20 respondents (11.1%) as executive directors, 15 respondents (8.3%) as general managers, 13 respondents (7.2%) as senior managers, 9 respondents (5.0%) as officers, 7 respondents (3.9%) as assistant managers, 6 respondents (3.3%) as senior executive directors, 5 respondents (2.8%) as chief operating officers, 4 respondents (2.2%) as assistant general managers and chief executive officers,

respectively, 3 respondents (1.7%) as executive coordinators, 2 (1.1%) as coordinators and deputy directors, respectively, as well as 1 (0.6%) as deputy executive director and a senior general manager.

Last but not least, the number of respondents with more than 5 years' work experience is the highest, at 159 (88.3%), followed by 16 respondents with 3 to 5 years' work experience (8.9%), 4 respondents with 1 to 2 years' work experience (2.2%), and only one (0.6%) with less than 1 year's work experience.

4.3 Normality Test

Table 4 shows the normality test for all five variables in this research in Appendix A. In this research, the Kolmogorov-Smirnov normality test was used to determine the normality value of the dependent variable because the sample size was larger than 50, which is 217. If the result of the Kolmogorov-Smirnov test shows that the p-value is lower than 0.05, the data is not normally distributed (Ghasemi & Zahediasl, 2012). The p-value of the normality test for all 5 variables was $p<0.005$, less than 0.05. Hence, the distribution of this study's collected data was non-normal.

Table 4: Normality test for all five variables

Variables	Statistic	df	Sig.
Operational Efficiency	0.136	180	0.000
Capacity Utilization	0.170	180	0.000
Inventory Distribution Turnover	0.163	180	0.000
Inventory Automation	0.169	180	0.000
Lean Inventory	0.224	180	0.000

4.4 Correlation Analysis

Since the data in this study were not normally distributed, Spearman's correlation analysis was used to determine the correlation between inventory management practices (IMP) and operational efficiency (OE). Table 5 shows the results of the correlation analysis. The correlation coefficient value of CU was 0.700, IDT was 0.733, IA was 0.672, and LI was 0.596. All the values of the correlation coefficient for the four independent variables were positive. Therefore, the relationships between the four independent variables and the dependent variable, OE, were positive. For p-values, CU, IDT, IA and LI obtained $p<0.0005$. The p-values of all variables were less than 0.05. Therefore, the four independent variables (CU, IDT, IA and LI) have a significant relationship with the dependent variable, OE.

Table 5: Outcomes of Spearman's correlation analysis

			Operational Efficiency	Capacity Utilisation	Inventory Distribution Turnover	Inventory Automation	Lean Inventory
Spearman's rho	Operational Efficiency	Correlation Coefficient	1.000	0.700**	0.733**	0.672**	0.596**
		Sig. (2-tailed)	-	0.000	0.000	0.000	0.000
		N	180	180	180	180	180

Capacity Utilisation	Correlation Coefficient	0.700**	1.000	0.713**	0.663**	0.625**
	Sig. (2-tailed)	0.000	-	0.000	0.000	0.000
	N	180	180	180	180	180
	Correlation Coefficient	0.733**	0.713**	1.000	0.737**	0.640**
	Sig. (2-tailed)	0.000	0.000	-	0.000	0.000
	N	180	180	180	180	180
	Correlation Coefficient	0.672**	0.663**	0.737**	1.000	0.574**
	Sig. (2-tailed)	0.000	0.000	0.000	-	0.000
	N	180	180	180	180	180
	Correlation Coefficient	0.596**	0.625**	0.640**	0.574**	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	-
	N	180	180	180	180	180

**. Correlation is significant at the 0.01 level (2-tailed).

The findings of correlation were used to clarify all four research questions. After implementing Spearman's correlation analysis, the p-values of capacity utilization (CU), inventory distribution turnover (IDT), inventory automation (IA), and lean inventory (LI) were $p<0.05$. The p-values for all four independent variables, which were CU, IDT, IA, and LI, were lower than 0.05. The p-values that are lower than 0.05 can be interpreted as there is a relationship between an independent variable and a dependent variable. Table 6 summarises the findings of the Spearman correlation analysis corresponding to the four hypotheses based on four research questions and four research objectives. The four hypotheses were generated to justify the four research questions.

The first hypothesis, that there is a relationship between CU and operational efficiency (OE), was accepted because the research findings showed that the p-value of CU was lower than 0.05. According to previous research, CU has been proven to be significantly related to OE in the context of the manufacturing industry (Panigrahi *et al.*, 2022). This is because the CU can help the manufacturing firms achieve optimal production to get rid of underproduction or overproduction that will affect the OE of these companies (Wang *et al.*, 2019).

Furthermore, the second hypothesis, that there is a relationship between IDT and OE, was accepted because the research findings showed that the p-value of IDT was lower than 0.05. Based on the research conducted by Panigrahi *et al.* (2022), it has been proven that IDT is one of the IMP that can significantly relate to manufacturing companies' OE. This is because IDT is one of the vital factors in determining the OE of manufacturing enterprises.

Furthermore, the third hypothesis, which was that there is a relationship between IA and OE, was accepted because the research findings showed that the p-value of IA was lower than 0.05. Previous literature has shown that the relationship between IA and OE in manufacturing companies is significant. This is because the more sophisticated IA is applied in manufacturing processes, the more effective the

operations of manufacturing enterprises become by reducing production and operating expenses (Panigrahi *et al.*, 2022).

Finally, the fourth hypothesis, which was that there is a relationship between LI and OE, was accepted because the research findings showed that the p-value of LI was less than 0.05. This finding was supported by the study by Khan and Siddiqui (2019) that there is a relationship between the two. LI and OE of retail enterprises. In contrast, LI can improve OE by reducing waste in manufacturing organisations.

As a result, this study achieved all four research objectives, which were to identify the relationship between four inventory management practises (IMP) (CU, IDT, IA and LI) and the OE of manufacturing firms, because all four hypotheses were accepted by the research findings of this and previous studies. Then, all four null hypotheses were rejected. Hence, it implies that there is a relationship between IMP and OE. The findings of a study conducted by Jawabri *et al.* (2019) also proved that IMP has a relationship with the OE of retail industry. This is because the importance of IMP is to enhance the OE of businesses, and manufacturing firms are no exception. Therefore, the findings of the correlation analysis also answered all four research questions.

Table 6: Summary of findings based on hypotheses

Hypothesis	Alternative Hypothesis	Findings
H1	There is a relationship between capacity utilization (CU) and operational efficiency (OE).	Accepted because p-value < 0.05.
H2	There is a relationship between Inventory distribution turnover (IDT)and operational efficiency (OE).	Accepted because p-value < 0.05.
H3	There is a relationship between inventory automation (IA) and operational efficiency (OE).	Accepted because p-value < 0.05.
H4	There is a relationship between lean and agile. inventory (LI) and operational efficiency(OE).	Accepted because p-value < 0.05.

5. Conclusion

In conclusion, all four research questions had been answered and all four research objectives had also been achieved because the four hypotheses of this study had been supported by the research findings. This study was carried out with the aim of generating more insight into the influence of the four types of inventory management practises (IMP), which were operational efficiency (CU), inventory distribution turnover (IDT), inventory automation (IA) and lean inventory (LI), on the operational efficiency (OE) of manufacturing firms. Firstly, based on the results of the correlation analysis, it was proven that there is a relationship between the CU and OE of manufacturing firms. The capacity

utilization (CU) represents how capable the manufacturing firms are of using their resources and workforce in the most effective way to contribute to the OE. Next, the correlation analysis results revealed that IDT has a relationship with the OE of manufacturing firms. Calculating the IDT rate is one of the useful inventory strategies for determining whether a manufacturing firm's OE is performing well or poorly. Subsequently, according to the results of the correlation analysis, it is possible to conclude that there is a relationship between IA and the efficiency of manufacturing organisations. The OE of manufacturing enterprises can be improved through the application of IA, which digitalises and simplifies inventory management when Malaysia's manufacturing industry is moving toward the era of Industry 4.0. Finally, the Spearman's correlation analysis outcomes proved that LI and manufacturing enterprises' OE are related to each other. Manufacturing firms can improve their OE by reducing waste through LI. It is hoped that some useful insights and understanding of the IMP and OE of manufacturing firms in Malaysia can be contributed through this research. Besides, it is also hoped that his study can be recognized as a fundamental resource for society to gain knowledge about how vital inventory management is to the efficiency of manufacturing firms in Malaysia.

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Appendix A

Demographic	**Frequency (N)**	**Percent (%)**
Location of company		
Batu Pahat	19	10.6
Johor Bahru	106	58.9
Kluang	15	8.3
Kota Tinggi	3	1.7
Kulai	13	7.2
Mersing	2	1.1
Muar	6	3.3
Pontian	8	4.4
Segamat	4	2.2
Tangkak	4	2.2
Nature of the business		
Automotive and vehicle	3	1.7
Beverages	4	2.2
Building materials	18	10.0
Ceramics	2	1.1
Chemical products	5	2.8
Consumer products	10	5.6
Electronics, electrical, and instrumentation	33	18.3
Equipment	5	2.8
Fabricated metal	20	11.1
Fertilizer	2	1.1
Food processing	18	10.0
Food processing and beverages	2	1.1
Furniture	6	3.3

Glass products	1	0.6
Leather and related products	1	0.6
Machinery	14	7.8
Oil and gas	1	0.6
Packaging materials	2	1.1
Pharmaceuticals	3	1.7
Rubber and plastic products	22	12.2
Textiles related products	7	3.9
Wood and timber	1	0.6
Department		
Procurement	13	7.2
Production and operation	128	71.1
Production control	8	4.4
Quality control and assurance	7	3.9
Supply chain	24	13.3
Position in the company		
Assistant general manager	4	2.2
Assistant manager	7	3.9
Chief executive officer	4	2.2
Chief operating officer	5	2.8
Coordinator	2	1.1
Deputy director	2	1.1
Deputy executive director	1	0.6
Director	38	21.1
Executive coordinator	3	1.7
Executive director	20	11.1
General manager	15	8.3
Manager	50	27.8
Officer	9	5.0
Senior executive director	6	3.3
Senior general manager	1	0.6
Senior manager	13	7.2
Working Experience		
Less than 1 year	1	0.6
1 to 2 years	4	2.2
3 to 5 years	16	8.9
More than 5 years	159	88.3

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