Examine the relationship between supply chain integration (sci) and modular product design and their impact on product performance

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Abstract

supply chain integration that involves Enterprise process multiple, internal functional units suppliers and customers can combine, supply chain integration is a process that does not count at all business functions and reflects activities or processes across multiple enterprise suppliers, internal functional units and customers and under such conditions unsafe for competition in the market, manufacturers and suppliers should have a modular design and produce their products. They are, independently, are designed the "make or process a product composed of smaller sub-collections as a whole together until." Given the complexity and their importance to being modular, this study examines the relationship between integrated product design on supply chain performance is produced, this study examines the relationship between integrated supply chain and modular products design their effect on product performance. In this study has been used a correlation -survey techniques for data collection, a sample have been selected, accessible randomly of 380 persons of personnel and managers producers associated with the modular industry .Assumptions to measure is designed questionnaire and data collected using Inferential statistical methods and structural equation modeling to has been investigate relationships between research variables. Results showed that model can be used for the statistical community. The next section data analyzes was the causal test. Results indicate Information sharing within integrated supply chains has not a positive relationship with product performance; Product co-development within SCI has not a positive relationship with product performance. Organizational coordination within SCI has a positive relationship with product performance. Information sharing within SCI has a positive relationship with product modularity. Product co-development within SCI has not a positive relationship with product modularity. Product co-development within SCI has a positive relationship with product modularity.

Keywords: Supply chain management; Product design; Production planning; manufacturing industries; IRAN

Examinando a relação entre a integração da cadeia de suprimentos (sci) e o design modular de produtos e seu impacto no desempenho do produto

Resumo

A integração da cadeia de suprimentos que envolve fornecedores corporativos e fornecedores de unidades funcionais múltiplas e internas pode combinar; a integração da cadeia de suprimentos é um processo que não conta em todas as funções de negócios e reflete atividades ou processos em vários fornecedores corporativos, unidades funcionais internas e clientes. condições inseguras para a concorrência no mercado, os fabricantes e fornecedores devem ter um projeto modular e produzir seus produtos. Eles são, independentemente, projetados para "fabricar ou processar um produto composto de sub-coleções menores como um todo até que". Dada a complexidade e sua importância em ser modular, este estudo examina a relação entre o design de produto integrado no desempenho da cadeia de suprimentos, este estudo examina a relação entre produtos de cadeia de suprimentos integrados e modulares projetando seu efeito

no desempenho do produto. Neste estudo utilizou-se uma técnica de correlação-pesquisa para coleta de dados, foi selecionada uma amostra, acessível aleatoriamente de 380 pessoas de produtores gerentes e associados à indústria modular. Suposições para medir é projetado questionário e dados coletados usando métodos estatísticos inferenciais e modelagem de equações estruturais para investigar relações entre variáveis de pesquisa. Os resultados mostraram que o modelo pode ser usado para a comunidade estatística. A próxima análise de dados da seção foi o teste causal. Os resultados indicam que o compartilhamento de informações dentro de cadeias de suprimentos integradas não tem uma relação positiva com o desempenho do produto; O co-desenvolvimento de produto dentro da SCI não tem uma relação positiva com o desempenho do produto. A coordenação organizacional dentro da SCI tem uma relação positiva com o desempenho do produto. O compartilhamento de informações dentro da SCI tem uma relação positiva com a modularidade do produto. O co-desenvolvimento de produtos dentro da SCI não tem uma relação positiva com a modularidade do produto. O co-desenvolvimento de produtos dentro da SCI tem uma relação positiva com a modularidade do produto.

Palavras-chave: Supply chain management; Design de produto; Planejamento de produção; indústrias de manufatura; IRÃ

Examinando la relación entre la integración de la cadena de suministro (sci) y el diseño modular del producto y su impacto en el rendimiento del producto

Resumen

La integración de la cadena de suministro que involucra el proceso empresarial de múltiples unidades funcionales internas que los proveedores y los clientes pueden combinar, la integración de la cadena de suministro es un proceso que no cuenta en todas las funciones comerciales y refleja actividades o procesos a través de múltiples proveedores empresariales, unidades funcionales internas y clientes y bajo tales En condiciones inseguras para la competencia en el mercado, los fabricantes y proveedores deben tener un diseño modular y producir sus productos. De forma independiente, están diseñados para "fabricar o procesar un producto compuesto por subcolecciones más pequeñas en su conjunto hasta". Dada la complejidad y su importancia de ser modular, este estudio examina la relación entre el diseño integrado de productos en el rendimiento de la cadena de suministro, este estudio examina la relación entre la cadena de suministro integrada y el diseño de productos modulares su efecto en el rendimiento del producto. En este estudio se utilizó una técnica de correlación-encuesta para la recolección de datos, se seleccionó una muestra, accesible al azar de 380 personas de personal y gerentes productores asociados a la industria modular. Los supuestos para medir se diseñaron cuestionarios y se recopilaron datos utilizando métodos estadísticos inferenciales y modelos de ecuaciones estructurales para investigar las relaciones entre las variables de investigación. Los resultados mostraron que el modelo puede usarse para la comunidad estadística. La siguiente sección de análisis de datos fue la prueba causal. Los resultados indican que el intercambio de información dentro de las cadenas de suministro integradas no tiene una relación positiva con el rendimiento del producto; El desarrollo conjunto de productos dentro de SCI no tiene una relación positiva con el rendimiento del producto. La coordinación organizacional dentro de SCI tiene una relación positiva con el desempeño del producto. El

intercambio de información dentro de SCI tiene una relación positiva con la modularidad del producto. El desarrollo conjunto de productos dentro de SCI no tiene una relación positiva con la modularidad del producto. El desarrollo conjunto de productos dentro de SCI tiene una relación positiva con la modularidad del producto.

Palabras clave: gestión de la cadena de suministro; Diseño de producto; Planeación de producción; industrias manufactureras.

1. Introduction

The first principle in today's business world is to create value for the customer that achieving it will only be possible through the processes of the company and its supply chain. The supply chain of the products or services of each organization is formed as a result of a combination of organizational legacy, environmental events, and calculated design (Ebtehaj, 2008, 1). Given the competition of markets and more attention to increasing productivity and reducing costs among enterprises, quick access to correct information has become a competitive advantage for firms so using that achieve diminished costs by reducing stock inventory and increasing the speed of material flow and quicker action in the final product (Karimi, 2010, 12). When the concept of integrated supply chain design is spoken, it is meant wise decisions that are made to determine some elements and existing relationships that take into account the different dimensions of chain performance. An integrated supply chain is defined as an organizational process for integrating suppliers, customers and internal operating units to optimize the overall performance of all partners in the supply chain.

Antonio et al. (2010, 2) and Rungtusanatham et al. (2003) stated that Supplier and customer integration is a useful way to obtain external resources from suppliers and customers (Rungtusanatham et al., 2010, 1085). It also reduces the integration of uncertainty in the supply chain and increases demand control in business operations (Towill et al., 2002, 81). Increasing integrated inventory systems by sharing information throughout the supply chain improves customer service and quick response to dynamic markets. Lee(2001), Lampert and Kooper (2000) suggest that in addition, the integration of the supplier and the customer, with a focus on internal integration, leads to product development. Using interactions such as functional coordination and mutual task teams, interaction and collaboration in a company will be improved (Antonio et al., 2010, 20). There are usually three main challenges in an integrated supply chain, product development, organizational coordination and information sharing. The integrated supply chain management system and the interaction between information systems

are one of the most important challenges faced by organizations and have made the need to use information a necessity. On the other hand, there is a significant discussion in the research literature that, is modular product design effective in production? And should modularity of products need to integrate supply chains? and is there any mechanism that allows manufacturing systems to function effectively without integration? (Antonio et al., 2010, 22).

When different groups of customers have different needs, the best idea is to separate them from each product group for their satisfaction; but this often seems impossible as a result of various time and cost constraints to solve such a problem, a strategy for using the product family is based on the modular architecture of the product in order to identify the needs of different customer groups and then to meet those needs by mapping and modifying the product modules. The basis of product design based on the modular structure is that products are designed in such a way as to structure, standard parts and modules that can meet the needs of different groups of customers (Antonio et al., 2010, 25).

In this research, the researcher is trying to explore three organizational processes, namely, information sharing, product development, and organizational coordination and then identifies and investigates the impact of these processes on supply chain integration in the development of modular product and production performance.
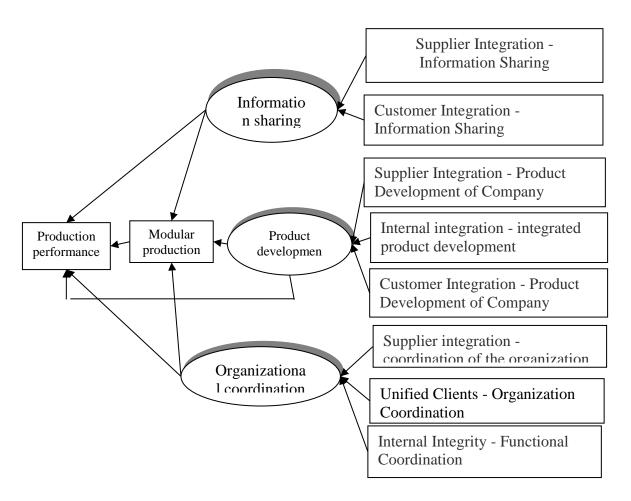
2. Materials and methods

This research from the view point of aim is applied. The statistical population of the research is all industries that produce modular products. In this research, the statistical sample was selected randomly and includes the staff of the relevant industry managers. In the present study, considering that structural equation technique has been used, so the statistical sample size according to the contents is said and according to the opinion of supervisors and counselors to achieve reliable results, 450 questionnaires were distributed. Out of these, 380 questionnaires were available and were collected.

2.1 Analytical model of research

The pattern of this research is based on the research carried out by Lau and Yam in 2010, in the research, information sharing, product development, and organizational

coordination are independent variable, modular production is the intermediate variable and the production performance is the dependent variable.

Figura 1: Theoretical framework model (Lau and Yam, 2010, 24).

3. Results

3.1 Model Research Fitness

Structural equation models are often used to test a theory of the relationships between theoretical structures. In this section, the values of fitness indicators calculated by Lisrel software are presented and then the model's fitness is concluded.

When the sample size is 75 to 200, is a reasonable amount for fitness; but for χ^2 models with larger n, χ^2 is almost always statistically meaningful. This contradicts the fact that, for the SEM method, large sample groups are recommended. In addition, the χ^2 is also affected by the correlation values in the model; the greater the correlation, the weaker fit. For this reason, other sizes have been developed to fit models. A solution to this problem is the development of fitness indicators, although based on χ^2 but because of the sample size, the way is controlled (Hooman, 2006, 40). Among the fitness indices, the RMSEA as a good indicator and CFI are considered as the best indicator. Fitness indices are generally placed in the range between zero and one. Coefficients above 90/0 are considered acceptable, although this is also optional as the surface, P= 0.05 (Ibid, 43).

3.2 Root Mean Square Error of Approximation (RMSEA)

This decimal figure is based on non-centered parameters. The value of RMSEA, which is in fact the same as the deviation test of every degree of freedom, is 0.05 or less for models that have good fitness. Values higher than 0.08 represent reasonable errors for approximation in the community. Models with a RMSEA of 10/0 or more have a poor fit (Homan, 2006, 42). Hue and Bentler (1999) as a good cut-off point for good model, they have suggested a value of less than or equal to 0.06 (Ibid, 245).

In the current study, the calculated value for this index is 0.081, which indicates the relative acceptability of the research model.

3.3 Adaptive or comparative fitness index (CFI)

If this index is greater than 0.1, then it is equal to 0.1, and if it is smaller than zero, then zero is set. Fitness indices are generally in the range between zero and one. Ratios above 90% are considered acceptable (Ibid, 43).

In the present study, the calculated value for this index is 0.49, which is an indication that it is desirable.

3. 4 Hypothesis Testing

In order to measure the variables of the research, the correlation relation used in the hypotheses is used to model structural equations. This work, in addition to the final step of a verifiable factor analysis previously undertaken on the research scale, also shows the reliability of the proposed conceptual model through fitting-out indicators of the model. As shown in Figures 2 and 3 validity and fitness of models are verified, as χ^2 and χ^2 to freedom degree ratio in all models are less than 3 and also RMSEA is bigger than 2. The values of AGFA, GFI, and t value will be significant at a confidence level of 99% or less than 2. All values are significant.

In the present study, after modeling the model based on the data, the size of the model parameters was obtained using Lisrel software. Therefore, using the gamma coefficients (γ), and T-test the hypotheses have been tested.
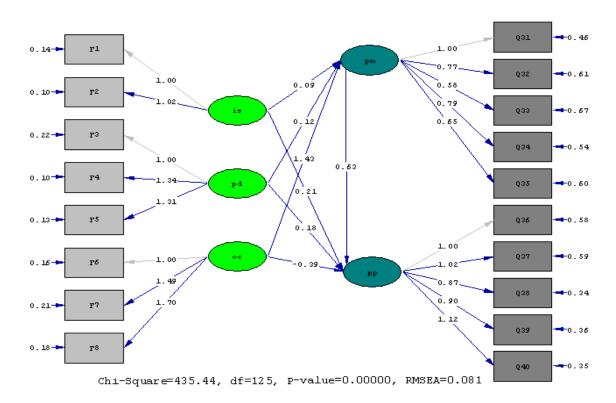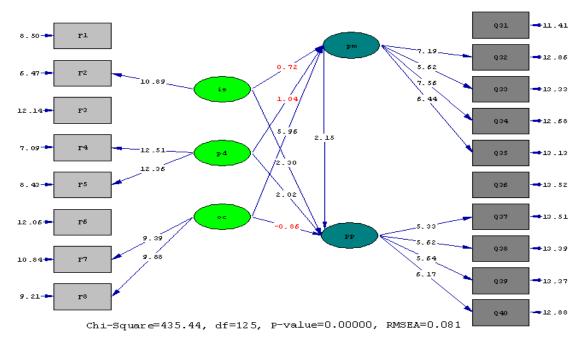

Figura 2: Structural Standard Model Coefficients and Measurement

Chi-Square=435.44, df=125, P-value=0.00000, RMSEA=0.081

Figura 3: T statistics for model coefficients

Following tables include questions related to the extent of information sharing, product development and organizational coordination. In the questionnaire of the present research, a total of 40 questions of 5 dimensions of the research model are measured, so that each of these dimensions has several questions.

Table 1
Information sharing Measurement Scale

	First Factor	Second Factor	Standard Coefficient	T-Value
1	Supplier Integration - Information Sharing	Information sharing	1.00	---
2	Costumer Integration - Information Sharing	Information sharing	1.02	10.98

Table 2
Product development Measurement Scale

	First Factor	Second Factor	Standard Coefficient	T-Value
3	Supplier Integrity - Product Development of Company	Product development	1.00	----
4	Internal Integration - Product Development	Product development	1.34	12.51
5	Customer Integration - Product Development of Company	Product development	1.31	12.36

Table 3

Organizational coordination Measurement Scale

	First Factor	Second Factor	Standard Coefficient	T-Value
6	Supplier integration - coordination of the organization	Organizational coordination	1.00	---
7	Unified Clients - Organizational Coordination	Organizational coordination	1.49	9.39
8	Internal Integration - Performance Coordination	Organizational coordination	1.70	9.88

Table 4

Modular product Measurement Scale

	Dimensions	Questions	Standard Coefficient	T-Value
9	Modular product	In this organization, the product can be split into separate modules	1.00	----
10	Modular product	In this organization, we can make a product redesign without changing the key components	0.77	7.19
11	Modular product	The product components can be reused in different products.	0.58	5.62
12	Modular product	Product production is a high degree of transmission of components.	0.79	7.56
13	Modular product	Product components are standard	0.65	6.44

Table 5

Production performance Measurement Scale

	Dimensions	Questions	Standard Coefficient	T-Value
14	Production performance	Production performance	---	1.00
15	Production performance	The products produced in this organization have helped to achieve sales goals.	5.33	1.02
16	Production performance	The product produced will help the organization earn the desired profit.	5.62	0.87
17	Production performance	The product produced has led to a high profitability of the organization.	5.64	0.90
18	Production performance	Customers are very satisfied with the production (product) of the product	6.17	1.12

Table 6

Indices of Research Model Fitness

Estimated Values	Standard values	Macro	Fit index
125	-----	Degrees of Freedom	Degrees of freedom
435.44	Due to the dependence on the sample size, the criterion is not suitable	Chi-Square	χ^2
0.081	0.05	RMSEA	Root Mean Squares Estimated Error
0.91	0.90	NFI	Normal fit index
0.93	0.90	NNFI	Non Normal fit index
0.94	0.90	CFI	Comparative or comparative fit index
0.036	0.05	RMR	Root mean squares remaining
0.89	0.90	GFI	Fit goodness
0.85	0.90	AGFI	Goodness corrected fit

To determine the measurement unit of the variable, the setting is a non-zero value (usually 0/1) in the columns and rows of the matrices of the latent variables. This operation defines any given variable in relation to one of the observed variables, that is, the unit of measurement of each variable is equal to the unit of measurement of the observed latent variable, including its error. In practice, for the observed variable, a constant value that indicates the best-fitted variable is considered (Hooman, 2006, 108).

As shown in Table 6, a coefficient of λ is assumed to be 0/1 in order to be basis of variable measurement, and remain latent variables constant.

As seen in the table above, GFI is 0.89 and AGFI is 0.85 RMSEA is 0.081 and CFI is 0.94, all at an almost acceptable level.

Table 7 also summarizes the results of standard coefficients and t statistics for each hypothesis.

Table 7

Hypotheses Results

Path	Estimated coefficients	t statistics	Hypothesis Results
1- Information sharing in integrated supply chain and production performance has a positive relationship.	0.09	0.72	Rejected
2- Product development of company in integrated supply chain and production performance has a positive relationship.	0.12	1.04	Rejected

	Estimated coefficients	T statistics	
3- Organizational coordination in integrated supply chain and production performance has a positive relationship.	1.43	5.96	Confirmed
4. Information sharing in integrated supply chain with the modularity of production has a positive relationship.	0.21	2.30	Confirmed
5. Product development in integrated supply chain with the modularity of production has a positive relationship.	0.18	2.02	Confirmed
6. Organizational in integrated supply chain with the modularity of production has a positive relationship.	-0.39	-0.86	Rejected
7. There is a positive relationship between modular production and production performance.	0.63	2.15	Confirmed

The first hypothesis Test

H1: Information sharing in integrated supply chain and production performance has a positive relationship.

H0: Information sharing in integrated supply chain and production performance has not a positive relationship.

H_1: Information sharing in integrated supply chain and production performance has a positive relationship.

Table 8
standard coefficient and T statistics of the first hypothesis

Path			Hypothesis	Estimated coefficients	T statistics
Information sharing	→	supply chain and production performance	H_0	0.09	0.72

Based on the results (t= 0.72 < t= 1.96), so this relation is not supported and the path that connects these two variables is positive and meaningless (This relationship is significant at 95% error level) ($t = 0.72, \gamma_{11} = 0.09$). So information sharing in integrated supply chain and production performance has not a positive relationship.

The second hypothesis Test

H2: Product development of company in integrated supply chain and production performance has a positive relationship.

H_0: Product development of company in integrated supply chain and production performance has not a positive relationship.

H_1: Product development of company in integrated supply chain and production performance has a positive relationship.

Table 9

standard coefficient and T statistics of the second hypothesis

Path			Hypothesis	Estimated coefficients	T statistics
Product development	$\rightarrow$	Integrated supply chain and production performance	H_1	0.12	1.04

Based on the results (t= 1.04 < t= 1.96), so this relation is not supported and the path that connects these two variables is positive and meaningless (This relationship is significant at 95% error level) ($t = 1.04, \gamma_{21} = 0.12$). So product development of company in integrated supply chain and production performance has not a positive relationship.

The Third hypothesis Test

H3: Organizational coordination in integrated supply chain and production performance has a positive relationship.

H_0: Organizational coordination in integrated supply chain and production performance has not a positive relationship.

H_1: Organizational coordination in integrated supply chain and production performance has a positive relationship.

Table 10

standard coefficient and T statistics of the Third hypothesis

Path			hypothesis	Estimated coefficients	T statistics
Organizationa coordination	→	Integrated supply chain and production performance	H_0	1.43	5.96

Based on the results (t=5.96 > t=1.96), so this relation is supported and the path that connects these two variables is positive and meaningful (This relationship is significant at 95% error level) ($t = 5.96, \gamma_{31} = 1.43$). So organizational coordination in integrated supply chain and production performance has a positive relationship.

The fourth hypothesis Test

H4: Information sharing in integrated supply chain with the modularity of production has a positive relationship.

H_0: Information sharing in integrated supply chain with the modularity of production has not a positive relationship.

H_1: Information sharing in integrated supply chain with the modularity of production has a positive relationship.

Table 11

standard coefficient and T statistics of the fourth hypothesis

Path			hypothesis	Estimated coefficients	T statistics
Information sharing	→	integrated supply chain with the modularity of production	H_0	0.21	2.30

Based on the results (t=2.30 > t=1.96), so this relation is supported and the path that connects these two variables is positive and meaningful (This relationship is significant at 95% error level) ($t = 2.30, \gamma_{12} = 0.21$). So information sharing in integrated supply chain with the modularity of production has a positive relationship.

The fifth hypothesis Test

H5: Product development in integrated supply chain with the modularity of production has a positive relationship.

H_0: Product development in integrated supply chain with the modularity of production has not a positive relationship.

H_1: Product development in integrated supply chain with the modularity of production has a positive relationship.

Table 12

standard coefficient and T statistics of the fifth hypothesis

Path			hypothesis	Estimated coefficients	T statistics
Product development	→	production performance	H_1	0.08	2.02

Based on the results (t=2.02 > t=1.96), so this relation is supported and the path that connects these two variables is positive and meaningful (This relationship is significant at 95% error level) ($t = 2.02, \gamma_{22} = 0.18$). So product development in integrated supply chain with the modularity of production has a positive relationship.

The sixth hypothesis Test

H6: Organizational coordination in integrated supply chain with the modularity of production has a positive relationship.

H_0: Organizational coordination in integrated supply chain with the modularity of production has not a positive relationship.

H_1: Organizational coordination in integrated supply chain with the modularity of production has a positive relationship.

Table 13

standard coefficient and T statistics of the sixth hypothesis

Path			hypothesis	Estimated coefficients	T statistics
Organizational coordination	→	integrated supply chain with the modularity of production	H_0	-0.39	-0.86

Based on the results (t= -086 < t= 1.96), so this relation is not supported and the path that connects these two variables is positive and meaningless (This relationship is significant at 95% error level) ($t = -0.86, \gamma_{33} = -0.39$). So organizational coordination in integrated supply chain with the modularity of production has not a positive relationship.

The seventh hypothesis Test

H7: There is a positive relationship between modular production and production performance.

H₀: There is no a positive relationship between modular production and production performance.

H₁: There is a positive relationship between modular production and production performance.

Table 14
standard coefficient and T statistics of the seventh hypothesis

Path			hypothesis	Estimated coefficients	T statistics
modular production	→	production performance	H₁	0.63	2.15

Based on the results (t=2.15 > t=1.96), so this relation is supported and the path that connects these two variables is positive and meaningful (This relationship is significant at 95% error level) ($t = 2.02, \gamma_{22} = 0.18$). So there is a positive relationship between modular production and production performance.

4. Discussion and conclusion

The analysis of the first hypothesis results

According to the structural equation graphs, path coefficients between Information sharing and supply chain and production performance is 0.09 that according T-test t= 0.72 < t= 1.96 at a significant level of 0.05 the relationship is not meaningful so it can be said that Information sharing in integrated supply chain and production performance has not a positive relationship. And because the path coefficient is positive, the type is directly related.

Several authors have emphasized the importance of sharing in the supply chain in the promotion of competitive advantage in a variety of ways, including better understanding of market processes and customer needs, new ideas for products, and the identification of methods

to improve production methods and reduce the production cycle time (Mentzer, 2004, 21). Information is critical to the performance of a single supply chain, because it creates the basis for decisions made by the supply chain managers in this regard. The information includes the tools used to obtain the necessary information from the available information as well as their analysis to get the best decision in the supply chain. Without information, a manager does not know what customers want, how much inventory is in stock, or when products are produced and shipped more. In fact, without the information of a manager, it can only take blind decisions. As a result of information sharing, the supply chain is visible to managers and employees, and with the view that the information is given to a manager, he can decide on the improvement of the supply chain. Some authors point to weaknesses caused by poor data sharing in the supply chain. But few empirical tests have been performed to examine the internal relationship between multiple supply chain integration processes and business performance, it is also not clear which of the supply chain integration processes has a direct or indirect relationship with the yield of the product. Considering this issue, this relationship has been investigated in this study, although some studies confirm this relationship, this relationship has been rejected in the present study. Due to the nature and features of the production systems, the knowledge of employees and managers of efficient information systems is indispensable for any industry, therefore, to achieve this goal, it is necessary for the industry to make the correct decisions in order to increase its production performance.

The analysis of the second hypothesis results

According to the structural equation graphs, path coefficients between Product development and integrated supply chain and production performance is 0.12 that according T-test t= 1.04 < t= 1.96 at a significant level of 0.05 the relationship is not meaningful so it can be said that product development of company in integrated supply chain and production performance has not a positive relationship. And because the path coefficient is positive, the type is directly related, that is, the increase and decrease of product development in the supply chain can contribute to the increase and decrease of production performance.

Growth and development of products is another important organizational process in the supply chain integration, it is because of the collective effort of product development among suppliers, customers and internal functional units, developing products with suppliers and customers returns to common product designs, process engineering, and manufacturing

operations, with suppliers and customers, respectively. Integrated product development integrates precisely from product design, process development, and production to product placement on the market. Different authors have emphasized on the harmonious development of products with suppliers, customers and internal functional areas. However, few experimental experiments have been carried out to determine and evaluate the internal relationship between the multiple processes of integrated supply chain and business performance, and it is not clear that the integrated supply chain processes have direct or indirect relations with production performance. In this study, this relationship has not been confirmed. And as stated, although paying attention to the different dimensions of customer requirements and requirements, the main motivating factor is to provide organizations with a new product or service and leads to increased customer satisfaction, but this factor cannot improve the performance of production.

The analysis of the Third hypothesis results

According to the structural equation graphs, path coefficients between Organizational coordination and integrated supply chain and production performance is 1.43 that according T-test t=5.96 > t=1.96 at a significant level of 0.05 the relationship is meaningful so it can be said that organizational coordination in integrated supply chain and production performance has a positive relationship. And because the path coefficient is positive, the type is directly related means that with the coordination of the organization in the supply chain, production performance increases, and in return, with the lack of organizational hierarchy in the supply chain, production performance is reduced.

Some studies say that organizational coordination is important for supply chain integrity, which means that internal and external coordination, business decision-making and collective valuation / business plan schemes return to the supply chain (Lee, 2000, 32). Mentzer (2004) suggests that the development of a joint system and joint decision making with suppliers and customers will increase understanding of the management decisions of the partners, and subsequently promote the sharing of risks and renewal of resources in the supply chain, organizational coordination reduces the cost and development time, and increases the percentage of net sales in product production. Internal coordination activities include functional coordination, engagement and collaboration with a company (Antonio et al., 2010, 25). Kahn stated that internal coordination increases the understanding of goals and activities among different functional units and increases mutual trust and commitment to the organization (Kahn, 1996, 140). Because people trust each other and cooperate more with their organizations, for

further coordination, they motivate the crop to increase production performance. Fishammar and Horte (2005) also found that collaboration between internal units was positively related to product innovation. The results of this research also indicate that organizational coordination in the supply chain is an important factor in the performance of production. In this regard, managers should pay attention to the improvement of communication and organizational co-ordination.

The analysis of the fourth hypothesis results

According to the structural equation graphs, path coefficients between Information sharing and integrated supply chain with the modularity of production is 0.21 that according T-test t=2.30 > t=1.96 at a significant level of 0.05 the relationship is meaningful so it can be said that information sharing in integrated supply chain with the modularity of production has a positive relationship. And because the path coefficient is positive, the type is directly related means that with the sharing of information in the supply chain, modular production performance is increased, and in spite of the lack of information sharing in the supply chain, modular production decreases.

The design of a product with product modularity shows that the product is composed of a set of independent modules with standardized intervals between different modules. These modules are largely different and can be successfully linked to outsourcing providers (Novak and Eppinger, 2001, 192). Since product modules are linked to external partners, information sharing is very important for the identification and production of modular products, in order to effectively design product distances, information about the market and customer preferences must be provided (Du et al., 2001, 314). And the information between the various designers in the organizations to be shared and share information about engineering parameters with supply chain partners. Marketing, production and technical information from suppliers and customers in modular production development projects can be identified and re-used to create better modular products in the future (Antonio et al, 2010, 28). Some authors state that since the modules and structures of the product are clearly defined, Information in modules can be discontinued, and recurring information and communications between supply chain partners may decrease in product development (Baldwin and Clark, 2000, 17). According to the stated content and importance of information sharing in the supply chain, it can be said that

information sharing in the production of modular products is effective and the results of the research are based on this.

The analysis of the fifth hypothesis results

According to the structural equation graphs, path coefficients between product development and production performance is 0.18 that according T-test t=2.02 > t=1.96 at a significant level of 0.05 the relationship is meaningful so it can be said that product development in integrated supply chain with the modularity of production has a positive relationship. And because the path coefficient is positive, the type is directly related means that with the development of the product in the supply chain, modular production performance increases, and in spite of the lack of product development in the supply chain, modular production decreases.

The development of the company with the model suppliers is an advantage in product development Sabel and Zeithin (2004) suggest that the development of modular products requires the development of the company with the appropriate suppliers to redefine the specifications of the distances for new products. Particularly if modules are used for future redevelopment projects, product development can help producers predict changes in customer needs. Sanchez (1991) stated that the unity between marketing, design engineering, manufacturing, and distribution departments for using modular product designs requires a full range of benefits of developing modular products. Also, many researchers have argued that the development of company products with suppliers, units of operation, and customers is important in modular product designs (Antonio et al., 2010, 28).

The analysis of the sixth hypothesis results

According to the structural equation graphs, path coefficients between organizational coordination and integrated supply chain with the modularity of production is -0.39 that according T-test t= -086 < t= 1.96 at a significant level of 0.05 the relationship is not meaningful so it can be said that organizational coordination in integrated supply chain with the modularity of production has not a positive relationship.

Experimental studies show that producers tend to coordinate their supply chain strategically and organizationally when they adopt a modular design. Chrysler Jeeps in his research he expresses that Close and credible relationships between customers and suppliers are needed to solve the problems of coherence and harmonization of distances between different

modules. Sabel and Zeithin suggest that when adopting a modular product plan, organizations must mutually evaluate each other's internal business processes in order to find solutions to technical problems and marketing in the development process. However, some writers suggest that modular products are outsourced to modular suppliers in a single integrated mode. Supply chain with little coordination, lets the manufacturers in a flexible way, their suppliers are changed to the main components for cost or technical benefits. Manufacturers must, in coordination with the supply chain, be able to maintain their own supply chain at any physical distance, have proper and independent management structures, and have structures with a low level of electronic connection (Antonio et al., 2010, 29).

According to the stated statements, organizations should work with the organizational coordination to produce modular tools and research shows that organizational coordination is an important factor in modular production. But the results of this study show that the organization's hometown in the supply chain does not affect the modularity of production and does not match the results of the research.

The analysis of the seventh hypothesis results

According to the structural equation graphs, path coefficients between modular production and production performance is 0.63 that according T-test t=2.15 > t=1.96 at a significant level of 0.05 the relationship is meaningful so it can be said that there is a positive relationship between modular production and production performance. And because the path coefficient is positive, the type is directly related means that with the modularity of production, production performance increases and, with the lack of modularity of production, production performance decreases.

Production performance is almost all of the goals of competitiveness and product excellence and it is related to cost, flexibility, speed, reliability or quality. In addition, performance can be described as an umbrella for all concepts that incorporate the success and activities of all companies. In the case of modularity, the product has some modularity advantages. First and foremost, they are reducing production costs caused by mass production savings in which modules have several functions, and reduce the cost of setting up the production process and the cost of maintaining inventory (Fisher et al., 1999, 300). There are also benefits in terms of reducing the cost of creating and developing which in that design

process must be carefully identified and managed in which the development of new modules is less complicated than the development of mainstream projects. Modularity can enhance the ability of the company to provide customer service through rapid problem solving and the transmission of general components and services to customers, as well as the possibility of offering goods and updating their growth and development at final cost (Antonio et al., 2010, 29). The overall impact of these advantages is to better serve the customers.

Some researchers have argued that by increasing the production of a modulus, the ability to increase production performance can be increased, but some researchers have reported negative modular effects on product performance, but in the present study, this relationship has been confirmed.

In a study conducted by Leo and his colleagues in 2010, his research results show that 1- information sharing in the supply chain of the company does not have a positive effect on production performance. 2- The product development of the company in the supply chain of the integrated production with the production performance has a positive relationship. 3. There is no positive relationship between the organization's hygienic supply chain and its production performance. 5- There is a positive relationship between information sharing in the supply chain with modular production. 6- Organizational co-ordination in the integrated supply chain and modularity of production has a positive relationship.7-There is a positive relationship between modular production and production performance.

According to the results of the present research, his research results show that in both studies, the first, second and sixth hypotheses have been rejected, as in the present research, but in Leo's study the third hypothesis has been rejected, however, the other assumptions in both researches are consistent.

- According to the results obtained in this study, the following suggestions can be made:
- Manufacturing companies need to know how to invest in information sharing in the supply chain, since the cost of sharing information cannot be ignored.
- Providing substrate for product development and manufacturing industry to modular production.
- Employing desperate, competent, talented and capable managers.
- Application of modular production system with efficient and efficient supply chain design.
- Establishing appropriate communication and information networks in the supply chain.

- Integrating knowledge and information and supporting people's awareness of organizational information.

- Identify the role and importance of human resources in increasing organizational performance and production process.

- Establishing the correct coordination in the supply chain organization.

- By modulating the process of product development and development, customer satisfaction increases, and market share and profits for all organizations involved in the supply chain increase.

- With the design of an integrated supply chain, manufacturing companies can maximize total value of production, reduce productivity, reduce inventory, and reduce the total production cycle time.

- Productive organizations, with the coordination of the organization in the supply chain, can have more agility, shorter delivery times, higher profits, and more competitive advantages.

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