

# **The impact of supplier integration on customer integration and new product performance: The mediating role of manufacturing flexibility (Case study: IRANKhodro Co.)**

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## **Abstract**

This study entitled "Analysis of the impacts of suppliers integration and customers integration on new product performance through mediating role of manufacturing flexibility and service ability" investigates the important role of suppliers integration on manufacturing flexibility, service ability, customers integration and finally new product performance regarding trust theory among IranKhodro's employees. In this study regarding the model of study there is a main hypothesis (which investigates significance of impact supplier integration on new product performance) and there are five lateral hypotheses (which investigate significance of impact of supplier integration on manufacturing flexibility and service ability and also significance of impact of manufacturing flexibility and service ability on customer integration and customer integration on new product performance).

This study is an applied research regarding the purpose and is a survey based study with the correlation approach regarding the method of execution. The sample of this study is limited and consists of 650 managers, supervisors senior experts of IranKhodro. Due to limited size of study's sample, 173 samples were selected using simple random sampling method using Cochran's limited sample size formula. Data collecting tool in this study is a 30 question questionnaire. The validity of this questionnaire were acknowledged by supervisor and advisor professors and management experts. Also, the reliability of this questionnaire were supported by Cronbach's Alpha of 97%. Study questionnaire includes demographic questions and main questions for testing hypotheses. From 173 distributed questionnaires 165 were back (return rate= 95%). In addition, collected data were analysed by statistical tests using AMOS and SPSS software in two levels including descriptive tests: frequency, percent cumulative percentage, mean and standard deviation and perceptive tests: t-test, regression

modeling, ANOVA, nonparametric test of Kolmogorov-Smirnov and nonparametric test of Friedman .

Based on study findings all of hypotheses were supported. Also, study results showed that third lateral hypothesis with path coefficient of 0.61 has the most effect and the fourth lateral hypothesis with path coefficient of 0.21 has the least effect. Therefore, regarding study findings, suppliers integration has a significant impact on new product performance .

**Keywords:** Supplier Integration, Customer integration (consistency with customer in supply chain), New product performance, Manufacturing flexibility, Service ability, Trust theory

## **Introduction**

In current global competitions in this era, diverse products must be available for customer and must be based on his/her demand. Customer demand about high quality and quick service have increased pressures that have not been existed before. Therefore, companies cannot put up with all these issues lonely anymore. In current competitive market economic and manufacturing firms need management and supervision on resources and fundamentals related to outside of organization beside giving attention to organization and internal resources. During recent years, emergence of new technologies and creating tremendous changes in global markets made supply chain essential more than before so that different organizations in order to create their competitive position and retain it have to use supply chain. Information revolution and emergence of new forms of bilateral organizational relationships and increase of customers' expectations in the field of products and services cost quality, delivery, technology and time of promised cycle regarding the increasing competition in global markets and so on are among factors which made organizations move from traditional purchasing and procurement systems to supply chain management system around the world. Management of process of creating of balance in link between customer and supplier in order to deliver the best value to the customer in minimum cost is considered as supply chain management. In 21<sup>st</sup> century regarding the globalization and economic activity in global competitive space and increasing growth of companies and firms in international business area and their close competition for survival and having more market share a complicated and difficult environment has been made for manager's decision making. Today the more we move toward future because of quick changes and more complicated situations, the more governance of companies is complicated and difficult. Therefore, how we enhance company's abilities and capacities in supply chain is becoming a very important issue.

## **Study theoretical framework (study background and hypotheses)**

### **Definition of supply chain and supply chain management**

Some people have limited supply chain in relationship between buyer and seller. This kind of point of view only focuses on buying operation in the first level in an organization. Other group have wider perspective of supply chain and consider it as sources of supply in organization. Another group consider supply chain as a set of attitudes and thoughts which their function creating synergy in the final performance of company. In general we can say that supply chain involves two or more organizations that legally are separate and linked with each other by

material, information and financial flows. These organizations could be companies which produce parts, constituents and final product and even could be providers of service and distribution (logistics) and the customer (end user) itself (Rajabzadeh et al. 2008).

Supply chain management is one of effective and efficient approaches that make reduction in production cost and waiting time. There are many definitions of supply chain management that almost all of them involves coherence of production, inventory, transformation, information and knowledge between components of a supply chain which the best possible combination of accountability and efficiency for market which feed it can be achieved (Amid et al., 2008).

In a simple supply chain there are three sections. Input section which includes providing various financial, material, information and knowledge resources from external suppliers. Internal section which in production, assembling, packaging or research and development is done and output section which involves distribution. Therefore explanation of flow of current inputs and outputs in supply chain is more than movement of tangible materials. Although there different opinions about it (Rajabzadeh et al., 2008), supply chain management has three main and crucial processes which are:

- 1) Information management
- 2) logistics management and
- 3) Relationship management (Basu & Write, 2010).

### **Information management**

Today role, importance and position of information is obvious for everyone. Proper circulation and correct transmission of information make processes more efficient and more effective and easier to manage. In the field of supply chain- as mentioned before- the important issue is the coordination in activities. This point also in the context of information management in the chain, management of information systems and information transmission is correct. Coordinated and proper information management among partners cause increasing effects on speed, accuracy, quality and other aspects. However, appropriate information management will create more coordination in supply chain (Nikmehr & Doroodchi, 2008).

### **Logistics management**

In analysis of production systems (such as automobile industry) the topic of logistics involves physical part of supply chain. This part which involves all of physical activities from the stage of providing raw material to final product and includes activities such as transportation, inventory, manufacturing timing. Furthermore, a large proportion of supply chain activities consist of this part. In fact, logistics range is not only flow of material and good but also it is the core of supply chain activities which relationships and information are supportive tools in order to improve activities (Karimi, 1389).

### **Relationship management**

Factor which conduct us to the result of this discussion and is the most important part of supply chain management is management of relationships in supply chain. Management of relationships has a tremendous effect on all supply chain aspects and its level of performance. In many cases information and technology systems required for supply chain management

activities simply are available and could be utilized in a relatively short period of time. However, many of primary failures in supply chain caused by poor transmission of expectations and are results of behaviors that take place between parties involved in the chain. Furthermore, the most important factor for successful supply chain management is the secured relationship between partners in the chain so that partners have mutual trust in their capabilities and operations. In sense, in the development of each integrated supply chain, development of trust and assurance among partners and relating assurance for them is among the important and critical elements for achieving sustainable success (Teymoori & Ahmadi, 2010).

### **Definition and the nature of development of new product**

In fact, the purpose of development of new product is to response to customers' needs, adoption with market conditions, environmental changes, increase in profit, customer satisfaction and confronting competitors policies. Development and production of new products successful commercialization in the market with improved product make product life cycle curve shorter and shift from mass production to customization. Today, manufacturers in order to create added value for customers and persuading them to purchase must have appropriate flexibility in concentration and differentiation of their markets or market development with dependence on product development strategy (Mameghani et al., 2012).

The nature of new product development is an interdisciplinary concept which comes from multiple disciplines. Management and marketing authors in the context of new product development used one of or both these terms: design and innovation. Doing many researches in the context of literature related to new product development shows the importance of this issue. From a wider perspective development of new product is an important factor for economic capital of a country. However, unfortunately the level of importance of new product development is not adoptable to the level of success and the danger of failure in new product development is very significant (Seyed Hoseiny & Iranban, 2005).

### **Service**

Service includes intangible activities and bring profit and satisfaction but does not result in possession of something (Ranjbarian et al. 2003). From the Galiano's (1994) point of view, service could be an idea, kind of information, kind of change in the customer appearance or health, creation of a desired mental status, making work in right time and right place or feeling of being secure. Different services have different characteristics that differentiate them from goods. Services various characteristics should be considered in service marketing. These characteristics are:

1. Intangibility: the meaning of intangibility is that during the buying, service can't be seen, tasted, felt, heard or smelled.
2. Inseparability: the meaning of this feature is that we can't separate service from the one who provide it, whether the provider is a person or a machine. If an employee or a worker provide a service, he or she could be considered as part of that service. Since the customer is present during the production of service, both of service provider and customer have an impact on result of that service.

3. Diversity: it means service quality depends on following factors: service provider, time, place and the way of providing of service.
4. Perishability: this feature means that service can't be stored and then sold or consumed. If the amount of demand is fixed and constant, perishability can be solved. But when the demand is fluctuating, service provider organizations face some issues and problems. Thus, service organizations attempt to formulate strategies that makes a better relationship between demand and supply (Kotler & Armstrong, 2006).

### **A review on service quality models**

#### **Service quality behavioral model**

Interpersonal behavior from service provider is an important factor that affect customer perception of process of service and its results. Based on this model, one of important factors of achieving service quality is the balance between customer expectations and employee expectations. According to this model, another important factor that helps to achieve service quality is that service provider system is relevant and effective (Ghobadian et al. 1994).

#### **Service quality hierarchical model**

Brady and Cronin (2001) suggested a hierarchical model for measuring service quality. According to this model service quality comprises three dimensions: interaction quality, physical environment quality and outcome quality. Each of these dimensions has three sub dimensions. According to this model, customers first combine their evaluations of sub dimensions and this sum of sub dimensions shapes customer perceptions of organization in each dimension. Then, sum of this perceptions result in customers overall perception of service quality. In other words, customers form their perceptions of service quality based on performance evaluation in multivariate levels (Brady & Cronin, 2001).

#### **Parasuraman model**

Attempts mentioned above in order to identification of determinant factors of service quality were superficial and do not have enough details. However, these attempts had a major proportion in dividing service quality into quality of process and quality of output. Accordingly, Parasuraman and his colleagues suggested multiple factors for measuring service quality which are as follows:

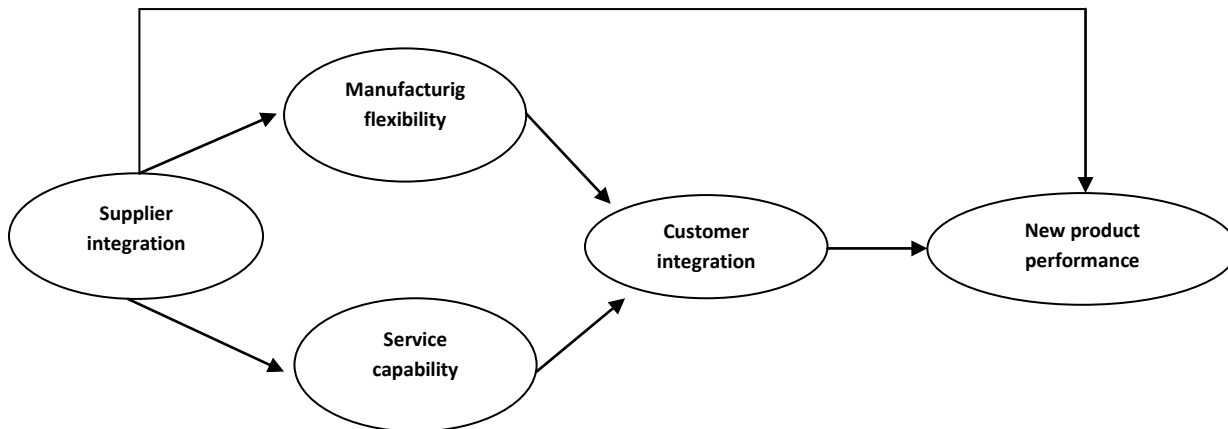
- Accesses: ease of accesses and ease of making connection
- Communications: keeping customers informed about service in a way that it is been understandable for them.
- Competence: employees must have required information, knowledge and skills to perform the service effectively.
- Courtesy: Politeness, respect, consideration, and showing friendly behavior to the customers.
- Reliability: the extent that service is believed. Credibility and reputation of bank, behavior of employees before the counter etc. all of them contribute to reliability.
- Credibility: ability to provide the service on time and correct.

- Responsiveness: ability to handling complaints and enhancing service effectively.
- Security: freedom from feeling danger, risk and doubt.
- Tangibles: these factor refers to physical conditions, decoration, appearance and cleanness of service provider place, appearance of personnel and modern equipment (Tayebinia, 2009).

### **SERVQUAL model**

In order to evaluation service quality, SERVQUAL model that is a wide spread and applicable models developed to identify service quality using the gap between customer expectations and imaginations about organization service quality performance. This model attempts to show main organization activities that affect perception of quality (Alvani & Riahi, 2004).

### **Study conceptual model**



**(Source: He et al., 2013).**

- H1: Supplier integration has a significant impact on new product performance.  
 H2: supplier integration has significant impact on manufacturing flexibility.  
 H3: supplier integration has a significant impact on service capability.  
 H4: manufacturing flexibility has significant impact on customer integration.  
 H5: service capability has a significant impact on customer integration.  
 H6: customer integration has significant impact on new product performance.

### **Methodology**

This study regarding the methodology is descriptive survey. Also from the purpose point of view, this study is an applied- scientific research and regarding the nature, it is type of correlation. In this kind of research the relationship between variables is analysed based on study objectives. Also, in this study existence or non-existence of relationship or correlation, magnitude and type of relationship between independent variables and dependent variables are tested. Since this study uses library method, review of related texts and also survey based method like questionnaire and its objective recognizing society people characteristics, preferences and behavior through referring to them, we can say that this study regarding the

nature of methodology is a field research. The sample of this study is limited and consists of 650 managers, supervisors senior experts of IranKhodro. Due to limited size of study's sample, 173 samples including males and females were selected using simple random sampling method. For identifying the sample size a primary study with 30 samples carried out. By calculating standard deviation and putting this value in the Cochran's limited sample size formula the appropriate sample size was achieved.

$$n = \frac{N \times Z_{\alpha/2}^2 \sigma^2}{d^2(N - 1) + Z_{\alpha/2}^2 \sigma^2} \text{ Cochran's limited sample size formula}$$

n: desired sample size,  $\alpha$ : level of significance (5%), d: standard error (5%),  $\sigma^2$ : variance of statistical sample and N size of sample. After estimation of standard deviation primary sample calculated as follows:

(Standard deviation: 0.392, N=650):

$$n = \frac{650 \times (1.96^2) \times (0.392^2)}{(0.05^2)(650 - 1) + (1.96^2) \times (0.392^2)} = 173.401 \approx 173$$

From 173 distributed questionnaires 165 were back (return rate= 95%).

### **Method and tool of collecting data**

As mentioned before for collecting required data in order to test the hypotheses and model, this study used a 35 question closed questionnaire. In this questionnaire 5 questions allocated to demographic characteristics such as gender, age, job position, level of education and job duration and there are 30 question designed for measuring study variables. Number of 173 questionnaires were distributed directly between managers, supervisors and senior experts of IranKhodro. Among these questionnaires 165 questionnaires were back and recognized suitable for analysing.

### **Validity and reliability of measuring tool**

Measuring tool in this study designed regarding the theoretical principals and considering study objectives. In order to investigating the validity of questions opinions of supervisor and advisor professors and related experts were used and after final acknowledgment from them questionnaire printed and distributed between samples.

Also in order to investigating the reliability of questionnaire Cronbach's Alpha coefficient were used. As a result, reliability index by distributing and collecting 30 primary questionnaires was calculated using SPSS and the achieved Cronbach's Alpha coefficient is 0.97. Since the minimum required reliability coefficient for a questionnaire should be 0.70, as a result we can say that study questionnaire has desired reliability. Also, in order to ensure that questionnaire has the required reliability Cronbach's Alpha coefficient were investigated for each of study factors (table 1).

**Table 1. Cronbach's Alpha coefficient for investigating questionnaire reliability**

variable	Number	Cronbach's Alpha
Supplier integration	1-6	0/88
Customer integration	7-11	0/79
Manufacturing flexibility	12-16	0/89
Service capability	17-21	0/92
New product performance	22-30	0/92
Questionnaire total		0/97

**Findings**

Before testing hypotheses, mean, standard deviation and variance of study variables should be considered (table 2). Among the variables new product performance has the highest value and the contingency reward appropriate for developing product has the lowest value.

**Table 2. Descriptive statistics for study variables**

variable	Number	Mean	Standard deviation	Variance
Supplier integration	1-6	3,0616	.81447	.663
Customer integration	7-11	3,0036	.75852	.575
Manufacturing flexibility	12-16	3,5055	.56377	.318
Service capability	17-21	3,6861	.63293	.401
New product performance	22-30	3,5192	.75530	.570

**Measuring model**

In the model of structural equations it is required to test two models. First model includes measuring models for each latent variable. Measuring model represents factor weights of observed variables (factor) for each latent variable. Common goodness of fit indices in measuring models for 6 study latent variables are representing in following table. As observed, main goodness of fit indices of all of latent variables are in the acceptable range.

**Table3. Goodness of fit indices for latent variables measuring models**

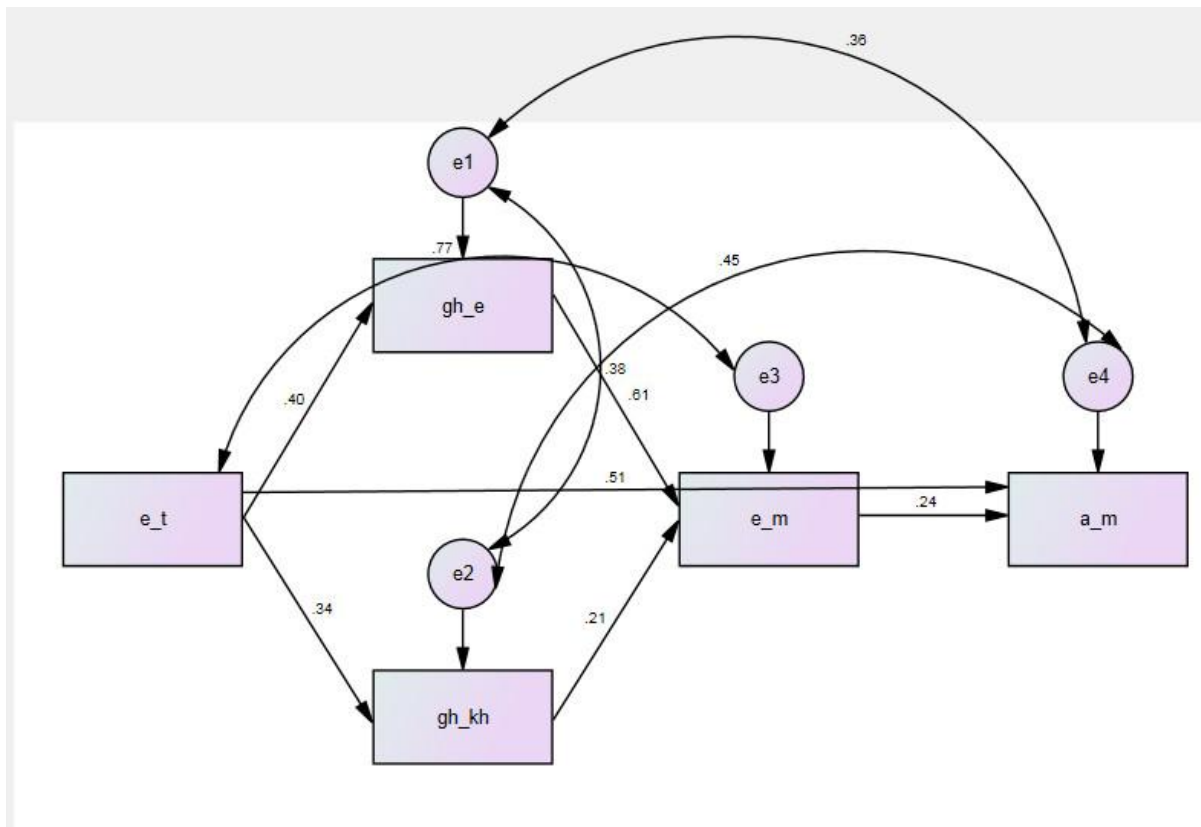
fit indices	Index	Basic model
	NPAR	15
	DF	0



	P greater than (/0/05)	---
absolute	CMIN (Chi Square)	0
	AGFI) greater than (0/9)	---
	GFI greater than (0/9)	1
Comparative or relative	TLI greater than (0/9)	---
	NFI greater than (0/9)	1
	CFI greater than (0/9)	1
thrifty	PNFI greater than(0/5)	0
	PCFI greater than(0/5)	0
	RMSEA) smaller than(0/08)	0/444
	CMIN/DF smaller than(0/5)	---

**Structural model**

After testing the measuring models, it is time to test and represent structural model that representing the relationship between study's latent variables. Using structural model we can test study hypotheses. Structural model of this study is analysed by AMOS software. Figure 1 shows the tested conceptual model. In outcome of structural equations, primary tested model of this study regarding the standard naming effect of exogenous variables on endogenous variables represents with the ( $\gamma$ ) symbol and effect of endogenous variables on each other represents with ( $\beta$ ) symbol. In order to investigating the extent of significance of  $\gamma$  and  $\beta$  coefficients it is required to show t value of each path. t value of paths shows that all of paths are significant (t-value>2) and as a result all of paths were acknowledged.



**Figure 2. Study model**

**Table 4. Testing study hypotheses**

	hypothes	Critical ratio C.R	Standard error S.E.	Standard coefficient	P	conclusion
Supplier integration ->new product performance	home	5/132	0/093	0/514	***	confirmed
Supplier integration---> manufacturing flexibility	First sub	5/510	0/050	0/395	***	confirmed
Supplierintegration--->service capabilhty	Second sub	4/602	0/057	0/338	***	confirmed
manufacturing flexibility-> customer integration	Third sub	0/479	0/072	0/607	0/013	confirmed
Service capabilhty---> customer integration	Fourth sub	3/387	0/075	0/207	***	confirmed
customer integration---> new product performance	Fifth sub	3/387	0/075	0/243	***	confirmed
*** indicate that P less than 0/001						

**Conclusion**

Study findings showed that supplier integration has a significant impact on new product performance ( $\gamma=0.51$ ) which is consistent with the previous study of Lau et al. (2010). They showed that there is a positive relationship between supplier integration, customer integration and new product performance. In this study supplier integration has a positive impact on manufacturing flexibility ( $\gamma= 0.40$ ). Chang et al. (2003) in their research showed that there is a positive and significant relationship between supplier integration and manufacturing flexibility. They also suggested that companies use different types of outsourcing to reduce internal flexibility which this outsourcing of flexibility requires involving all of supply chain and committed relationships in manufacturing planning and flow of physical resources with partners. Also in this study supplier integration has positive impact on service capability ( $\gamma= 0.34$ ). Vickery et al. (2003) in their research showed that there are direct and positive relationship 1) between information technology integration and supply chain integration, 2) between supply chain integration and service offered to customers and 3) between service offered to customers and company performance. They also suggested that there is an indirect relationship between supply chain integration and financial performance of company through offering service to customers. In this study manufacturing flexibility has a positive impact on customer integration ( $\beta=0.61$ ). Hing et al. (2004) found that manufacturing flexibility makes

better responsiveness to customers' needs which this issue by its own is possible through selecting right suppliers and flexible manufacturing strategies. Also in this study service capability has a positive impact on customer integration ( $\beta=0.21$ ). Furthermore, customer integration has a positive impact on new product performance ( $\beta= 0.24$ ). This result is consistent with Danese and Romano (2011) study which showed that new product performance and improvement of productivity require simultaneous leveling, customer and supplier integration and promotion of their interaction instead of investing on customer integration alone. Moreover, before decision making for investing on customer integration, managers should consider supplier integration as a prerequisite for successful execution of customer integration.

### **Implications**

This study suggest that multiple promises such as technological promises for connecting to technologies used by companies, managerial promises result from adjustment of procedures and management systems or legal promises in the form of contracts between companies which can include transfer of knowledge contracts and different licenses are used for reinforcement of consistency and sustainability of members of supply chain. Study findings also suggest that other variables affecting new product performance are investigated and measured which this work can make the road lighter for managers. Also it is suggested that this study is carried out among other industries which by doing this we can extent results to other areas. It would be suitable if impact of supply chain mechanisms on innovation is investigated which this way we can use its results to improve process of developing new product. Finally it is suggested that managers have access to demand information that is created by sellers and end users (the final stage of supply chain). This issue besides helping decision makers make their decisions based on right knowledge can create a sense of trust and honesty between involved organizations in supply chain.

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