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## The effects of applying just-in-time production system on maximizing profitability of small and medium industrial companies in Jordan

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### ABSTRACT

This study aimed to investigate the extent of applying just-in-time production system on maximizing profitability of small and medium industrial companies in Jordan, where maximizing profitability of companies represented in both (reducing product costs and reducing ending inventory obsolescence) for those companies. In order to achieve the objectives of the study, a questionnaire was designed as a tool for study and was distributed to the study sample represented by administrative managers and financial managers in small and medium industrial companies. The study community consisted of (235) companies of small and medium industrial companies. The Robert Mason equation was used to determine the sample size which consisted of 146 companies, where this study distributed 292 questionnaires, and 217 of them were received, while 33 questionnaires were excluded, and the final sample was 184 questionnaires. The results of the study showed that there is a statistically significant impact of applying just-in-time production system on maximizing profitability of small and medium industrial companies in Jordan, and there is a statistically significant impact of applying just-in-time production system on (reducing product costs and reducing ending inventory obsolescence) in small and medium industrial companies. The Study recommended a number of recommendations, the most important of which is: It is necessary to review the successful experiences of international companies that adopt applying just-in-time production system, and to benefit from them by small and medium industrial companies in Jordan in applying just-in-time production system as an advanced tool for cost management and thus maximizing their profitability.

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## 1. Introduction

Jordan faces a specific challenge in the contents of its economic companies, where most of them consist of small and medium companies at a rate of 95% of the total economic companies in the country, which impacts significantly on the gross national product. On the other hand, the nature of these small and medium companies, in terms of being industrial, commercial or service, is concerned with the industrial sector accounting for 24% of the GDP (Jordan Chamber of Industry, 2018). The nature of these economic companies drives the student to focus on trying to improve and develop the mechanisms and methods of companies to achieve a healthy and sound economy, because these small and medium companies constitute the majority of the economy. Therefore, it is important to find economic, administrative and accounting solutions that enable these companies to reduce the costs of their final outputs, and support the quality of these outputs, thus maximizing the profitability of these small and medium companies which may positively affect the gross national income (the contribution of economic sectors to the GDP at current prices) (Jordan Chamber of Industry, 2018). One of the most important modern methods that can be applied in small and medium industrial companies is the use of Just-In-Time system by these companies, which is observed through its use to ensure a complete control over the inventory, with the advantage of applying this system as a reduction of ending inventory obsolescence, and production in process to their lowest levels until they almost reach zero on the one hand, and on the other hand, it focuses on the quality of the final product, easily and quickly detecting defects during the manufacturing process, and then processing it smoothly and quickly.

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The use of Just-In-Time production system by small and medium companies may have a significant impact on the ratio of ending inventory obsolescence, and thus, it leads to a clear reduction in the cost of the final product, which may impact positively on the profitability ratio in the statements of income of these companies, and this is what has been proven in some study such as the study of Al-Yaqoub, (2009). The inventory obsolescence makes it necessary for the company to create an obsolescence allowance when preparing a statement of financial position, then the company must evaluate the ending inventory at the lowest value between the cost and the realizable value. Given the continuing change and rapid evolution in the industrial environment of business, industrial products are often vulnerable to a decline in their market prices, which makes the balance during the valuation of the ending inventory tend toward the realizable value, which means the market value minus the selling costs, and this makes the company intended to reduce inventory to the extent of the difference between cost and realizable value which may negatively affect the inventory in the statement of financial position. Hence, the idea of implementing these industrial companies of Just-In-Time production system came, as one of the most important options for these companies to avoid losses, and how the application of this system would affect reducing product costs, avoiding losses of inventory obsolescence, and thus maximizing profits for these companies.

### *1.1 The Study Problem and Its Questions*

Small and medium industrial companies suffer from the high product costs of their products for more than one reason, including that these companies cannot obtain a competitive purchase price in relation to their purchases of raw materials needed for manufacturing products, compared to large companies, which get competitive purchase prices, as they buy these materials in huge quantities. A large proportion of small and medium industrial companies are also manufacturing products with sensitive usability, including food and pharmaceutical products, and products with advanced technology, which may make the surplus production negatively affect product costs due to ending inventory obsolescence, which makes the surplus production negatively affect the product costs due to ending inventory obsolescence, the expiration date of such materials for use, or the emergence of newer materials from older materials makes the market price of old materials low. Therefore, it is important to look for means to reduce the product costs of products of these small and medium companies, and the most important of which is the use of Just-In-Time production systems in these companies. Several key questions related to the problem of this study could be formulated as follows:

1. Is there an impact of applying Just-In-Time production system by small and medium industrial companies on maximizing the profitability of these companies?
2. Is there an impact of applying Just-In-Time production system by small and medium industrial companies on reducing product costs of their products?
3. Is there an impact of applying Just-In-Time production system by small and medium industrial companies on reducing ending inventory obsolescence of these companies?

### *1.2 The Importance of the Study*

The importance of this study stems from the fact that the industrial sector in Jordan represents 24% of the total contributions of the economic sectors to the GDP, and that small and medium companies represent more than 95% of the total companies in Jordan, which leads for seeking to conduct research and studies to help these companies reduce the costs of their products and maximize their profits, thereby promoting the national economy to an acceptable level. Hence, the importance of applying Just-In-Time production system, in these companies, and what may result from its application of reducing product costs, controlling inventory in general, and ending inventory in particular, and the focus on improving the quality of the final product, thus maximizing the profitability of these companies, and of this will be proved or disproved based on the results of this study.

### *1.3 Study Objectives*

The aim of this study is to identify the application of Just-In-Time production systems in small and medium industrial companies, and the impacts that its application may have on the products of these companies, and on the companies themselves. These objectives can be specifically formulated with the following points:

- Identify the impact of applying Just-In-Time production systems by small and medium industrial companies in maximizing the profitability of these companies.
- Identify the impact of applying Just-In-Time production systems by small and medium industrial companies in reducing product costs of these companies.
- Identify the impact of applying Just-In-Time production system by small and medium industrial companies in reducing ending inventory obsolescence.
- Provide some solutions that enable small and medium industrial companies to use Just-In-Time production systems, in order to reduce their costs and maximize their profitability.

## 1.4 Study Hypotheses

In light of the study problem and its objectives, the following hypotheses were formulated:

**Main hypothesis H<sub>01</sub>:** *There is no statistically significant impact of applying Just-In-Time production system on maximizing the profitability of small and medium industrial companies in Jordan.*

And it branches out:

- **H<sub>01-1</sub>:** There is no statistically significant impact of applying Just-In-Time production system on reducing ending inventory obsolescence in small and medium industrial companies.
- **H<sub>01-2</sub>:** There is no statistically significant impact of applying Just-In-Time production system on reducing product costs in small and medium industrial companies.

## 2. Theoretical Framework and Previous Studies

Small and medium industrial companies suffer from the high costs of their final products, for several reasons, including the difficulty in obtaining competitive purchase prices for the raw materials needed for manufacturing compared to what large companies obtain the discounts that large companies receive on purchases because of the large volume of purchases, and companies are generally known as a major building block for the economies of countries, so one of the most important recent trends in the industrial business environment is the tendency of industrial companies to apply Just-in-Time Production (JIT) system.

### 2.1 Just-in-Time Production (JIT) system

Although the idea of applying Just-in-Time Production (JIT) system dates back to the 1970s, the first to apply this system was Japanese Toyota, which found itself facing a major strike by the company's workers, and at the same time there was an increase in demand for its products. After numerous studies conducted by the company, its director, Ohno, discovered Just-in-Time Production (JIT) system, which was able to overcome the problems faced by the company, and this system was therefore very successful, and then its application began to expand outside Japan by American and European companies at the beginning of the 1980s due to the continuing successes of the system (Antic and Nocicevic, 2012), which was positively reflected on the companies in developing their performance and achieving a competitive advantage that enables them to continue in light of intense competition between companies (Mahjoub et al., 2005). Several definitions have emerged that define Just-in-Time Production (JIT) system, where Kootenai and Talari (2013) defined it as a system that buys the materials needed for the production process, and production in quantity and time according to customer needs. Also, Essam El-Din (2013) defined it as a production philosophy based on limitation of wasting time and continuous productivity improvement by producing what the market needs when it is needed in order to produce the products needed for customers on time. The philosophy of Just-in-Time Production is based on the quality and quantity required in time and at the appropriate price, which is Japanese philosophy applied in the different industries to exploit companies' resources and remove all activities that do not add any value to their products (Kootenai & Talari, 2013). Therefore, of Just-in-Time Production system is described as a set of methods and tools that combine to achieve immediate performance of purchasing and production processes to meet demand needs to add value to the product by continuous improvement of processes and products, in a manner that can reduce costs and increase productivity (Mustafa, 2013). Also, Just-in-Time Production system is considered one of the modern systems used, especially in the industrial fields where industrial companies are concerned with the issue of reducing product costs as much as possible, from the supply of raw materials, through manufacturing processes, and ending with the delivery of the final product to customers (Rawazaki, 2008).

### 2.2 Small and medium companies

The term of small and medium companies has been widely used in various countries of the world, because of the rapid spread of such companies, but there is still a problem in defining this type of companies despite its widespread, and there is still a difference of opinion on how they are classified despite the great economic space that they occupy globally, and there are several criteria for classifying them, including the employment standard, capital standard, the size of production and sales, and the level of technology used (Soliman, 2009). In 1996, the European Union defined small and medium companies within certain specifications, which are that they employ less than 250 workers, with sales of less than 40 million euros, or take into account the principle of independence, and include all with less than 25% capital control or voting rights.

According to Economic indicators 2018, number 16, issued by Jordan Chamber of Industry, small and medium industrial companies in Jordan are classified under two criteria: the quantitative standard and the dual standard, as they were classified according to the quantitative standard for companies whose number of employees ranges from 5-100 workers. Also, it was classified according to the dual standard of companies whose capital is 30,000 dinars, and the number of workers therein is less than 100 workers (Jordan Chamber of Industry, 2018).

### 2.3 Previous Studies

There were many scientific studies that dealt with Just-in-Time Production system and maximizing profitability, where the study of Jarera, (2016) aimed at identifying the requirements for applying Just-in-Time Production system in public shareholding industrial companies, describing difficulties in its use and the impact of its use on global competition, reducing product costs, reducing the size of inventory, and developing the production process. The most important results of this study were that using Just-in-Time Production system requires developing the production process, developing accounting, administrative and cost systems in public shareholding industrial companies, and it affects reducing the size of inventory. Also, the application of Just-in-Time Production system requires the cost system with reverse flow. Moreover, the study indicated that there is a desire by industrial companies in Jordan to apply Just-in-Time Production system and the most important recommendations of the study were that industrial companies in Jordan work to overcome the difficulties that prevent the application of Just-in-Time Production system and benefit from those with expertise in this field, even if they cannot apply it at this time. The study of Qasam Allah, (2016) aimed to investigate the application of Just-in-Time Production system in the industrial companies in Sudan and its impact on reducing product costs. The problem of the study was that local industrial companies could not compete with international companies in terms of product quality price due to the high costs. This study used the analytical descriptive approach and the researcher designed questionnaires to examine the hypotheses of the study. Accordingly, the study concluded a set of results, the most important of which is that there is a positive relationship between the Sudanese industrial companies' use of Just-in-Time Production system and reducing product costs. The study then recommended the application of Just-in-Time Production system as an advanced cost management tool. Also, the study of Mohammad, (2016) aimed to examine the application of Just-in-Time Production system in industrial companies, and its impact on achieving comprehensive quality and continuous improvement of products. The results of this study indicated that there is an increase in production efficiency when applying the system, and also the discovery and correct errors at the time they occurred. Also, there is a reduction in all forms of inventory and removal of activities that do not add value to the product, thus reducing product costs. The most important recommendations of the study were to take advantage of wasted money in storage and inventory operations and invest them in other areas to gain more benefits. Moreover, the study of Al-Azel and Mahmoud, (2016) aimed to know the impact of integration between Just-in-Time Production system and the mechanism of scheduling and controlling production processes in improving production efficiency to build an integrated production system that helps in controlling production processes in the specified quantity and time and to achieve customer requirements in the quantity, time and quality required in order to maximize productivity and profitability. The study used the analytical descriptive approach, and concluded that the interest in the mechanism of controlling and scheduling production processes in addition to using Just-in-Time Production system leads to regulating the production process, thus controlling the lost time during production and improving the quality of products, which increases profitability. The most important results of the study were to convince companies' departments of the necessity to apply Just-in-Time Production system, taking into account scheduling and controlling production processes, which helps to expand sales and create new markets.

The study of Abdi, (2014) aimed to develop an optimal purchase model for hospital supplies in light of its use of Just-in-Time Production system, and recommended that only the required supplies should be purchased, storage space must be guaranteed and to ensure that transport trolleys make sufficient trips to deliver all packages to the warehouse, as well as the need to know the minimum and maximum daily inventory demands. While the study Sammour, (2014) aimed to investigate the application of Just-in-Time Production system in Palestinian industrial companies, and the role of its application in enhancing financial performance, through the ratios of liquidity, profitability, activity and indebtedness. The study used the analytical descriptive approach based on books and scientific references, as well as interviews, and the distribution of survey lists for Just-in-Time Production system. The most important findings of this study were that the companies applying Just-in-Time Production system show an improvement in their financial performance indicators, and the most important recommendations of the study were the need to increase the awareness of the industrial companies' administrations of the importance of applying management accounting practices, especially Just-in-Time Production system and its advantages on the financial performance of companies. As for the study of Al-Asadi, (2011), it aimed to know the impact of applying Just-in-Time Production system on product costs in industrial companies. The study was conducted on the Jordanian industrial public shareholding companies, and the analytical descriptive approach was used. The results indicated that there was a positive relationship between applying Just-in-Time Production system in industrial companies and reducing product costs and achieving comprehensive quality. The most important recommendations of the study were that production should take place except when needed for production in the later stages in order to help achieve significant savings in time and costs by reducing inventory in all its forms. As for the study of Al-Yaqoub (2009), this study aimed, through the analytical descriptive approach, to find the impact of applying Just-in-Time Production system on maximizing profitability in industrial companies by reducing product costs, improving product quality, reducing the waste time, and achieving the overall competitiveness in Jordan during 2008. A questionnaire was prepared and distributed to employees of production departments, marketing departments, quality management, and maintenance department. The most important results indicated that there is a statistically significant impact on maximizing profitability of the company by reducing product costs, and the results showed that there is a statistically significant effect on maximizing profitability by reducing the losses. The most important recommendations of the study were the necessity of reviewing the successful experiences of international companies that adopt the application of Just-in-Time Production system and benefit from them.

The study of LeBlanc et al., (2008), also aimed to find a model for the use of therapeutic resources, such as family and workers, based on JIT system in hospitals and emergency cases, by using the simulation model to solve any problems faced by these institutions, where this model responds to the patient's requirements of doctors, nurses, treatments, radiology and laboratories. The study showed that using JIT in the use of therapeutic resources reduced cost and gave more care to the patient. The study found the model that it proposed that facilitates the work of emergency departments in hospitals, reduces overcrowding, provides beds, and reduces waiting time.

#### *2.4 Characteristics of this Study from Previous Studies*

This study is distinguished from previous studies in several aspects of clear importance, as it dealt with the Jordanian environment, which is known to suffer from a fragile economic situation, weak state resources and a lack of final consumer numbers, which requires taking all precautions, avoiding the excess cost during and after manufacturing, and handling manufacturing techniques with finite accuracy. The study also examined small and medium industrial companies in Jordan, where the industrial sector in Jordan accounts 24% of the total economic component, and small and medium companies account more than 95% of the total companies. Moreover, it focused on the food industries sector, which represents 15.2% of the total industry sector (Jordan Chamber of Industry, 2018). Furthermore, the current study was distinguished from previous studies in its variables, as it dealt with reducing product costs, maximizing profitability, and increasing the quality of the final product, and added to them a new dependent variable of influential importance, which is the percentage of ending inventory obsolescence, and the resulting increase in product costs, losses as a result of destruction, or make allowance account due to the decrease of inventory prices.

### **3. Methodology of the Study**

The study relied on the descriptive analytical method based on studying the estimates and perceptions of the sample members in small and medium industrial companies on applying Just-in-Time Production system and its impact on maximizing profitability of their companies through a questionnaire developed and distributed to the study sample. The study used the Statistical Packages for Social Sciences (SPSS) to analyze the data required statistically, in order to try to test the hypotheses of the study and answer its questions in order to produce the appropriate results.

#### *3.1 Community and Study Sample*

The study community consists of small and medium industrial companies, in the food industries sector in Jordan which are 235 companies according to the Economic indicators published by Jordan Industry Chamber in 2018. In order to determine the size of the study sample, Robert Mason equation was used, and after applying the equation to the size of the community represented by (235) companies, it was clear that the results of the sample that can be generalized to the study population are (146) companies, and accordingly (292) questionnaires were distributed intentionally to (administrative directors and financial managers) by two questionnaires for each company, (217) questionnaires were retrieved, and (33) questionnaires were excluded for the lack of completion or seriousness of the respondents in filling them, where the final study sample was (184) questionnaires, and (63%) observations of the study sample.

### **4. Statistical Analysis and Hypothesis Testing**

This axis aims to present the results of statistical analysis of data on the impact of applying Just-in-Time Production system in maximizing profitability of small and medium industrial food companies in Jordan, as it includes verifying the stability and reliability of the study tool, descriptive analysis of the study variables, and the validity of data for statistical analysis, in addition to testing study hypotheses based on the simple regression model.

#### *4.1 Test the stability and reliability of the study tool*

The stability element test was used by testing its paragraphs through Cronbach's Alpha using the internal consistency equation method, which focuses on determining the extent of reliance on the measurement tool to produce the same or close results, if measurements were repeated in similar conditions on the same or similar sample. On the other hand, the Convergent Validity of the answers was tested by factor loadings, and the value of Cronbach's Alpha and the Tolerance factor were given in Table 1.

It is noted from Table 1 that the ratios of Cronbach's Alpha coefficient indicate that there is a high degree of stability for all questions of the questionnaire, where Cronbach's Alpha coefficient was statistically acceptable for all components of the questionnaire because all variables were higher than (70%) according to Sekaran, (2014), where the questionnaire reached a stability degree which is (0.926). As for Hayduk & Littvay (2012), all Factor Loadings should be greater than (0.50), and according to the table, the study variables are close to the answers.

**Table 1**

Test the study tool

Factor	Question	Factor Loading	Cronbach's Alpha
Application of Just-In-Time production system	Q1	0.63	0.828
	Q2	0.87	
	Q3	0.55	
	Q4	0.70	
	Q5	0.58	
	Q6	0.67	
	Q7	0.83	
	Q8	0.69	
	Q9	0.60	
	Q10	0.86	
	Q11	0.56	
Reducing product costs	Q1	0.68	0.820
	Q2	0.82	
	Q3	0.80	
	Q4	0.62	
	Q5	0.55	
	Q6	0.59	
	Q7	0.59	
	Q8	0.53	
	Q9	0.78	
	Q10	0.60	
Reducing ending inventory obsolescence	Q1	0.90	0.859
	Q2	0.71	
	Q3	0.84	
	Q4	0.62	
	Q5	0.68	
	Q6	0.56	
	Q7	0.67	
	Q8	0.52	
	Q9	0.54	
	Q10	0.52	
All Survey questions	Q11	0.61	0.926

#### 4.2 Descriptive statistics

In order to determine the answer rates of the questionnaires, the researcher used descriptive statistical methods by finding the arithmetic means, standard deviations of the answers of the paragraphs, and the general result for each of the question axes. The study sample was asked to answer the questions according to a five-degree Likert Scale. Accordingly, its arithmetic mean was calculated by dividing it into three sections as follows:  $(5-1) / 5 = 0.8$ , therefore, the paragraphs can be judged as in the following tables, in order to present them better, as the following table included the results of the descriptive analysis of the study questions by which the independent study variable and the dependent variables were examined as follows:

**Table 2**

Results of the descriptive analysis of the study variables

Title	Mean	Std. Deviation	Importance	Skewness	Kurtosis
Applying just-in-time production system	4.116	0.612	High	0.568	0.586
Reducing product costs	4.253	0.539	Very high	0.489	0.789
Reducing ending inventory obsolescence	3.955	0.693	High	0.887	0.968

Table 2 presents the descriptive analysis of the answers to the questions of the paragraphs of the independent variable represented by (the application of Just-in-Time Production system) and the dependent variable (maximizing profitability) measured by (reducing product costs and reducing ending inventory obsolescence). It is clear from the table that the independent variable (the application of Just-in-Time Production system) obtained an arithmetic mean of (4.116) relatively low standard deviation of (0.612) with a high level of application, and the general result of this variable indicates the availability of the necessary requirements to apply Just-in-Time Production system in achieving the goals of those companies. With regard to the variable (reducing product costs), the decrease in the value of the standard deviation which is (0.539) indicates the convergence of the results of the paragraphs to this variable, and the result of the general average of the variable reached (4.253), which indicates the importance of reducing product costs of small and medium industrial food companies in Jordan in order to maximize its profitability. With respect to the variable (ending inventory obsolescence), the majority of the paragraphs obtained an arithmetic mean of (3.955), which indicates the interest of small and medium

industrial food companies in Jordan in reducing ending inventory obsolescence in order to maximize their profitability according to the view of the administrative managers and financial managers of these companies. also, the standard deviation of the majority of the variable's paragraphs was (0.693), which indicates a small dispersion in the study sample answers to the paragraphs of this variable.

It is necessary to review the indicators of Kurtosis and Skewness, which measure the suitability of the data to the conditions of a normal distribution, and according to (Field, 2013), the appropriate extent of for Kurtosis is when it falls between (-3) and (3), while the appropriate range for Skewness is (1-) and (+1), and by reference to the table, it is shown that their values for all variables fall within the appropriate range, indicating that the data for these variables are appropriate to the normal distribution condition.

#### 4.3 Data validity tests

There are many conditions and criteria that data should have and define its characteristics in order to determine their suitability for the study model, as it is important to ensure that the dependent and independent study are normally distributed, and if none of the study variables follow this condition, then analysis tests of data with abnormal distribution should be conducted, and the results of the normal distribution test for study variables are as follows:

**Table 3**

The normal distribution test for the study variables

	<i>Factor</i>	<i>P-Value</i>
1	Applying just-in-time production system	0.062
2	Reducing product costs	0.079
3	Reducing ending inventory obsolescence	0.082

Table 3 shows the results of the normal distribution test for the study variables using Kolmogorov-Smirnov test and the convergence of each quantitative study variable to its normal distribution which are applying Just-in-Time Production system as an independent variable, reducing product costs and reducing ending inventory obsolescence as dependent variables. To ensure that the variables follow the normal distribution, the P-value must be greater than (0.05), which is confirmed by the results of Table 3, which shows that all the study variables follow the normal distribution, and therefore parametric tests can be used to demonstrate the impact of applying Just-in-Time Production system in maximizing the profitability of small and medium industrial companies in Jordan. The study also relied on the linear Pearson correlation in order to evaluate the relationship between the independent variable and the dependent variables as follows:

#### 4.4 Test of Study Hypotheses

**Main hypothesis, H<sub>01</sub>:** There is no statistically significant impact of applying Just-in-Time Production system on maximizing profitability of small and medium industrial companies in Jordan.

In order to prove or deny the main hypothesis, the sub-hypotheses related to it were tested, and the simple regression method was used in order to answer the hypotheses of the study. The following is the presentation of the results of testing hypotheses that are derived from the main hypothesis, discussing those results, and comparing them with the results of previous studies. To reject the null hypothesis and accept the alternative hypothesis, the absolute value of the calculated T must be greater than its tabular value at a significance level (Sig) less than 5%, and the Adjusted R Square value is also relied upon to determine the accuracy of the interpretation of the dependent variables by changing the independent variable.

**The first sub-hypothesis, H<sub>01-1</sub>:** There is no statistically significant impact of applying Just-in-Time Production system on reducing product costs in small and medium industrial companies.

**Table 4**

Simple regression test results for the impact of applying Just-in-Time Production system on reducing product costs

T- statistics	Coefficient	R <sup>2</sup>	Adjusted R2	
12.163	0.670	0.488	0.445	
<b>Model F test</b>	<b>Constant (β) =</b>	<b>1.823</b>		<b>Sig = 0.000</b>
147.940	<b>JIT Index (β) =</b>	<b>0.590</b>		

Table 4 shows the results of a simple regression analysis of the independent variable (applying Just-in-Time Production system) and its impact on maximizing profitability of companies through (reducing product costs). The results showed that the coefficient value reached (0.670), which indicates that there is a positive impact of applying Just-in-Time Production system on maximizing profitability of companies through reducing product costs. With regard to the absolute value of the calculated T, the results of the study showed that it reached (12.163), which is higher than its tabular value of (1.653) at a degree of freedom (183), and this result is supported by the value of the significant level Sig, which was less than (5%) as

it reached (0.000). According to the decision rule, which states rejecting the null hypothesis ( $H_0$ ) if the absolute value of the calculated T is higher than its tabular value at a significant level is less than (5%), and accordingly, the first sub null hypothesis is rejected and the alternative hypothesis is accepted, which means that there is a statistically significant impact of applying Just-in-Time Production system on reducing product costs in small and medium industrial companies. The results also showed that the value of Adjusted  $R^2$  which is (0.455) means that only about 44.5% of the fluctuations that occur in reducing product costs can be explained by applying Just-in-Time Production system. It must be noted that the value of Adjusted  $R^2$  ranges between (0-1), and if ranges between (0-1), and in the event that its value exceeds 30%; it is possible to depend on a mathematical equation for prediction and interpretation (Ohtani, 2000), thus, the value of Adjusted  $R^2$  in this model can be judged as strong in the process of prediction and interpretation, and the complementary value of Adjusted  $R^2$  indicates that other factors are outside the interrelationship between these two variables that may have a mutual effect on each other.

**The second sub-hypothesis,  $H_{01-2}$ :** There is no statistically significant impact of applying Just-in-Time Production system on reducing ending inventory obsolescence in small and medium industrial companies.

**Table 5**

Results of the simple regression test for the impact of applying Just-in-Time Production system on reducing ending inventory obsolescence

T- statistics	Coefficient	$R^2$	Adjusted R2	Sig = 0.000
9.812	0.588	0.346	0.342	
Model F test	Constant ( $\beta$ ) =	1.212		
96.269	JIT Index ( $\beta$ ) =	0.666		

Table 5 shows the results of a simple regression analysis of the independent variable (applying Just-in-Time Production system) and its impact on maximizing profitability of companies through (reducing ending inventory obsolescence). The results showed that the coefficient value reached (0.588), which indicates that there is a positive impact of applying Just-in-Time Production system on maximizing profitability of companies through reducing ending inventory obsolescence. With regard to the absolute value of the calculated T, the results showed that it reached (9.812), which is higher than its tabular value of (1.653) at a degree of freedom (183), and this result is supported by the value of the significant level Sig, which was less than (5%) as it reached (0.000). According to the decision rule, which states rejecting the null hypothesis ( $H_0$ ) if the absolute value of the calculated T is higher than its tabular value at a significant level is less than (5%), and accordingly, the second sub null hypothesis is rejected and the alternative hypothesis is accepted, which means that there is no statistically significant impact of applying Just-in-Time Production system on reducing ending inventory obsolescence in small and medium industrial companies. The results also showed that the value of Adjusted  $R^2$  which is (0.342) means that only about 34.2% of the fluctuations that occur in reducing ending inventory obsolescence can be explained by applying Just-in-Time Production system. Thus, the value of Adjusted  $R^2$  in this model can be judged as strong in the process of prediction and interpretation, and the complementary value of Adjusted  $R^2$  indicates that other factors are outside the mutual relationship between these two variables that may have a mutual effect on each other. In order to prove the results previously reached, a simple regression test was conducted for all dependent study variables (reducing product costs, and reducing ending inventory obsolescence by finding an arithmetic mean for all dependent variables in order to obtain a new variable represented by maximizing profitability of small and medium industrial companies in Jordan, to measure the impact of applying Just-in-Time Production system, through the statistical program SPSS in accordance with the following equation:

$$Y = \text{Mean} (\sum_{i=1}^2 x_i)$$

where:

Y= Maximizing profitability

i: 1-2

$x_1$ : Reducing product costs

$x_2$ : Reducing ending inventory obsolescence

Accordingly, it is possible to determine whether there is an impact of applying Just-in-Time Production system on maximizing profitability of small and medium industrial companies in Jordan, as in the following table:

**Table 6**

Simple regression test results for the impact of applying Just-in-Time Production system on maximizing the companies' profitability

T- statistics	Coefficient	$R^2$	Adjusted R2	Sig = 0.000
12.101	0.668	0.446	0.443	
Model F test	Constant ( $\beta$ ) =	1.517		
146.436	JIT Index ( $\beta$ ) =	0.628		

Table 6 shows the results of a simple regression analysis of the independent variable (applying Just-in-Time Production system) and its impact on maximizing profitability of companies through (reducing ending inventory obsolescence). The results showed that the coefficient value reached (0.668), which indicates that there is a positive impact of applying Just-in-Time Production system on maximizing profitability of companies through reducing ending inventory obsolescence. With regard to the absolute value of the calculated T, the results showed that it reached (12.101), which is higher than its tabular value of (1.653) at a degree of freedom (183), and this result is supported by the value of the significant level Sig, which was less than (5%) as it reached (0.000). Accordingly, the main null hypothesis is rejected and the alternative hypothesis is accepted, which means that there is a statistically significant impact of applying Just-in-Time Production system on maximizing profitability of companies in small and medium industrial companies in Jordan.

The results also showed that the value of Adjusted R<sup>2</sup> which is (0.443) means that only about 44.3% of the fluctuations that occur in maximizing profitability of companies can be explained by applying Just-in-Time Production system. Thus, the value of Adjusted R<sup>2</sup> in this model can be judged as strong in the process of prediction and interpretation, and the complementary value of Adjusted R<sup>2</sup> indicates that other factors are outside the mutual relationship between these two variables that may have a mutual effect on each other.

## 5. Discussion of Results and Recommendations

### 5.1 Results of the Study

Based on the findings of the previous chapter, the results can be summarized as follows:

- 1- There is a statistically significant impact of applying Just-in-Time Production system on maximizing profitability of small and medium industrial companies in Jordan. This may be due to the nature of Just-in-Time Production system operation, which is based on the purchase of materials for the production process by building strong relationships with suppliers to ensure that the raw materials needed for manufacturing are provided in time, and production in the quantity and time required in line with the needs of customers, which enables companies to reduce costs and focus on the quality of the final product and thus maximize their profitability. This result was similar to the study of Sammour, (2014) which found that companies that apply (JIT) production system show improvement in their financial performance, and the study of Al-Yaqoub (2009) which concluded that there is an impact of applying Just-in-Time Production system on maximizing profitability.
- 2- There is a statistically significant impact of applying Just-in-Time Production system on reducing product costs of small and medium industrial companies. This may be due to the nature of Just-in-Time Production system operation, as one of the modern systems used, especially in the industrial fields, which is concerned with reducing product costs as much as possible, starting from the supply of primary resources, passing through the manufacturing processes, and ending with the delivery of the final product to customers, which explains its important impact on reducing product costs. This result was similar to the study of Jarera, (2016) which concluded that applying Just-in-Time Production system leads to reducing product costs, the study of Al-Yaqoub (2009) which concluded that applying Just-in-Time Production system leads to reducing product costs, and the study of Mohammad, (2016) which showed that applying Just-in-Time Production system leads to an increase in production efficiency and the elimination of activities that do not add value to the product, which reduces product costs.
- 3- There is a statistically significant impact of applying Just-in-Time Production system on reducing ending inventory obsolescence of small and medium industrial companies. This may be due to the role of Just-in-Time Production system in the limitation of surplus production, where the production process is according to this system is at customer demand, which determines exactly how much of the final product is required, and helps to get rid of the defective product by detecting it during manufacturing and processing it quickly, which explains the impact of applying Just-in-Time Production system on reducing ending inventory obsolescence. This result was similar to the study of Jarera, (2016) which concluded that applying Just-in-Time Production system leads to reducing ending inventory obsolescence, the study of Al-Yaqoub (2009) which concluded that applying Just-in-Time Production system leads to reducing maximizing profitability by reducing the percentage of destruction, and the studies of Qasam Allah, (2016), the study of Al-Asadi, (2011), and the study of Mohammad, (2016), showed that applying Just-in-Time Production system leads to reducing all forms of inventory.

### 5.2 Study Recommendations

Based on the findings of the study, the study recommends increasing awareness among the administrations of small and medium industrial companies in Jordan and encouraging them to apply Just-in-Time Production system, and not produce except when there is a need for production and reducing all forms of inventory. The need to learn about the successful experiences of international companies that adopt the application of Just-in-Time Production system, and to make use of them by small and medium industrial companies in Jordan in applying Just-in-Time Production system as an advanced tool for cost management and thus maximizing their profitability. Increasing the interest of small and medium industrial companies in Jordan in handling raw materials and production under operation, and making sure that they use production mechanisms to ensure the application of Just-in-Time Production system. The managements of small and medium industrial companies in Jordan must be flexible in the use and investment of all that reduces the time needed for the production process

and reduces the product cycle, and should be concerned with constantly updating the supplier and consumer records. The administration of small and medium industrial companies in Jordan should conduct advertising campaigns that would provide a solution for inventory that is about to become obsolete, and ensure that ending inventory that has expired will be destroyed. Also, benefiting from the intellectual aspects in applying Just-in-Time Production system in small and medium-sized industrial companies in Jordan in order to conduct more research and studies to reach an integrated practical and philosophical framework that guides them in practical application.

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