

Impact of Just-In-Time Manufacturing on Profit Maximization

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Abstract: Just-In-Time (JIT) manufacturing is a production system in which products are produced to meet demand on time. The companies benefits to hold no inventories, meaning possessing zero inventories. But the requirements of applying JIT strategy are several to be challenging for developing countries. However, it is argued that the advantages of implementing JIT such as the lower warehouse costs, better supply chain management and less waste are very worthy in order to down product cost and improve its quality towards the industrial organizations profit maximization and their position in the markets. Given the importance of the foregoing, the current study tried to investigate the extant of the implementation of JIT production strategy by small companies in Kurdistan region of Iraq and its impacts on profit maximization. To achieve this end, the quantitative method for data collection in the framework of the case study was chosen. This has been through the use of a questionnaire survey that has already been tested. The results of the study revealed that at Kurdistan region's small manufacturing firms can take advantages better of JIT implementation through overcome the difficulties like the lack of providing raw materials at any needed time without having to keep stock. This is in order to decreasing product cost and increasing its quality towards maximizing their profits and position in the markets.

Key words: JIT, small-sized manufacturing firms, product cost, quality, profit maximisation, companies

INTRODUCTION

In the last recent decades, the application of JIT production by manufacturing companies all over the world is one of the most controversial issues. Numerous studies have been conducted identifying this process and analysing its possible impacts on the critical aspects such as profitability, product cost, quality of product, competition in the market, production time and some extra related subjects (Monden, 2011). Companies challenge the difficulties of implementing the JIT manufacturing system in order to enhance profitability as well as strengthen competitiveness through quality enhancement and cost reduction resulting from decreasing the inventory level close to zero (Ahuja and Khamba, 2008).

To investigate the influence of JIT on the profit of the firm one must specify the control variables to drive profit. The underlying factors in the literature tend to be cost and quality of products of the firm. JIT is only one type of the management strategies which is used in manufacturing control. Several potential benefits of JIT has been confirmed such as minimizing inventories, reduce waste, decrease production cost (Kariuki and Mburu, 2013) enhance both productivity and quality of products (Javadian *et al.*, 2013) and better utilisation of

equipment and labour force (Finch and Cox, 1986). Therefore, JIT implementation is expected to have positive impacts on performance of industrial firm.

After the first introduction by Toyota, many large companies around the world such as Dell, GE, Xerox and Harley Davidson have adopted JIT strategy and it gained extended support because of the great successes (Wilson, 2010). This does not mean, however, the adoption of JIT is limited to the large companies and some particular industries. Finch and Cox (1986), Manoochehri (1988), Brown and Inman (1993), White *et al.* (1999) and Chakraborty *et al.* (2012) emphasised that Small and Medium Sized Enterprises (SMEs) as well as large size ones in a variety of manufacturing industries, could implement JIT. This could be the central incentive factor behind the selection of sample industries of this research.

As the level of competitiveness has largely been increased in today's markets worldwide, one of the vital aspects that is necessary to be considered by SMEs could be the application of JIT. Buying large volume of inventory blocks the money which is not suitable for small enterprise (Chakraborty *et al.*, 2012). Additionally, industrial companies are suffering the crucial problems of handling a massive level of inventories and huge cost of

managing it especially in the developing and undeveloped countries (Al-Yaqub, 2009). Therefore, it is necessary to investigate the possibility of JIT application and its effects on small industries of those countries. From this perspective, this study aims to investigate the implementation of JIT system within the Kurdistan region's small-sized manufacturing firms and the impacts on profit maximization.

Literature review: The concept of JIT production is mentioned and described for the first time by Ford (2007) in "My Life and Work" book which was first published in 1923, mentioning "We have found in buying materials that it is not worthwhile to buy for other than immediate needs. We buy only enough to fit into the plan of production, taking into consideration the state of transportation at the time". The Ford Automobile Company is consequently, considered to be the first firm to implement the principles of JIT to manage its inventory and control the supplier-manufacturer-customer relationships. The company applied JIT in the early part of the 20th century. Nevertheless, the origins of the JIT manufacturing as a management strategy dates back to the 1950's (Rouse, 2015). AIDT (2006) states that the person invented JIT is Taiichi Ohno of the Toyota Manufacturing Company. This is why JIT is also called Toyota Production System (TPS). Ohno developed the JIT strategy as a means of competitive advantage in Japan. Since, then JIT was not acknowledged and employed as a system or a strategy that manufacturing firms might have obtained benefits from it. Rouse (2015) argues that the system of Ohno was designed to handle small or large volumes of a diversity of parts. However, the system of Ford could impossible to handle variety parts, though it was designed for enormous volumes and enormous batch sizes of the same parts (AIDT, 2006). This might be the major factor why Ohno is considered as the inventor of JIT strategy rather than Ford, though Ford implemented it in his company almost four decades prior.

Just-in-time production is a manufacturing strategy in which products are produced to meet demand in spite of produce in surplus or prior to need (Rouse, 2015). Put another way, JIT strategy could benefit and suite the manufacturing organisations that necessarily possess various kinds of inventories. According to this well-known strategy, manufacturing companies attempt to reduce their level of storage to zero or at least close to zero. That means the three major popular inventories of manufacturing firms raw materials work in process and finished goods inventories are tried to be diminished. Companies produce only the required quantity of

products at the necessary time (Filippini and Forza, 2016). Regarding the core purpose of JIT production in manufacturing companies (Lai and Cheng, 2009) argue that the elimination of waste is likely to be the major drive to implement this strategy. Additionally, it can be emphasised that the major motive behind the entire scene is to reduce costs of production whilst ensuring quality in manufacturing companies.

JIT manufacturing is also defined by Rouse (2015) and Maskell (2009) to almost be about a systematic elimination of unnecessary and waste transactions in manufacturing companies. Additionally, it is described by Alabama Industrial Development Training (AIDT) (2006) as "the production of the minimum number of different units in the smallest possible quantities at the latest possible time, thereby eliminating the need for inventory". JIT manufacturing is termed as a philosophy by some researcher such as White and Ruch (1990), AIDT (2006) and White *et al.* (2010). However, Bhasin and Burcher (2006) see JIT as a set of tactics and techniques rather than a philosophy.

Regarding the role of JIT which might play in manufacturing firms, numerous studies has been carried out in many different countries. Al-Yaqub (2009) conducts a research within Jordanian manufacturing firms. The major dependent variables of the research, depending on JIT implementation are costs of product, quality of product, percentage of defects, competitive superiority, and producing time. The study also considers the extent of JIT application within the research sample. Depending on a research questionnaire, the study found significant correlations between the implementation of JIT and profit maximization. The same result is also indicated by other researchers such as Bivin (2003) and Capkun *et al.* (2009).

JIT might also expand return on investment and profits by decreasing inventory level, reducing both production and delivery lead-times and improving product quality (Chakraborty *et al.*, 2012). As a result, this research concludes that JIT is one of the significant strategies to be considered by SMEs in today's competitive world. They claimed a remarkable influence of the JIT system upon all operations of a company including design, marketing and distribution.

Mazanai (2012) investigates the effects of JIT implementation by manufacturing SMEs in South Africa on efficiency, quality and flexibility. Using a research questionnaire, the researchers observed that the majority of SMEs was not applying the JIT principles. This was probably because of the difficulties that the SMEs face in implementing the system. The challenges are identified to

be deficiency of capital, lack of reliable supplier networks and having limited experience of instantaneous financial gains among others. This research concluded that manufacturing sector SMEs could take several advantages of the application of JIT manufacturing, including operational cost reduction, enhancing product quality and improving flexibility.

A theoretical research has been conducted by Kariuki and Mburu (2013) to illustrate the effects of lean management pillars including JIT strategy as one of the major pillars on diverse aspects of organisations. The study comes up with a conclusion that JIT is a zero-cost or low-cost technique for enhancing manufacturing procedure if it is applied appropriately. Therefore, the study claims that JIT manufacturing is most likely to result in several positive outcomes such as high customer satisfaction, improve communication, minimizing waste and product cost, production flow, increase labour and equipment utilisations, being competitive in the market and maximizing profit. Filippini and Forza (2016) examines whether the JIT system adds value to products and eliminates waste. The research conducted on a sample of Italian industries based on a survey method. The outcomes indicate an incredible improvement in product quality and an important reduction of waste as a result of JIT implementation by firms.

The possibility of applying JIT system by small-sized manufacturing firms is also widely investigated by researchers such as Fawcett and Pearson (2015). Thier study examines the benefits of JIT implementation for companies have small sizes. A questionnaire is used among small electronic firms in the USA. Subsequently, it suggests that JIT manufacturing is a valuable strategy to enhance the competitive position of small firms similar to large size firms. Whereas White *et al.* (1999) conducted a research also in the USA and emphasised that JIT application has dissimilar effects on companies' performance regarding their sizes. Furthermore, Polito and Watson (2006) emphasise that pure JIT is appropriate only for limited economic environments depending on factors such as organisational culture, economic conditions and suppliers ability.

Al-Maathedi (2009) indicates several key requirements for the JIT manufacturing system to be appropriately and effectively implemented such requirements are summarised as follows; purchase on exact time; the concept of buying on time refers to the procurement of raw materials, parts and components arrive on time for use in the manufacturing process. This concept is featured by the following characteristics; reduce the number of suppliers, long-term contracts, small instalments of payment and minimal examination of

the materials and parts receipts. Minimum levels of inventories; the second significant pillar requirement of JIT application is minimal inventories in which under optimal conditions company who applied JIT system, buy the necessary amount of materials on a daily need basis. That means there is no ending raw materials inventory at the end of every single day of research. Moreover, the company possesses no research in process inventory because the completed product will be fully and directly delivered to customers as soon as it has finalised. Therefore, there should be no balance of finished goods. In summary, raw materials are received in time to enter the production process immediately and finished products are delivered to the customer without delay.

Multi-skilled workers; one of the key elements of JIT production system is the role of the labour force. This system struggles to get workers who are highly skilled and own great flexibility. Those researchers are characterised to seek for production problems and have ability to overcome the obstacles. This could be done by increasing the efficiency of researchers, stabilising labour turnover ratio as well as putting the right person in the right place and task. Reduce production lead time, initialising time and setup time; manufacturing time can be defined as the time that takes to complete a product starting from the entry of materials into product line to become a finished product. Reduce this time helps the company to response rapidly towards any changes in customer demand. Reducing the time of manufacturing cycle dramatically connected to initialize and setup time reduction which can be defined as the time takes to re-adjust the machines between the processes of producing a product.

Small batch size; under JIT system, companies are needed to follow small batch size of materials order and production as well. This leads to faster detection of damage or failure because small batches presumably become an instant feedback for damaged units. This results in high quality of production. Additionally, small batch size helps in reducing storage cost, transportation cost and handling cost.

MATERIALS AND METHODS

Over the last decade, Kurdistan regional government has supported small businesses to be formed considerably into the region by funding entrepreneurs. This has led to increase competition in the market (KRGMP, 2012). Accordingly, it might be challenging for small enterprises to maximise their profits and enhance quality of their products at the same time aiming to sustain in the market and compete the contenders

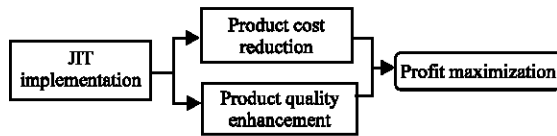


Fig. 1: Study model

(UNDP, BSA-KRG-Iraq, 2013). Given the importance of the above it is necessary to implement contemporary strategies such as JIT manufacturing to face those difficulties, this is what many researchers have confirmed such as Cheng and Podolsky (1996), Collis and Moonen (2001) and Miltenburg (2005). Therefore, the current study aims to investigate in extending do the small enterprises in Kurdistan region have been implementing JIT production and to decrease production cost and then maximize profit. Where, Implementing JIT production is likely to eliminate unnecessary costs of the production process which would in turn leads to decrease production cost and maximize profit.

Study model and hypothesis development: The main objective of the study is to help better understand about the extent of the implementation of JIT system within the Kurdistan region's small-sized manufacturing firms and the impacts on profit maximization which has not been studied in any previous researches. In light of the foregoing, the study model has been built along with the hypotheses of the present study; this is for verification of the goal of the current study.

Study model: The present study is descriptive in nature, therefore; the aiming the of the current model was to explore the extent of the implementation of JIT and its impact on the product cost reduction and profit quality enhancement at the small manufacturing firms in Kurdistan Region of Iraq. The model is shown in Fig. 1.

Hypothesis development: Based on the study model above and by depending on the literature review in the current study, the following hypotheses were drafted. This is for the purpose of the investigation of the implementation of JIT system within the Kurdistan region's small-sized manufacturing firms and the impacts on profit maximization:

Hypothesis 1: it is possible for the Kurdistan region's small manufacturing firms to appropriately implement JIT manufacturing.

Hypothesis 2: JIT implementation has a significant influence on reduce in cost of production towards profit maximization.

Hypothesis 3: JIT implementation has a significant influence on enhancement in quality of production towards profit maximization.

Sample selection and distribution: According to Krejcie and Morgan (1970), it was selected a sample of 120 small-sized manufacturing enterprises out of a population of around 170 companies. A research survey was distributed among employees, mainly managers and accountants of the study sample to collect data. The 88 survey questionnaires were returned and the response rate was 73.3%.

The industrial specialisation of sample companies has distributed as such 50% were consuming Aluminium and Plastics to produce their products. The 31.8% were carpenter manufacturing firms who use wood as raw materials, 13.6% were manufacturing products from Iron tools and 4.5% were using other kinds of materials. The companies' average years of research experience as follows, 25% were in the market for more than 10 years, 36.4% between 6-10 years and 38.6% were working 5 years or less.

Regarding the size of the firms, capital size and number of employee measurements were applied. The companies were investing amounts of capitals as such 15.9% between \$70,000 and \$100,000, 27.3% were between \$50,000 and \$69,999, 38.6% were from 30,000-49,999 and the reminder invests <30,000 as capital. However, number of employees was varied, 61.4% were employ <5 people, 27.3% employ between 5-10 employees, 9.1% have 11-15 workers and 2.3% employ more than 15 individuals.

RESULTS AND DISCUSSION

Descriptive analysis: First main part of the research survey was dedicated to examine the possibility of applying JIT and achieving success of it. Thus, the section was designed based on the requirements and fundamental principles of JIT system. Descriptive statistics were computed for all items of this part using SPSS Version 21. The total results showed that the arithmetic mean reached 3.58 with 0.97 standard deviation. This indicates that small enterprises in Kurdistan Region can take advantages of using JIT system. This results came to consistent with the findings by Chakraborty *et al.* (2012) and Fawcett and Pearson (2015) who emphasised that SMEs can take advantages of JIT implementation. Consequently, the first research hypothesis can be accepted, since it is possible for small manufacturing enterprises in the Kurdistan Regions to properly implement JIT manufacturing system.

Table 1: Correlation coefficient

Dependent variables	JIT Implementation	
	Correlation	Sig.
Product cost reduction	0.508**	0.001
Enhancing product quality	0.382**	0.002
Cronbach's alpha	0.777	3 items

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

Hypothesis 1: It is possible for the Kurdistan Region's small manufacturing firms to appropriately implement JIT manufacturing.

Correlation coefficient analysis for variables: Pearson correlation was conducted to establish the association between JIT implementation with product cost reduction and with enhancing product quality. Pearson correlation checks for the significant association between variables (Saunders *et al.*, 2016). The results of correlation are shown in Table 1.

Pearson correlation results were found to be significant for all variables of the study. The results indicated that JIT implementation had a significant positive and strong relationship with product cost reduction ($R = 0.508$, $p < 0.01$). Similarly, JIT implementation were found to have a moderately strong and positive association with enhancing product quality ($R = 0.382$, $p < 0.01$). Moreover, both of them were statistically significant because the p-value is less than the common alpha 0.05. Cronbach's alpha was also used to obtain the final result of reliability, the information of the question obtained from the participation twice to make the honest of the respondents. The result of the reliability was 0.777. Thus, the questionnaire was reliable. Once association was established between variables, regression analysis techniques was conducted, their results are shown in Table 2.

Regression analysis: For the study, the simple linear regression analysis to check the relationship and influence of one independent variable with the dependent variable had been performed. Where, to check the influence of JIT implementation on product cost reduction towards profit maximization the simple linear regression was used. Similarly, to check the influence of JIT implementation on enhancing quality of production towards profit maximization the simple linear regression was used.

Regression analysis for JIT implementation and product cost reduction: Simple linear regression has been used to test the influence of composite variable of JIT implementation on product cost reduction. This was done to test the second hypothesis. Table 2 illustrates the findings of the linear regression analysis.

The linear regression results of the present study indicate that JIT implementation play an important role in reducing product cost towards profit maximization. The results indicate that the JIT implementation as an independent variable has a strong relationship ($R = 0.508$) with the dependent variable of the product cost reduction. The results indicate that the value of R^2 here is 0.56. This means that JIT implementation are causing 56% variation in the product cost reduction. Likewise, the results indicate that the JIT implementation has a significant influence ($\beta = 0.657$, $p < 0.05$) on the product cost reduction. This result indicates that the JIT implementation will have an influence of 65.7% on the product cost reduction. Thus, it can be confirmed that there is a significant association between JIT implementation and reduce in cost of production towards profit maximization. This means the acceptance of Hypothesis 2 of the research.

Hypothesis 2: JIT implementation has a significant influence on reduce in cost of production towards profit maximization.

In other words, the implementation of JIT system by small firms significantly reduces product costs towards profit maximization. The similar result has also found by researchers such as Mazanai (2012) and Kariuki and Mburu (2013).

Regression analysis for JIT implementation and enhancing production quality: Simple linear regression has been used to test the influence of composite variable of JIT implementation on enhancing production quality. This was done to test the third hypothesis. Table 3 illustrates the findings of the linear regression analysis.

The linear regression results of the present study indicate that JIT implementation also play an important role in enhancing production quality towards profit maximization. The results indicate that the JIT implementation as an independent variable has a moderately strong relationship ($R = 0.382$) with the dependent variable of the enhancing product quality. The results indicate that the value of R^2 here is 0.52. This means that JIT implementation are causing 52% variation in the enhancing product quality. As well as, the results indicate that the JIT implementation has a significant influence ($\beta = 0.601$, $p < 0.05$) on the enhancing product quality. This result indicates that the JIT implementation will have an influence of 60.1% on the enhancing product quality. Thus, it can be confirmed that there is a

Table 2: Linear regression model for JIT implementation-product cost reduction

Model	R	R ²	Adj. R ²	F-value	Sig.	β	t-value	Sig.
JIT implementation	0.508	0.56	0.68	12.778	0.000	0.657	3.575	0.001

Table 3: Linear regression model for JIT implementation-enhancing production quality

Model	R	R ²	Adj. R ²	F-value	Sig.	β	t-value	Sig.
JIT implementation	0.382	0.52	0.63	10.964	0.000	0.601	3.311	0.002

significant association between JIT implementation and enhancement in quality of production towards profit maximization. This means the acceptance of Hypothesis 3 of the research.

Hypothesis 3: JIT implementation has a significant influence on enhancement in quality of production towards profit maximization.

Similar to the outcomes by Chakraborty *et al.* (2012) and Filippini and Forza (2016), this study finds that the application of JIT manufacturing by small enterprises considerably improves quality of products.

Through the results obtained in the current study, it is found that JIT application has significant impacts on both product cost and quality. This result confirms the credibility of the assumption of the model of study in terms of the relationship between the JIT implementation with profit maximization. Where this result in turn, confirms that there is positively correlated between JIT implementation with profit maximization. Thus, this means that JIT implementation properly in most industrial organizations including companies sample study in the Kurdistan region of Iraq will lead to achieve maximum profits through reduce product cost and improve its quality. Likewise, Al-Yaqoub (2009) and Kariuki and Mburu (2013) claimed similar result elsewhere. This could subsequently strengthen the ability the organizations in obtaining the competitive advantage required to meet the volatile market needs.

CONCLUSION

This research studies the the extent of implementing the JIT manufacturing system by small firms within the Kurdistan region of Iraq and the their potential impacts on down product cost and improve its quality. All these in turn lead to be these companies more competitive and thereby expand their market shares and the maximise profit which considered the main concern of these companies through implementation of the JIT system. The results of the current study theoretically showed that there is still a big gap of the researches regarding this field in Iraq and Kurdistan region particularly. This is despite of it is practically improved by some previous studies in other countries such as South Africa, Turkey and the UAE.

Moreover, the results of this research revealed that the small companies under study in Kurdistan Region partially applied JIT without having enough knowledge about it. As well as the study results demonstrate that the other factors are more common which were led to the failure of implementing JIT system appropriately in the companies under study represented in; the political and economic instability in the region, thereby the lack of providing raw materials at any needed time without having to keep stock and also the lack of an accurate control system on manufacturing process in order to satisfy customer demands on time. However, the consequences showed that JIT application has positive influences on profit of small sized companies under study through reducing cost and increasing quality of their products. Therefore, the small manufacturing companies in Kurdistan region are recommended to overcome the difficulties mentioned above, this is in order to implement the JIT system better and then getting the desired results towards maximizing its profits and position in the markets.

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