



Impact of Supply Chain Management on Firm Performance Through T-JIT: Shiraz Industrial Estate

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Abstract

Total Just-in-Time (T-JIT) is known as a strategy in Supply Chain Management which includes already defined elements such as production in JIT, purchase in JIT, sale in JIT or information in JIT (a recent addition). It appears that a search into the probable impacts of these broad definitions on supply chain management and firm performance is both attractive and instructive. Therefore, the present study tries to investigate the Impact of Supply Chain Management on Firm Performance through T-JIT. To do this, a questionnaire was handed out to 110 subjects of our research population, namely, all managers and firm experts active in Shiraz Industrial estate. This research is methodologically descriptive and correlational. To answer research questions and test the hypotheses, Smart-PLS was used to analyze structural equations and path analysis through Partial Least Squares (PLS) method. The results show that Supply Chain Management strategy has positive significant impact on T-JIT. In addition, it was found that Supply Chain Management strategy has positive significant impact on Supply Chain capability. The results also indicate that T-JIT bears a positive significant effect on Supply Chain and firm performance. Eventually, results prove that organizational performance is positively and significantly affected by Supply Chain capability. Thus, it is possible to say that Supply Chain Management strategy affects T-JIT, JIT affects Supply Chain Management and Supply Chain Management capability affects organizational performance.

Keywords: Supply Chain Management, T-JIT, Supply Chain Capability, Organizational Performance.

JEL Classification: C31, C87, M31

Introduction

Operations management has taken center stage in efforts towards improving organizational performance since it enhances operations and employs planned strategies. Existing economic conditions have made it difficult to obtain a steady competitive edge: firms now must focus on total supply chain and on integrated status of the firm in its supply chain (Lummus *et al*, 2008). Firm performance must develop strategies that enhance competitive strength for the entire supply chain rather than those which optimize a certain section of the chain. A total business model, through strategies which would successfully improve supply chain relations cooperatively, can secure the goals (Chen *et al*, 2009; Chen and Paulraj, 2004). JIT is an advanced strategy (Huang *et al*, 2012) which incorporates the element of time into considerations of competitive advantages in a supply chain (Vokurka and Davis, 1996; Claycomb *et al* 1999; Vokurka and Lummus 2000; Green and Inman 2005; Matsui 2007; Bayraktar *et al* 2007). An empirical study by Narasimhan *et al* (2006) investigated various strategies within supply chain. They identified 25 cooperative goals in 6 subcategories, including JIT. Analyses revealed three factors, one of which was JIT. Narasimhan *et al* concluded that integration of supply chain is obvious, thanks to its large innovations in JIT. Thus, JIT must be emphasized. Recent study by Schoenherr and Swink (2012) revealed that firms can strategically benefit from their partners by entering into transparent integration with them in supply chain. External integration through both production and sale in JIT can bring about flexible and free enterprise (Schoenherr and Swink, 2012).

Claycomb *et al* (1999) defined JIT as ‘JIT in total system’ which included three elements. This definition is here expanded to include another element: information. Hence, the new name, Total-JIT. This addition is meant to clarify the impact of information on supply chain and also the impact of T-JIT on supply chain capability and organizational performance.

Given the value and importance of T-JIT, this study tried to assess the effect of T-JIT on supply chain capability and performance of firms operating in Shiraz Industrial Town. Although T-JIT plays a crucial role in improving the organizational performance and effectiveness, it has been ignored to some extent. Some of the existing deficiencies may be better addressed, it is hoped, by conducting this applied, empirical research. In addition, the present research seeks to build upon the JIT for Total System as developed by Claycomb *et al* (1999): we try to introduce the element of time into JIT and keep the structure of T-JIT. In this way, we can see the impact of information on supply chain in the same way that supply chain capability and firm performance are assessed. Finally, this research will attend to the influence of T-JIT on firm performance and, through this, on supply chain capability.

2. Hypotheses

As defined by Hunt (1991), a theory is an orderly system of relations between statements which can be tested and which have little possibility of generalization. The present research uses this definition in the following form:

T-JIT strategy is a synthesis of *production, purchase, sale, and information* in JIT and aims to eliminate loss and to use resources fully in the entire supply chain. T-JIT optimizes general supply chain management in manufacturing organizations and enhances their performance through supply chain capability, both directly and indirectly. Further, thanks to supply chain management strategy, both supply chain capability and firm performance would be affected.

In terms of content, the theory is elaborated in 6 testable assumptions, as shown in fig 1. Here, all direct relations are considered positive. The structural model shows T-JIT as main structure,

Supply chain management strategy as an initiator, and supply chain capability and firm performance as results. It lets us see that there are direct and indirect relations between structures under study. Our model is designed to evaluate the impact of T-JIT in a given supply chain. Overall, we assume that combining a supply chain strategy with T-JIT increases the supply chain capability, improving firm performance in turn. The following explains the partial approval of each assumption.

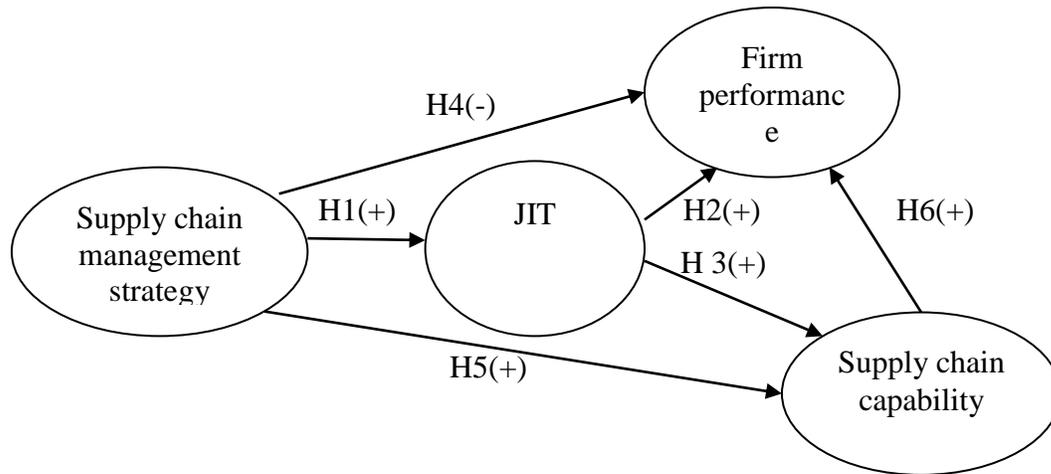


Fig 1 Research Conceptual Model

JIT is employed to enhance supply chain management and involves purchase in JIT (Germain *et al*, 1994; Green and Inman, 2005) and sale in JIT (Germain *et al*, 1994; Green and Inman, 2005): these stress the development and promotion of integrating mechanisms. Mentzer *et al* (2001) explicate a ‘direct supply chain’ which is a main organization that connects prime suppliers with customers. Green *et al* (2007) assume that supply chain management acts as an initiator for information in JIT. They find a relation between structures for purposes of significance and positiveness. JIT gives strategic tactics when used in supply chain level. The first hypothesis follows theoretical justifications and empirical evidence:

Hypothesis 1: supply chain strategy has positive impact on JIT strategy.

Next area of interest is the identification of the effect of applying a supply chain strategy of JIT on firm performance. Germain and Dröge (1997) realize that purchase in JIT predicts both marketing and financial performances. Claycomb *et al* (1999) find a JIT strategy in total system would include all production, purchase, and sale in JIT and leads to better financial performance. Besides, Claycomb *et al* (1999) find that buyers of JIT perform considerably better than those that don’t buy. Similar results were brought out by Inman and Mehra (1993) who found that success in JIT depends on financial success of a certain company. Other researchers also found that users of JIT are significantly more efficient than those who don’t use it (Brox and Fader, 2002; Kinney and Wempe, 2002). These studies supported the assumption that JIT is a workable strategy aimed at removing losses and optimizing resources to enhance firm performance. They pointed out a positive relation between JIT and organizational performance before other studies started discussing the mediating role of supply chain capability in this now indirect relation

(Chopra and Meindl, 2004). Based upon numerous existing empirical evidences, we now propose the second assumption of this study:

Hypothesis 2: JIT strategy has positive impact on organizational performance.

As explained above, JIT stresses loss elimination and optimum usage of resources throughout the entire supply chain. T-JIT seeks to integrate all processes related to production, supply, and maintenance. The integrated processes must reach the minimum output and also maximum amount in at least two of the following: fast maintenance service, responsibility, and flexibility. As stated by Olhager (2002), integration depends on the development of communication mechanisms among successive firms in a supply chain. After comparing elements of JIT against those of supply chain management, Vokurka and Lummus (2000) concluded that those companies that successfully employed JIT strategies are better able to move on to supply chain management. The empirical study by Claycomb *et al* (1999) refers to a relation between JIT in total system and supply chain capability. They found that those companies that run purchase, production, and sale in JIT as a uniform process can decrease levels of foreign inventory (subject to maintenance). Halley and Beaulieu (2009) found that firms with more integrated processes enjoy an operational capability in maintenance services, indicating a possible positive relation between maintenance (as T-JIT) and supply chain. In the same vein, Bowersox *et al* (2000) argued for existence of crucial capabilities for supply chain. These are in line with T-JIT: integrating customer relations (sale in JIT, information in JIT), internal integration (production in JIT, information in JIT), integrating relations (sale in JIT, purchase in JIT), integrating technologies and planning (production in JIT, information in JIT), integrating scale (information in JIT), integrating suppliers (purchase in JIT, information in JIT). Then, the third hypothesis is as follows:

Hypothesis 3: JIT strategy has positive impact on supply chain capability.

Visener (2003) assume that supply chain management is a positive predictor of firm performance. The assumptions were approved when he found that purchase and supply chain management are in close accord with determiners of organizational performance (growth, profit, and market share) (Carter and Narasimhan, 1996). Visener (2003) analyzed the model structurally. It comprised of suppliers management and customer relations strategies as initiators for supply chain management and firm performance as one result. The relation between supply chain management strategy and firm performance was found to be positive and significant. Chen and Tan (2011) analyzed the results of a study with 10 elements of production in JIT in order to see the relations between these elements (both separately and together). Using regression analysis, they found separate elements of production in JIT have different effects while they have a significant positive impact on production as an intense production group. White *et al* (2010) studied the general impact of JIT in form of 4 distinct JIT activities: quality control, delivery, volume flexibility, and cost. In this setting, they found that JIT contributed to none but value added.

Other evidence put forth by Armistead and Mapes (1993) weighed integration of supply chain against understanding production. Here they found these to be positively correlated. After a review of experts in material and supply in USA, Tan (2002) concluded that supply chain management affected firm performance positively. Using research results, Whitten *et al* (2012) realized that supply chain strategy is positively related to supply chain performance. Also, there are evidence showing that supply chain activities can create competitive advantage in terms of chief resources of firms (Rungtusanathan *et al*, 2007; Cousins *et al*, 2008; Squire *et al*, 2009),

which is itself a proof for hypotheses 4 to 6. Resource-based competitive advantage comes from relations within supply chain and prevents rivals from forming similar relations with vital suppliers or customers, or it can deny them the warrant for their inventories (Rungtusanathan *et al*, 2007). Hypothesis 4 is partially in accord with Visener (2003) and Chen and Tan (2011). To a lesser degree, it also fit Tan (2002), Armistead and Mapes (1993), Whitten *et al* (2012); then it can be as follow:

Hypothesis 4: supply chain management strategy has positive impact on firm performance.

According to Visener (2003), a given strategy should increase the value of customers and their satisfaction, which would enhance the competitive advantage of supply chain. Vokurka and Lummus (2000) supports the increase of value of customers as the goal of supply chain management. Added values must be reflected in cost, quality, flexibility, and delivery elements of supply chain (Ho *et al*, 2002). Other evidence (Oliver and Delbridge, 2002; Bowersox *et al*, 2000) point out the effect of a supply chain management strategy on supply chain performance. Oliver and Delbridge (2002) made a comparison between strong and weak performance chains in terms of 4 scales. The strong supply chains showed fewer errors in profit, fewer errors in expenses, fewer delays in delivery to second level suppliers, and fewer delays in delivery from first suppliers. One contribution of this study by Bowersox *et al*, (2000) is that they split firms into two groups according to strength of supply chain: firms that perform most tasks and those that perform average number of tasks. Then they compared them on specified scales: customer relations, productivity and asset management. The first group achieved higher scores for each scale. Bowersox *et al*, (2000) believed that strong supply chain management makes companies perform better. Therefore, our study posits supply chain capability as an index for supply chain performance. This scale works well for individual companies and thus may not efficiently do a comparison on supply chain level. But, Bowersox *et al*, (2000) argued that target capabilities are among the features of companies with highly integrated supply chain. Further, Halley and Beaulieu (2009) supports the idea that with more intense control over operations a supply chain would be more integrated. According to these findings, hypothesis 5 can be as follow:

Hypothesis 5: supply chain management strategy has positive impact on supply chain capability.

Traditionally, managers tend to focus on improvement of organizational performance of those who are directly responsible. Nevertheless, efforts to optimize performance may bear negatively on supply chain and harm its competitive advantages (Meredith and Shafer, 2002; Chopra and Meindl, 2004). Then, supply chain management must attend to the possible effects of organizational strategies on partners in a supply chain. According to Chopra and Meindl (2004), supply chain can be optimum only when an organizational strategy is accepted by all other partners operating in that chain. Such strategy would lead to maximum surplus for chain partners. The organizational strategies that support supply chain must strengthen competitive edge of supply chain. This would lead to better performance of each partner in a supply chain. Despite the lack of an empirical scale for the entire chain, supply chain management focus on the relation between producer and customer outside production tasks. This, Bowersox *et al* (2000) explain, is a reflection of supply chain. Therefore, hypothesis 6 can be stated as following:

Hypothesis 6: supply chain capability has positive impact on firm performance.

3. Methodology

Our purpose was to investigate the Impact of Supply Chain Management on Firm Performance through T-JIT. A structural model with JIT embedded as the focal construct was described and supported in the previous section. Data were collected from a sample of experts (executives and operation managers) using a questionnaire designed and developed by Green et al. (2014). The data were analysed to assess the structural model using the methods of structural equation modeling and partial least squares (PLS) path modeling.

Data collection

The target population was executives and operation managers in companies in the Shiraz Industrial Estate since they were expected to have specialist knowledge of manufacturing, purchasing, selling, and information-related processes within their organisations. Sampling was not considered necessary since the population was limited in size (N=110). The questionnaires were distributed among all members of the target population requesting their participation and assuring them that all responses would be anonymous. In an effort to improve the participation rate, an offer was made to supply an executive summary to each of the respondents.

Statistical Analysis

This research was applied in type and descriptive-correlational in method. All measurement indicators were assessed for validity and reliability within a measurement model context and common model bias was assessed to ensure that the indicators consistently measured what they were supposed to measure. Descriptive statistics were computed to ensure that the study variables were sufficiently normally distributed. Correlations were computed to establish bivariate relationships among the study variables. The theorised model was then assessed following a structural equation modeling methodology using smart PLS software. This software generates goodness of fit indices that were used to determine how well the theorised model fits the data. The software also generates standardised coefficients that were used to assess support for the study hypotheses.

4. Results

Indicators assessment process

The research questionnaire was assessed for content validity by several experts and professors of business management working in universities. Following some modifications, which were approved by the expert panel, 30 questionnaires were distributed in the population to assess face validity. A number of questions were not clear. Several were deleted and others were rephrased. The final questionnaire was assessed as having sufficient face validity. PLS software has the capability to investigate internal consistency reliability, composite reliability, reagents' reliability, convergent validity and divergent validity.

Table 1 shows values for Cronbach's Alpha and composite reliability. It is clear that Cronbach's Alpha coefficient for all components is larger than 0.7, indicating sufficient internal reliability. Also, the values for composite reliability for all variables in first and second order are larger than 0.7, approving model fitting. In analyzing Loading Factors, it is clear that the values of indexes are larger than 0.6. Therefore, no item was left out. Validity and reliability of the model is shown in table 1:

Table 1: Cronbach's Alpha Coefficient, CR, Average Variance, Loading Factor

Loading factor	Indexes	variable	Loading factor	Indexes	variable
0/728	Q13	Organizational performance	0/608	Q1	SUPPLY CHAIN STRATEGY
0/631	Q14	Alpha coefficient : 0/7405	0/631	Q2	
0/852	Q15	CR : 0/8375	0/678	Q3	
0/780	Q16	AVERAGE VARIANCE :0/7658	0/759	Q4	
0/735	Q17	SUPPLY CHAIN MANAGEMENT CAPABILITY	0/858	Q5	
0/758	Q18		0/682	Q6	Alpha coefficient : 0/8168
0/808	Q19		0/684	Q7	CR : 0/8582
0/870	Q20	Alpha coefficient : 0/7932	0/617	Q8	AVERAGE VARIANC : 0/6381
0/792	Q21	CR : 0/8591	0/768	Q9	JIT
0/679	Q22	AVERAGE VARIANCE : 0/6309	0/813	Q10	Alpha coefficient : 0/7759
			0/731	Q11	CR : 0/8451
			0/769	Q12	AVERAGE VARIANC : 0/7944

Average variance calculated in the study was used to assess convergent reliability. Average variance for all research variables are larger than 0.5, approving convergent reliability of the study.

Divergent validity was examined using the method of Fornell and Larcker (1981). As shown in Table 2, this involves first calculating the square root of amounts of AVE (average variance) and then replacing the obtained values on the diagonal matrix (latent variable correlation). The square root of average variance for the main variables of the study in the main diagonal matrix was larger than the correlation between variables in the boxes of the lower-left diagonal. Thus it can be stated that the study variables in the model had more interaction with their indices than with indices of other variables; hence the divergent validity of the model was confirmed

Table 2: Fornell & Larcker's Matrix or Divergent Reliability (Latent Variable Correlation)

	JIT	ORGANIZATIONAL PERFORMANCE	SUPPLY CHAIN STRATEGY	SUPPLY CHAIN MANAGEMENT CAPABILITY
JIT	0.6311			
ORGANIZATIONAL PERFORMANCE	0.6062	0.5864		
SUPPLY CHAIN STRATEGY	0.2486	0.2274	0.4072	
SUPPLY CHAIN MANAGEMENT CAPABILITY	0.5764	0.5228	0.3787	0.3980

Structural Equation Modeling Results

Fig. 2 shows the path coefficients of the effect of supply chain management strategy and T-JIT on supply chain capability and firm performance. As shown below, R^2 is almost 0.536 for firm performance (the dependent factor), implying that all aspects together can account for 0.536 portion of the variance of firm performance. R^2 is represented as weak, medium, and strong by set values: 0.19, 0.33, and 0.67, respectively. Therefore, 0.53 approves that our model has high predictive power.

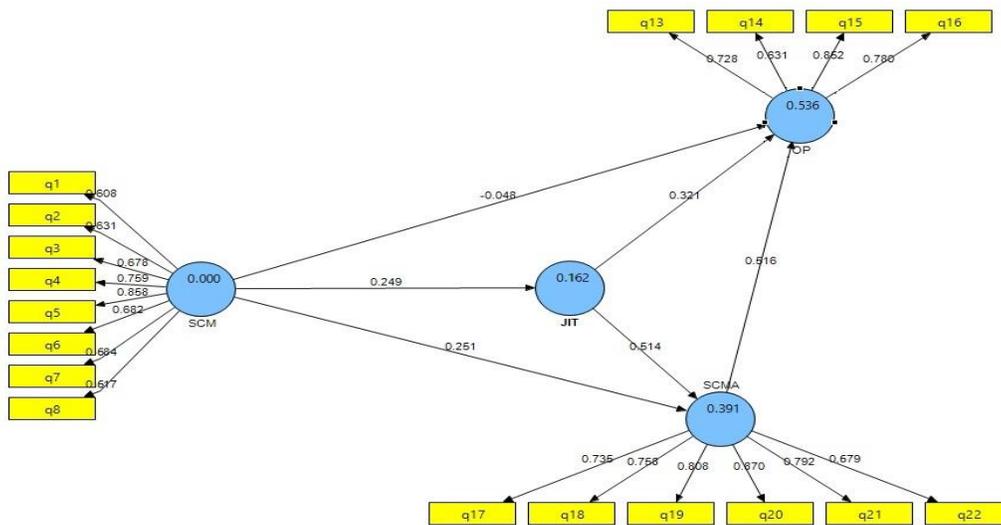


Fig 2 Research Model with Estimated Standard Coefficients

Fig. 3 shows research models in terms of t-values. In fact, this model uses t-value to test all measuring equations (loading factor) and structural equation (path coefficients). So, loading factor and path coefficients are significant in 95% only if t-value is larger than 1.96 and smaller than -1.96. The significance is refuted if t-value is between -1.96 and +1.96. Path coefficient and

loading factor are significant with 99% significance level only if t-value lies outside the span between -2.58 and +2.58. Here, all loading factors are significant and therefore play a significant role in their constructs.

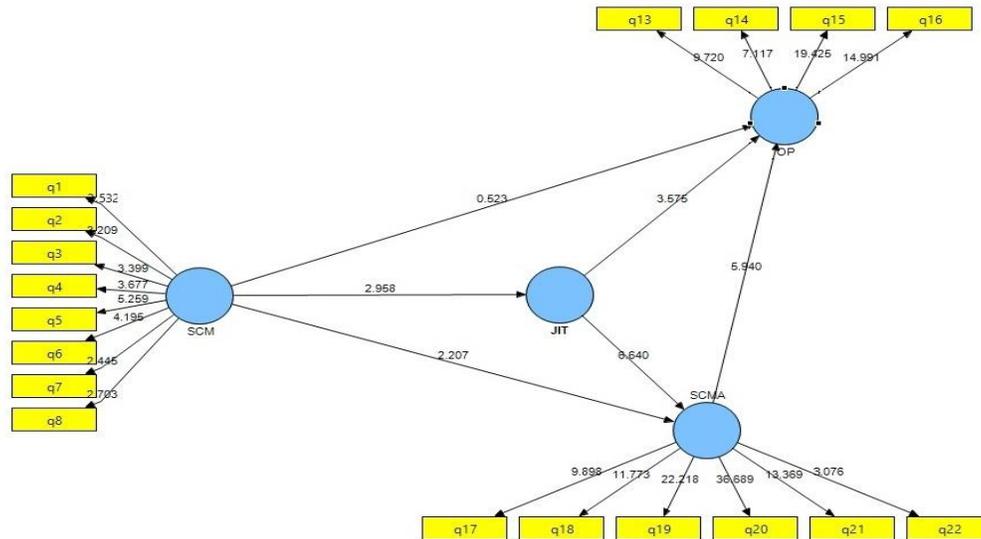


Fig 3: Significance Levels for Research Hypotheses

It is observed that overall, the theorised model fits the data well. The standardised estimates and associated t -values support all six hypothesised relationships, each of which is discussed below.

Hypothesis 1: Supply Chain management Strategy Has Positive significant Impact on T-JIT Strategy.

After reviewing the results from path coefficients and t -value (shown in Table. 3 and Figs 2 & 3), it was found that Supply Chain Management Strategy has positive significant impact on JIT Strategy (t -value does not lie between -1.96 and +1.96). Considering path coefficient, it is fair to say that supply chain management strategy has positive significant impact on T-JIT strategy (t -value is positive). Thus, a better chain supply management strategy increases T-JIT strategy while a weak one would diminish T-JIT strategy.

Hypothesis 2: T-JIT Strategy Has Positive Impact On Organizational Performance.

After reviewing the results from path coefficients and t -value (shown in Table. 3 and Figs 2 & 3), it was found that T-JIT Strategy has positive significant impact on Organizational Performance (t -value does not lie between -1.96 and +1.96). Considering path coefficient, it is fair to say that T-JIT strategy has positive significant impact on Organizational Performance (t -value is positive). Thus, a better T-JIT strategy increases Organizational Performance whereas a weak one would diminish Organizational Performance.

Hypothesis 3: JIT Strategy Has Positive Impact On Supply Chain Capability.

After reviewing the results from path coefficients and t -value (shown in Table. 3 and Figs 2 & 3), it was found that JIT Strategy has positive significant impact on Supply Chain Capability (t -value does not lie between -1.96 and +1.96). Considering path coefficient it is fair to say that JIT strategy has positive significant impact on Supply Chain Capability (t -value is positive). Thus, a better JIT strategy increases Organizational Performance whereas a weak one would diminish Supply Chain Capability.

Hypothesis 4: Supply Chain Management Strategy Has Positive Impact On Organizational Performance.

After reviewing the results from path coefficients and t-value (shown in Table. 3 and Figs 2 & 3), it was found that Supply Chain Management Strategy has no positive significant impact on Organizational Performance (t-value lies between -1.96 and +1.96).

Hypothesis 5: Supply Chain Management Strategy Has Positive Impact On Supply Chain Capability.

After reviewing the results from path coefficients and t-value (shown in Table. 3 and Figs 2 & 3), it was found that Supply Chain Management Strategy has positive significant impact on Supply Chain Capability (t-value does not lie between -1.96 and +1.96). Considering path coefficient it is fair to say that Supply Chain Management strategy has positive significant impact on Supply Chain Capability (t-value is positive). Thus, a better Supply Chain Management strategy increases Supply Chain Capability whereas a weak one would diminish Supply Chain Capability.

Hypothesis 6: Supply Chain Capability Has Positive Impact On Organizational Performance.

After reviewing the results from path coefficients and t-value (shown in Table. 3 and Figs 2 & 3), it was found that Supply Chain Capability has positive significant impact on Organizational Performance (t-value does not lie between -1.96 and +1.96). Considering path coefficient it is fair to say that Supply Chain Capability has positive significant impact on Organizational Performance (t-value is positive). Thus, a better Supply Chain Capability increases Organizational Performance whereas a weak one would diminish Organizational Performance.

Table 3: Direct Effects, T-Value, hypotheses

Rejected/approved	significance	t-value	Standardized path coefficient	hypotheses
approved	Sig<0.05	2/958	0/249	Supply Chain Management strategy ←T-JIT Strategy
approved	Sig<0.05	3/575	0/321	T-JIT Strategy ← Organizational Performance
approved	Sig<0.05	6/640	0/514	JIT Strategy ←Supply Chain Capability
Rejected	Sig>0.05	0/523	- 0/048	Supply Chain Management strategy ←Organizational Performance
approved	Sig<0.05	2/207	0/251	Supply Chain Management strategy ←Supply Chain Capability
approved	Sig<0.05	5/940	0/516	Supply Chain Capability ← Organizational Performance

5. Discussion

In summary, a relatively broad sample of Shiraz Industrial Estate executives and operation managers provided data that were used to assess the SCM model. All study indicators were determined to be reliable and valid and the measurement model fit the data well. Results of the structural equation modeling analysis supported all hypotheses. Supply chain management strategy has positive significant impact on T-JIT. Also, supply chain management strategy has positive significant impact on supply chain capability. T-JIT has positive significant impact on supply chain capability and organizational performance. Supply chain capability has positive significant impact on organizational performance. Then it is possible to claim that supply chain management strategy affects T-JIT while T-JIT influences supply chain capability and supply chain capability bears on organizational performance in turn. Thus, T-JIT strategy, which involves principles and activities such as production, purchase, sale in T-JIT, and information in T-JIT, stands as an effective and sustained strategy for directly enhancing supply chain capability which brings about better organizational performance as well. The idea behind T-JIT and its activities are successfully integrated along the supply chain and organization.

6. Conclusion

It generally can be argued that a successful supply chain requires management strategy and capability as an organization does. Our results support T-JIT as a sustained supply chain management strategy. Those willing to compete in a supply chain are recommended to consider becoming producers, buyers, sellers and information providers in T-JIT. In short, production managers should benefit from a T-JIT strategy. This conceptual strategy is useful for efforts towards no-errors deliveries, quality deliveries to final customers, and for accurate on-time deliveries.

It is worth noting that the present study expanded Claycomb *et al*'s tri-partite model (1999) by adding a fourth dimension: information in T-JIT. Vizener (2003) evaluated a model which consisted of the relation between customer and supply management as initiator for supply chain management strategy and organizational performance as result. He found a positive significant relation between supply chain management strategy and firm performance. Our study contributes to existing literature by focusing on T-JIT and also by including production activities as a research variable. Chen & Tan (2011) analyzed the results of a research which had 10 T-JIT. They found that, T-JIT, as an intense complex, has a positive significant influence on operations. To this, our study added purchase, sale, and information in T-JIT. White *et al* (2010) discovered that T-JIT means applying 4 kinds of activities: quality, delivery, volume flexibility, and cost flexibility. Results, as they argued, would enhance the performance except the added value. Our study contributed by advancing a different perspective and also providing a more complete picture.

Optimizing supply chain through supply chain capability leads to better organizational performance in case of each partner. In short, total optimization of the chain contributes to performance of specific spots on a chain. This also gives rise to the idea that a supply chain management strategy can indirectly affect performance through T-JIT. Once managers decided to accept a supply chain management strategy, they need to determine, for instance, how a T-JIT will be employed strategically and tactically.

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