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THE EVALUATION OF OPERATIONAL PERFORMANCE OF SUPPLY CHAIN AT AUTOMOTIVE INDUSTRY

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ABSTRACT

Todays, Supply Chain Management is one of the most important and complex issues for automakers in the world. The main objectives of this research are to explore the factors to predict operational performance of the supply chain (OPSC) through survey and case study research in IRANKHODRO Company (IKCO). Based on the supply chain theories, previous studies and structural equation modeling operational performance of the supply chain was predicted by process innovation (PI) and partnership quality (PQ). In addition, the relationship between IT and OPSC was moderated by process innovation and the positive effect of IT on OPSC was rejected. A total numbers of 217 completed questionnaires were collected from IKCO. The reliability of data was evaluated by using SPSS to analyse Cronbach's alpha, where all values of alpha were acceptable strongly. According to SEM, measurement and structural model were analyzed to evaluate validity and hypothesizes. The confirmatory factor analyses (CFA) were utilized based on the Maximum Likelihood (ML) to examine model. OPSC model was examined for the first time in the automotive industry, which as the research gap was concluded. This research contributes to focus on IT, PQ, PI and OPSC as theoretical, managerial and practical implications.

KEYWORDS: *Supply Chain Management, Operational Performance, It, Organizational Learning, Sem*

1. INTRODUCTION

Todays, for automakers, Supply-chain management is one of the most important issues due to its complexity and extent variables of supply, costs, resources that have caused firms are led to supply chain development. Many previous studies have investigated on challenges of SCM. Previous researchers have shown there are some problems, which has a negative impact on supply chain performance. These problems include buyer-supplier collaboration, controlling costs and wastes, inventory level, systems and procedures, partnership quality of chains, customer service, supplier network performance, and information flow [51]. Collaboration of the buyer-supplier is important to get a high performance. Lack of collaboration between chains, increases wastes, costs, even reduce products' quality. In recent years, high-tech industries have encountered with the challenges that companies must dominate not only with competitive price but also by controlling inventory, which results from a shorter life cycle of products [31].

In the twentieth century, the automotive industry with positive slope grown and developed. Complexity of the supply chain due to complexity of automotive components and technology caused the automotive firms lead to find methods of improvement and promoting performance [40]. Therefore, automotive industries have contributed to create the value chain in the supply chain. However, they have faced some challenges such as limitation of pricing, on-time delivery, quality, customer services, environmental subjects, product life cycle, new-product development, time to market, product's costs and chains relationships. A new model is utilized to evaluate operational performance of supply chain for first time. Our

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contribution in this research is to develop partnership quality, process innovation, information technology and operational performance of SC.

1.1 A Glance to IKCO's Supply Chain

IKCO has been preparing the production planning as annual, biannual, monthly, and weekly to publish across the supply chain. The week plan and orders issue to SAPCO (as SCM of IKCO) to supply parts and sets. The information flow across supply chain, shown at figure 1, which the orders and plans issue via ORACLE and KANBAN system. The ORACLE system issue overall plan across SC and the specific of orders issue by KANBAN system in which when, what time, and how many parts should be sent to warehouse of IKCO. All suppliers can trace the level of inventory and the status of financial in SAPCO by ORACLE system that before was assigned a username and password for each supplier.

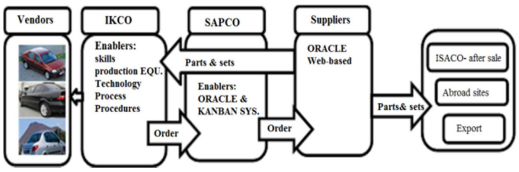

Figure 1: Supply Chain Schematic Of IKCO

IKCO has developed IT by SAP (like ERP) a few years ago to integrate all chains. It has just been developed at IKCO site, which they are trying to develop it across supply chain.

2. LITERATURE REVIEW

2.1 Information Technology

For more than two decades, scientific society have been observed computerization and information flow by technological development, which have submitted a broad variety of tools for documentation of transactions, improvement of decision-making, and speeding up information flow. Hence, using especial software systems (e.g., SAP system) and market-oriented system, firms have improved their inter-organizational relationships by learning [51] and effective interaction.

An Empirical research has shown that the effect of information technology on supply chain performance is moderated by factors such as a commitment of relation, key partner, interaction, and uncertainty [26]. A study conducted a research on process innovation (e.g., cross docking to collect and enhance exchange processes among chains), collaboration quality (commitment and effective interaction among partners), and uncertainty (price, input supply, and competitor's actions [51], which the relationship between process innovation and supply chain performance are moderated by collaboration quality and uncertainty.

Sanders and Premus offered an empirical research to show the direct effect of technology on supply chain performance. In addition, they reported that organizations could attain operational benefits such as decreasing costs and cycle time of functions by using IT across supply-chain management [42].

2.2 Partnership Quality

Promise and commitment are two indicators for partnership quality among the supply chain that shows how the chains' members understand each other in the long term. When organizations as partners enjoy the mutual promise, they can share sensitive data more than in other situations and less involved in opportunism behaviors. The partnership quality effects on the relationship between Information Technology (IT) and organizational performance [51]. The role of partnership quality between main firms and external and internal actors is the most important factor to extend supply chain 24].

The indices of partnership quality such as trust, commitment and mutual adoption are surveyed to measure the effect of partnership quality on the supply chain performance. A study has surveyed to explore how partnership quality is understood and perceived among members of the supply chain to arise outcomes and performance [15]. High quality partnerships among members of supply chain Result in equipping them to solve problems, reduce monitoring costs, and improve the economic situation [45].

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2.3 Process Innovation

Possessing new ideas are only a partial of success factors to develop process innovation. Management of process innovation covers methods, tools, procedures and the kind of technology at all management levels in a firm [39]. There are some process approaches in the field of innovation; developing process innovation gradually from manufacturing strategy to innovation projects [23]; a process model is termed "fusion model", is begun from changing process in line production based on product features; from technical features to manufacturing features [21].

Whereas, supply-chain management coordinates functions across SCM: forecasting, producing, supply, transportation, order and demand process, delivery, marketing, and so on. New process is needed to facilitate and to access high productivity [51]. In fact, this amount of coordination, need to flow effective information across the supply chain. Process innovation covers all layers and levels of the SCM event production process. An innovative line production can improve production methods to get at high productivity, high quality and reduce production costs.

Successful leaders are able to create a suitable environment to make decisions and to share knowledge [2, 25, 50]. They encourage employees to promote their level of knowledge. The researchers of innovation paid attention on the leader's characteristics of firms such as education, experience, personality, and attitudes to analyze the impact of these characteristics on innovation [47, 49].

2.4 Operational Performance of Supply Chain

Managers in many industries, especially those works in manufacturing industries, try to manage supply chains as well. Important techniques/methodologies like just in time (JIT), Total Quality Management, lean production, computer generated enterprise resource planning schedule (ERP) and Kaizen have been embraced [17]. At the operational level, these techniques are brought together the functions that are as old as commerce itself-seeking goods to buy, store and distribute them. At the strategic level, SCM is a relatively new and rapidly expanding discipline to transform the way that manufacturing and non-manufacturing operations meets the needs of their customers [17].

Today, many firms have taken bold steps to break down both inter and intra firm barriers to form alliances, with the objective of reducing uncertainty and enhancing control of supply and distribution channels [17]. Such alliances are usually created to increase the financial and operational performance of each channel member through reductions in total cost and inventories and increased sharing of information [32].

The growth and development of SCM are not driven only by internal motives, but also by a number of external factors such as increasing globalization, reduced barriers to international trade, improvements in information availability and environmental concerns [17]. Supplementing this flow control, an operating system must try to meet the broad competitive and strategic objectives of quality, speed, dependability, flexibility and cost [17].

The total order cycle time, called order to delivery cycle time, refers to the time elapsed between the receipt of customer order until the delivery of finished goods to the customer. The reduction in order cycle time leads to reduction in supply chain response time, and as such is an important performance measure and source of competitive advantage [11], which it directly interacts with customer service in determining competitiveness. In this study, lead-time is one of dimensions to measure operational performance of supply chain in IKCO.

According to [46], an increase in delivery performance is possible through a reduction in lead-time attributes. Another important aspect of delivery performance is on-time delivery. On-time delivery reflects whether perfect delivery has done at true place and time, which is a measurement of customer service level. A similar concept, on time order fill, was used to describe it as a combination of delivery reliability and order completeness [11]. Various factors that can influence on delivery speed include vehicle speed, driver reliability, frequency of delivery, and location of depots. An increase in efficiency in these areas can lead to a decrease in the inventory levels [37].

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The number of faultless notes invoiced: An invoice shows the delivery date, time and condition below, when the goods were received. By comparing these with the previously made agreement, it can be determined whether perfect delivery has taken place or not, and areas of discrepancy can be identified so that improvements can be made.

Flexibility of delivery systems to meet particular customer needs: This refers to flexibility in meeting a particular customer delivery requirement at an agreed place, agreed mode of delivery and with agreed upon customized packaging. This type of flexibility can influence the decision of customers to place orders, and thus can be regarded as important in enchanting and retaining customers [37].

A report in 2006 shows the absence of effective process across the supply chain in many companies is a main problem. In fact, the supply chain is a complex issue, which companies should pay attention to in all SCM dimensions to access acceptable inventory level across the supply chain [14]. The low level of inventory in supply chain made to lower production at main firms and as such results unsatisfactory for customers. The high level of inventory in supply chain made to increase the costs of warehouse [55]. There are two main problems across supply chain include inventory level and transportation decisions [10], which need to plan by order forecasting, lead time to delivery and resources evaluation. In this study, for inventory level is evaluated to measure the operational performance of the supply chain. In this research, product quality is one of dimensions of operational performance, which is developed to measure OPSC.

2.5 The Conceptual Framework of the Research

According to presented theories and literature review, our conceptual framework was hypothesized as the following:

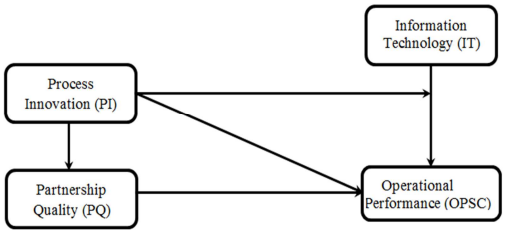

Figure 2: The Conceptual Framework Of The Study

An empirical research conducted in 123 manufacturers to examine the effect of IT-oriented supply-chain management systems on financial and operational performance that shows a strong relationship between them [12]. A study found that the result of interaction between electronic integration and logistic performance was limited to decreasing cost, but the service development was not improved by them [29]. Speed, quality, accuracy, and transaction costs are outcomes of information technology [20]. Therefore, H1 was hypothesized as the following:

H1: Information Technology has positive Effect on Operational Performance of Supply chain.

A research was done on 135 companies that confirmed environment as a factor to moderate relationship between the role of using IT and SCM [13]. Vijayasarathy (2010) examined the role of moderator of process innovation between information technology and operational performance of supply chain. Therefore, H2 was hypothesized as the following:

H2: The Relationship between Information Technology and Operational performance is moderated by process innovation.

Process innovation helps to improve procedures, communications, and partnership quality. This investigation contributes to measure partnership quality by three dimensions include keeping promises, sharing sensitive information, and keeping commitment across supply chain.

H3: Process Innovation (PI) has positive effect on Partnership quality.

A large number of investigations have implied to have been the effects of uncertainties in demand, lead-time, and production process of operational performance of supply chain, which many methodologies were provided to decrease their effects [22]. Whereas, in supply-chain management coordinates functions across SCM: forecasting, producing, supply, transportation, order and demand process, delivery, marketing, and so on, the new process is needed to facilitate and to access high performance [51].

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H4: Process Innovation (PI) has positive effect on Operational Performance of Supply Chain.

The partnership quality between main firm and suppliers improves customer satisfaction and reduce lead-time, delay in delivery [45], and transaction cost [54]. A study conducted by Narasimhan and Jayaram, confirmed that high level of partnership quality between focal firm and its suppliers led them to high operational performance [35].

H5: Partnership Quality (PQ) has positive effect on Operational Performance of Supply Chain.

3. RESEARCH METHODOLOGY

Research methodology consists of a systematic procedure for data collection and analyzing to understand phenomenon and events, which researchers are interested to explore [52]. In fact, the main purposes of research including thinking, understanding, formulating, and examination of new theories to enhance human knowledge. Research methodology show road map as well as GPS and directly follow validity of research [33, 52]. Deductive and inductive approaches are the main approaches of research methods to answer research questions. In deductive approach, researcher develop objectives, research questions and hypothesizes to examine while, in inductive, researchers collect data, generate hypothesizes and develop theory as a result of research [42]. A research plan includes all materials and methods to develop a research [53].

3.1 Research Instrument Development

The past studies in field of quantitative research in supply chain management, point out that many of them have hypothesized to model supply chain management [36]. In this study, quantitative approach was implemented to evaluate operational performance of supply chain. A comprehensive survey questionnaire includes four latent variables with twelve items (see appendix 1) were applied to measure the variables and to test the research model [38]. The main section of the research scales are Likert-scale questions including five-point that defined as (1) "strongly agree" to (5) "strongly disagree". The pilot test was done to develop research instruments and finalization of questionnaire [16]. In fact, the pilot test is utilized to enhance, finalize questionnaire, and improve the questions for editing word meaning, spelling, and all issues of related to target population [41]. The respondents of the pilot study and research were experts, managers of IKCO who have been skilled at supply chain. Stratified random sampling was utilized to identify sample size. The number of fifty questionnaire for pilot study [30] and two hundred and fifty questionnaires for research [28] distributed among our respondents at IKCO. From 250 of questionnaires, approximately 236 (94.4%) returned which just six (2.4%) of them due to incomplete are rejected.

4. ANALYSIS AND FINDINGS

The Cronbach's alpha was utilized to test the internal consistency. According to McMillan and Schumacher (2001) research, a value of 0.9 for alpha point out to have been high reliability, values of 0.7 until 0.9 are acceptable, and values of less than 0.7 are weak reliability [34]. The overall α value was 0.923, which was greater than all α values of scales separately. The alpha values of pre-test and research shown at Appendix1 those are acceptable to continue research. After examination of model using structural equation modeling, Mahalanobis distance was evaluated for outliers. The data of Mahalanobis distance imply that existence of the numbers of thirteen cases was outliers. About the else, At least, one of values of p1 or p2 was more than 0.05. In addition, the values of D^2/df of all cases were less than 3.5, which is an appropriate index to not be an outlier [1]. According to Kline (2010) research, Skew and Kurtosis were utilized for normality test that all values of them were between +2 and -2. Therefore, the normality distribution was confirmed [27].

4.1 The First-Order CFA of OPSC Model-Measurement Model

The measurement model of OPSC was examined to ensure the reliability and validity of constructs and scales. As shown in figure 3, OPSC model includes operational performance of the supply chain (OPSC), process innovation (PI), partnership quality (PQ), and information technology (IT). By surveying multiple squared correlations, the values for all scales are more than 0.5, which imply to appropriate items to measure constructs [1].

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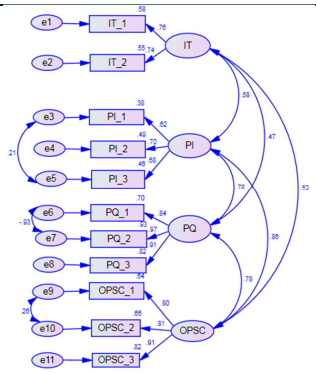

Figure 3: The Measurement Model Of OPSC Model At IKCO

The correlations between constructs are less than 0.7, which are acceptable to examine confirmatory factor analysis (CFA) model. The fit indices of OPSC model including; χ^2 =120.49, $\chi^2/df = 3.44$, RMR=0.026, GFI=0.98, AGFI=0.826, NFI=0.924, RFI=0.881, IFI=0.945, TLI=0.913, CFI=0.944, and RMSEA=0.078, which imply to goodness of fit.

4.2 The Structural Model –Confirmatory Factor Analysis

The path diagram construction of OPSC model was drown according to figure 4, which all constructs includes observed and latent variables, residual, and errors. The Confirmatory Factor Analysis (CFA) was utilized based on Maximum Likelihood (ML) estimation [1].

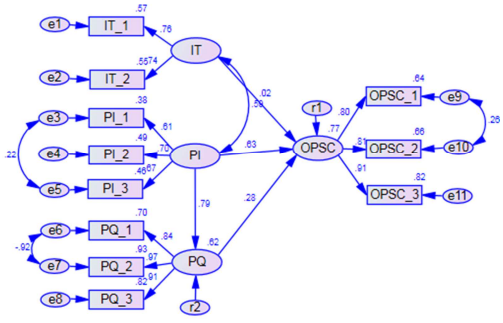

Figure 4: CFA Of Structural Model Of OPSC At IKCO

As seen at table 1, the fit indices of OPSC model including chi-square is 120.58, χ^2/df = 3.35, Root Mean square Residual (RMR) =0.026, Root Mean Square Error of Approximation (RMSEA) = 0.077, Comparative Fit Index (CFI) = 0.945, Tucker – Lewis Index (TLI) = 0.916, Goodness of Fit Index (GFI) = 0.908, Adjusted Goodness of Fit Index (AGFI) = 0.831, and NFI=0.924. Therefore, all indices imply to goodness of fit at high level. As seen in table 1, all hypothesizes were supported exception of H1, which was rejected (t = 0.288 and P>0.05).

Table1: Regression Weights of constructs and items

			Estimate	S.E.	C.R.	P	Label
PQ	<---	PI	0.998	.147	7.448	***	par_11
OPSC	<---	IT	.020	.070	.288	.774	par_8
OPSC	<---	PI	.834	.241	3.461	***	par_9
OPSC	<---	PQ	.267	.122	2.193	.028	par_10
IT_1	<---	IT	1.000				
IT_2	<---	IT	.907	.144	6.289	***	par_1
PI_1	<---	PI	1.000				
PI_2	<---	PI	.959	.123	7.791	***	par_2
PI_3	<---	PI	0.999	.140	8.780	***	par_3
PQ_1	<---	PQ	1.000				
PQ_2	<---	PQ	1.000	.077	15.080	***	par_4
PQ_3	<---	PQ	1.000	.069	15.750	***	par_5
OPSC_1	<---	OPSC	1.000				
OPSC_2	<---	OPSC	.993	.065	15.231	***	par_6
OPSC_3	<---	OPSC	0.999	.079	14.114	***	par_7

4.3 Process Innovation as Moderator between IT and OPSC

According to Vijayasarathy research, the moderator role of process innovation between IT and operational performance of supply chain was examined that imply to being of the moderator role of process innovation. Based on Reuben et al. research, if the relationship of interaction (moderator) and OPSC is significant, that mean process innovation moderates the relationship between IT and OPSC. Furthermore, they suggested to measure correlation between interaction (IT*PI) and PI and IT that should not be correlated strongly.

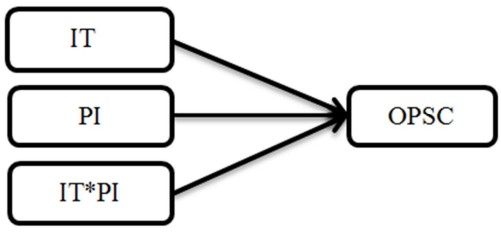

Figure 5: *The moderator model*

Some studies have examined the role of moderator by using regression in two steps; at the

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first step, independent variable and moderator are entered to multi-regression and at second step, interaction variable is entered to regression [5]. In the first step, independent variable not has to be significant, while moderator must be significant. In order to access to being moderator role, interaction variable must be significant4]. Some researchers have suggested to being uncorrelated between moderator and independent and outcome.

Table 2: Regression Model for First Step

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.696	.152		4.595	.000	.398	.995
	IT	.114	.060	.102	1.887	.061	-.005	.232
	PI	.722	.062	.624	11.553	.000	.599	.845

a. Dependent Variable: OPSC

As seen at table 2, process innovation (PI) at probability level of p<0.05 and T-value equal 11.553 is significant, while IT is not significant due to P>0.05 and t=1.887 that is less than 1.96, but we can continue to examine the role of interaction term [5].

Table 3: Regression Model for Second Step

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.646	.089		18.445	.000	1.471	1.822
	IT*PI	.196	.019	.578	10.389	.000	.159	.233

a. Dependent Variable: OPSC

As table 3 shows, the interaction term is significant at probability level of p<0.05 and t=10.389, in which imply to moderator role of PI.

4.4 Discriminate and Convergent Validity

Both convergent and discriminate validities were assessed by confirmatory factor analysis [3]. The Maximum likelihood (ML) estimation used to fit model by measuring fit indices. Convergent validity implies to agreement among scales- when is used that a CFA model has the appropriate condition to goodness of fit and all factor loadings are acceptable strongly [6]. Discriminate validity, was introduced by Fiske and Campbell (1959) to evaluate validity [9]. That is the extent to which the scales represent a latent variable from aspects of whether they are relevant or irrelevant and is important when scales highly are correlated to other scales. Hair *et al.* (2010) emphasized that, the value of 0.3 for factor loadings is significant, 0.4 is more important and 0.5, or more is very significant. The factor loadings of OPSC model were ranged from 0.614 to 0.966, which are very significant [19].

Surveying squared multiple correlation shows that values related to dependent variables are equivalent R^2 in regression analysis. That means the default model explains 62.5% of covariance of Partnership Quality (PQ), and 76.8% of covariance of operational Performance [1]. As shown at table 4, most squared multiple correlation of observed variables were more than 0.5, which imply to the appropriate scales to measure latent variables. All AVE values of OPSC model were more than 0.5, which means discriminate validity was established (first condition) and all values of squared correlation are less than relevant AVE, which implies to establish discriminate validity (second condition) [7]. Average variance extracted is calculated by below formula as the following:

$$\text{AVE} = \frac{\Sigma(\lambda_i{}^2)}{\Sigma(\lambda_i{}^2)+\Sigma(variance\ error)}$$

Where, λ_i is standardized loading square.

Table 4: Comparing AVE with Squared Correlation of OPSC Model

Constructs	IKCO	
	Squared correlation	AVE
OPSC	0.42(PI),0.0.38(PQ), 0.102(IT)	0.764
PQ	0.265(PI),0.38(OPSC), 0.147(IT)	0.757
PI	0.42(OPSC),0.265(PQ), 0.108(IT)	0.576
IT	0.102(OPSC),0.147(PQ), 0.108(PI)	0.887

4.5 Multicollinearity

When fitting of a model is surveyed, multicollinearity of variables should be assessed in order to there are not strong inter-correlation between independent variables. In fact, multicollinearity problem occurs when an

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independent variable has high correlation with another independent variable. Multicollinearity implies to an unacceptable high level of correlation among independent variables. Therefore, it can be said that two independent variables are equal to predict the dependent variables. Which means one of them should be omitted from the model. If the inter-correlation of independent variables are above 0.8, there is a multicollinearity problem [48]. A high level of multicollinearity leads to occurrence of wrong regression coefficients in outcome [19]. Using SPSS, multicollinearity of OPSC scales were evaluated, which the values of VIF for all scales are less than 5 and tolerance values are more than 0.2, which imply to being acceptable condition for multicollinearity test [8].

5. DISCUSSION

Based on Maximum Likelihood (ML) estimation and confirmatory factor analysis (CFA) evaluation, hypothesize tests were done. Many studies have explored that information technology is an enabler to develop operational performance of supply chain [51]. According to research of Vijayasarathy, a hypothesis test was implemented in order to evaluating the impact of IT on operational performance of supply chain that confirmed to being positive effect. While, based on H1, the positive effect of IT on operational performance of supply chain was not supported (standard regression weight: λ=.288, $p>.05$). IT has been developed in IKCO, but it could not developed operational performance in field of delivery on time, order fulfillment lead-time, and reduction of rejected parts. Delivery on time and order fulfillment lead-time is related to situation of Iran's sanction.

Whereas, Process innovation can improve procedures, communications, and partnership quality, this investigation contributes to measure partnership quality by three dimensions include keeping promises, sharing sensitive information, and keeping commitment across supply chain. According to H3, PI has positive effect on partnership quality (λ=7.448, $p<.05$). That means process innovation with indices of automatic replenishment, scientific forecasting of order and demand to planning, and existence of effective system to respond to customers' needs- has developed partnership quality with indices of promises to each other, comfortable to share information, and keeping relations for long term. According to Jaipuria and Mahapatra (2014), many investigation have proved the impact of process innovation on operational performance of supply chain. Vijayasarathy examined the mediator role of process innovation on relationship between IT and operational performance of supply chain, while this research examined the effect of process innovation on operational performance of SC. According to table 1.1, λ=3.461, $p<.05$, which imply to support H4 for effecting process innovation on OPSC. In addition, according to table 1 and table 2, the hypothesis H2 was supported. In fact, process innovation moderates the relationship between information technology and operational performance. As seen at Table 2, IT at probability level $p>.05$, no effect on operational performance of SC while, interaction terms (IT*PI) is significant at probability level ($p<.05$). Therefore, process innovation has a moderator role to enhance relationship between IT and OPSC. That means IKCO should develop IT based on dimensions of process innovation in order to develop operational performance. Of course, a partial of which IT no effects on OPSC is related to Iran's sanction, which CKD parts were not imported to Iran.

Srinivasan et al. emphasized the being of partnership quality between main firm and suppliers improve customer satisfaction and reduce lead-time, delay in delivery. A study confirms that high level of partnership quality between focal firm and its suppliers led them to high operational performance [35]. Therefore, according to our analysis, hypothesis H5 was supported (λ=2.193, $p<.05$). In fact, IKCO has somewhat developed partnership quality measures to develop OPSC. In practical and managerial approaches, IKCO should invest on IT development, PQ, PI and OPSC.

In fact, statistical significant of acceptance level evaluates the hypothesizes as outcomes of this research. The managerial and practical approaches show the development level of constructs including partnership quality, process innovation, information technology and operational performance of SC at all level of supply chain in IKCO. It seems IKCO should develop IT tools in order to develop operational performance, enhance PQ, and PI situation across SCM. Of course, a partial of problems in low performance is related to global sanction against IRAN that the firms could not import CKD from

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foreign partners. Process innovation has developed partnership quality across supply chain.

Whereas, IKCO have some abroad sites but no information of them received. This was our limitation in order to evaluate whole site of IKCO. IT of suppliers was another limitation that not evaluated at IKCO.

6. CONCLUSION

The OPSC model was examined under a survey research in automotive industry by using confirmatory factor analysis (CFA) by SEM. The basis of OPSC model is to develop operational performance of supply chain by information technology, process innovation, and partnership quality. According to key findings, all hypothesizes were supported at IKCO using structural equation modeling exception of H1. Discriminate and convergent validity were examined, which imply to appropriate validity of model. All values of incremental and absolute measures confirm to being goodness of fit model. To sum up, OPSC was predicted by PI and PQ. In addition, PI moderates the relationship between IT and OPSC. Therefore, IKCO should plan to develop IT, PI, and PQ in order to enhance operational performance of supply chain.

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Appendix 1: The Cronbach's Alpha of the Pilot and the Research

Constructs	Scales	Cronbach's α	
		Pilot	Research
Information Technology (IT)	1. There are direct computer-to-computer links with key suppliers (IT_1).	0.946	0.913
	2. We use electronic transfer of purchase orders, invoices, and/or funds (IT_2).	0.945	0.912
Process innovation (PI)	3. In our company, automatic Replenishment is done (PI_1)).	0.945	0.923
	4. In across supply chain, Collaborative Planning, Forecasting, and Replenishment scientifically (CPFR) are done (PI_2).	0.943	0.918
	5. In our company, there is an Efficient System to Respond Consumers (PI_3).	0.946	0.916
Partnership Quality (PQ)	6. We keep our promises to Each other across SC (PQ_1).	0.942	0.910
	7. We are comfortable for Sharing Sensitive Information with each other across SC (PQ_2).	0.941	0.912
	8. We expect our Relationship to Continue for a Long time across SC (PQ_3).	0.940	0.904
Operational Performance of Supply Chain (OPSC)	9. Our supply chain, Delivery is On Time (OPSC_1).	0.945	0.910
	10. The Order Fulfillment Lead-times are suitable in our supply chain (OPSC_2).	0.942	0.905
	11. The Inventory level is acceptable across SC (OPSC_3).	0.942	0.905
	12. Conformances to Specifications of supplied Goods are suitable (OPSC_4).	0.941	0.908