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INTERACTIVE SUPPLY CHAIN MODEL CONSISTING ON STRATEGIC COOPERATION IN TABRIZ PIECE MAKING INDUSTRY

MODELO INTERATIVO DA CADEIA DE SUPRIMENTO CONSISTINDO NA COOPERAÇÃO ESTRATÉGICA NA INDÚSTRIA DE FABRICAÇÃO DE PEÇAS TABRIZ

MODELO DE CADENA DE SUMINISTRO INTERACTIVO CONSISTIENDO EN LA COOPERACIÓN ESTRATÉGICA EN LA INDUSTRIA DE FABRICACIÓN DE PIEZAS DE TABRIZ

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ABSTRACT
The dynamics of supply chain structure have led to interesting challenges to the point of effective chain coordination. Due to the fact that chain members cannot compete as independent members, the permanent success of a company depends not only on the performance of that company alone, but also on cooperation and interaction with other companies operating in the supply chain. Therefore, the aim of this study is presenting an interactive supply chain model with a strategic cooperation approach in Tabriz parts manufacturing industry. According to findings, the level of cooperation has the highest influence and the infrastructure of cooperation is the least effective in strategic cooperation. The level of cooperation and the mechanism of cooperation as a causal variable and the infrastructures of cooperation and the context of cooperation and the type of coordination as a disabled variable are related to other variables in the strategic cooperation of the supply chain. The results also showed that the level of cooperation has an impact on cooperation infrastructure.

Keywords: Supply Chain, Interactive, Causal Relationships, Strategic Cooperation, Tabriz piece Making

RESUMO
A dinâmica da estrutura da cadeia de suprimentos tem levado a desafios interessantes ao ponto de uma coordenação efetiva da cadeia. Devido ao fato de que os membros da cadeia não podem competir como membros independentes, o sucesso permanente de uma empresa depende não apenas do desempenho dessa empresa, mas também da cooperação e interação com outras empresas que atuam na cadeia de suprimentos. Portanto, o objetivo deste estudo é apresentar um modelo interativo de cadeia de suprimentos com abordagem de cooperação estratégica na indústria de fabricação de peças de Tabriz. De acordo com os resultados, o nível de cooperação tem a maior influência e a infraestrutura de cooperação é a menos eficaz na cooperação estratégica. O nível de cooperação e o mecanismo de cooperação como variável causal e as infraestruturas de cooperação e o contexto de cooperação e o tipo de coordenação como variável deficiente estão relacionados com outras variáveis na cooperação estratégica da cadeia de abastecimento. Os resultados também mostraram que o nível de cooperação tem impacto na infraestrutura de cooperação.

Palavras-chave: Cadeia de Suprimentos, Interação, Relações Causais, Cooperação Estratégica, Confecção de Peças Tabriz

RESUMEN
La dinámica de la estructura de la cadena de suministro ha llevado a desafíos interesantes hasta el punto de una coordinación efectiva de la cadena. Debido al hecho de que los miembros de la cadena no pueden competir como miembros independientes, el éxito permanente de una empresa depende no solo del desempeño de esa empresa por sí sola, sino también de la cooperación y la interacción con otras empresas que operan en la cadena de suministro. Por lo tanto, el objetivo de este estudio es presentar un modelo de cadena de suministro interactivo con un enfoque de cooperación estratégica en la industria de fabricación de piezas de Tabriz. Según los hallazgos, el nivel de cooperación tiene la mayor influencia y la infraestructura de cooperación es la menos efectiva en la cooperación estratégica. El nivel de cooperación y el mecanismo de cooperación como variable causal y las infraestructuras de cooperación y el contexto de cooperación y el tipo de coordinación

como variable discapacitada se relacionan con otras variables en la cooperación estratégica de la cadena de suministro. Los resultados también mostraron que el nivel de cooperación tiene un impacto en la infraestructura de cooperación.

Palabras clave: Cadena de Suministro, Interacción, Relaciones Causales, Cooperación Estratégica, Creación de Piezas de Tabriz

1 INTRODUCTION

During the years, the point of strategic cooperation in the supply chain obtained a special place in different issues of supply chain management. Supply chain cooperation is the in partnership activity of two or more independent companies in order to plan and execute supply chain operations, with the aim of achieving greater success (Reddy et al., 2021). What is called strategic cooperation is about building cooperation as one of the fundamental strategies of organizations in the supply chain and a major look at the point of cooperation to achieve a competitive benefit. The rationale behind the collaboration strategy is that an organization by itself cannot compete and succeed in nowadays marketing. Therefore, most of organizations try to coordinate inter-organizational activities and mutual cooperation with each other in order to obtain transcendent and individual performance (Nyaga and Lynch, 2010).

The success and effectiveness of the holdings depend on the value creation of subsidiaries and the synergy between the headquarters and its units. The way to gain synergy in holdings is to create a spirit of cooperation between the components. During recent decades, cooperation has been considered as the main axis of improving supply chain performance, and inter-organizational communication has emerged as an undeniable reality and one of the organizational challenges (Qamar et al.,2018). Considering the complex and dynamic nature of markets, not only vertical and internal cooperation but also horizontal cooperation is needed, especially capacity sharing between companies that are not competitors at similar levels, can bring them profitability and stability (Krajewska et al., 2008). It is not possible to accurately determine supply chain levels, depending on the industry in question. Overall, supply chain levels and layers can be supplied in several layers: raw material supplier, manufacturer, distributor or warehouse, retailer and customer. These supply chain levels can be generalized to the auto parts industry, which is a major part of the

complexity of operations and coordination occurs in the first three levels of the supply chain. The three-level supply chain refers to suppliers, manufacturers and distributors (Abdirad et al., 2021).

Lee et al. (2011) mentioned that the mechanism of cooperation between supply chain partners in the use of new technology that potentially improves supply chain efficiency and security as the most important factor in establishing supply chain cooperation. Liu and Wang (2011) consider the existence of crisis in the supply chain system as the most important factor for cooperation between members and believe that in a complex supply chain system, the presence of crisis in each component of the supply chain has negative impact on the whole chain. Crises that arise in a supply chain include whipping, supply chain failure, and cost overruns. Each of these crises has internal causes such as; Demand issues include information transfer problems, technological factors, and defects in supply chain structure, or have external causes such as economic policies and restrictive laws for regional and international activities. Although each member of the supply chain has policies to deal with these crises independently, in the long run term cannot solve these crises alone, so the choice of cooperation strategies from three perspectives: systems theory, psychology and business operations. An essential need for the supply chain. Nyaga et al. (2010) have addressed the issue of dependency in supply chain relationships. Dependency means dependence on the company's need to maintain an interactive relationship to achieve the desired goals. The structure of this dependence determines the level of interdependence in the relationship and has important results such as planning, setting a common goal, measuring performance and problem solving, which are considered as the most important factors in the relationship between supply chain partners. Simatupang and Sridharan (2005) consider supply chain cooperation as an effective strategy and introduce the indicators of supply chain collaboration as quality of information, commitment, automation system, customer focus, coordination between partners, integrated policies, joint decision making. Cai et al. (2010) did not cite the creation of an integrated supply chain information system as factors of trust, legal support, sharing, production planning, product development, and coordination.

The nowadays situation of the automotive industry in the world indicates that long-term contracts have increased. On the other hand, the number of pieces' makers has decreased. So, parts piece making companies and automakers can create a highly competitive supply chain through close cooperation and interaction. Considering the economic and

commercial conditions in today's competitive world, it can be mentioned that the automotive and parts industry needs high competitive capabilities for its survival, and these capabilities are achieved in the light of cooperation strategies and synergy of the supply network (Al-Doori et al., 2019). Based on many management researchers, in the current era, it is no longer individual companies and organizations that compete with each other, but it is the supply chains that are competing with each other. Understanding these conditions and these changes poses many strategic challenges to managers, among which the most important of these challenges are (Dias, 2020):

• By what mechanism and structure within the company can functional integration be established within the company and inter-company integration outside the company?

• How can cooperation or partnership be achieved in inter-organizational relations in the supply network from the level of coordination (alignment of actions) and cooperation (alignment of goals)?

There has been much research one on logistics resources such as physical, human, information, knowledge, and communication resources influencing competitive advantage, but very little research has been done on processes and models of interaction and collaboration in industrial clusters. (Fathi & et al., 2020).

Investigating the future orientations and recommendations of some researchers for future research represents the research gap in providing a model that examines the coordination between the components of supply chain relationships. In such a way that cooperation is done only in one dimension of supply chain, such as operational dimensions or information flow, and requires a study that shows the components of supply chain cooperation in a systematic way. So, the researcher intends to present a model that covers the above restrictions while considering the interaction and cooperation of the supply network. The object of this research is to determine the effective factors in the interaction and cooperation of the three-level supply network in vehicle parts manufacturing and to present the model of supply network interaction with the strategic cooperation approach.

2. THEORETICAL FOUNDATIONS OF RESEARCH

Supply chain management as business activities and relationships is as follows:

(Xu et al., 2020)

The chain is weakened when one of the links tries to optimize its profits, regardless of its other neighbors. Non-compliance in supply chain relationships usually occurs due to the diversity of interests and demands of the parties. On the one hand, the supplier tries to decrease uncertainty, dependency management, exchange efficiency, social satisfaction of the relationship, and protection against price competition; On the other hand, the buyer hopes to obtain continuous improvement, better alignment between the supplier's sales characteristics and his purchase characteristics, and reduction of long-term costs. The purpose of supply chain management is to improve the different activities of the components and levels of a supply chain in order to improve the overall condition of the supply chain system. At this time, there may be many contradictions between the goals of different components and levels to achieve the overall goals of the supply chain, which over time will lead to a decrease in the competitiveness of the supply chain (Craighead, 2020). Thus, the establishment of cooperation system in the supply chain as a response to environmental changes has attracted the attention of many organizations; Many successful organizations now depend on more interaction with their business partners in the supply chain. Strategic cooperation in the supply chain is classified into five main factors:

1) The level of cooperation with policy components, long-term planning, resource allocation, joint performance appraisal system, volume of joint activities, resource sharing and capacity development, activity selection Cooperation, activity planning, activity implementation and activity control.

2) Cooperation infrastructures including capable human resources, organizational culture, trust between colleagues, commitment to cooperation, history of cooperation, attitude to cooperation, information technology and infrastructure Transportation.

3) Collaborative mechanisms include defining common goals, joint decision-making, information sharing, contract management, product standardization, process standardization, and inter-organizational team building.

4) Coordination in new product design tasks, product manufacturing, inventory adjustment, purchasing and logistics, logistics and transportation.

5) Coordination including financial flows, information flows and goods transfers (Subramanian et al., 2016)

Level of cooperation: The cooperation system will remain stable if the strategic components of cooperation are seriously considered. The level of cooperation refers to strategic decisions at the senior levels of partner organizations and also the survival and stability of cooperation relationships depends on it (Nyaga and Lynch, 2010).

Collaborating Infrastructures: Strategic collaboration is possible in the context of infrastructures that refer to the cultural, technological and motivational capabilities of organizations and facilitate the exchange of information and the implementation of the roles of the parties (Nyaga and Lynch, 2010).

Cooperation context: One of the components of strategic cooperation is determining the tasks and activities involved in the supply chain. In other words, creating joint decision-making processes and integrating supply chain processes that can increase the tactical and operational coordination of the chain (Simatupang et al., 2008).

Cooperation mechanism: refers to a set of activities, actions and reactions and methods that supply partners use with each other to adopt a cooperation method (Samei, 2011).

Task coordination: Major activities in the supply chain from upstream to downstream can include non-compliance, inventory management, new product design and development, manufacturing, ordering process, distribution and logistics, sales, demand management and customer service (Larsen, 2000).

Coordination material: Among suppliers, communications such as forecasting information about demand, inventory, inventory, capacity and data of suppliers on the one hand and the purchase order and clearance permit from the focal company to confirm the order by the supplier on the other hand and finally send the goods and there is the invoice and payment of the transaction by the focal company to the suppliers (Mohaghar et al., 2011).

3. RESEARCH METHODOLOGY

The current study is an applied research in terms of purpose method and correlational research in terms of research method. The statistical population of the research is the expert and expert of Tabriz Parts Supply Chain, who have been appointed by the headquarters of the Parts Manufacturing Association. According to the estimate made by the Tabriz piece making Association, the active units in Tabriz piece making is equal to 150 units, and the sample size

is determined to be 108 people based on Morgan's table. The data collection tool is a questionnaire. The face validity of the questionnaire has been approved by professors and experts in this field and to measure content validity, two content validity ratio (CVR) and content validity index (CVI) have been used. In this regard, a questionnaire was presented to 10 expert professors to express their opinions based on the necessity of each question. Thus, for each question, the CVR index is examined so that if its value is less than 0.62, that question is deleted, otherwise it is kept. The CVI index was then evaluated for clarity, simplicity and relevance for each question, if its value was more than 0.79, it was approved, otherwise it was reviewed. Cronbach's alpha coefficient test was used to assess the reliability of the questionnaire, which was 0.919 and its reliability was confirmed. Data collection is a questionnaire of pairwise comparison of research variables. This questionnaire represents a pairwise comparison between the two variables. In order to analyze the data, the Dematel method was used to analyze the internal relationships of factors and indicators. In this way, first the influential factors were investigated and ranked using the network analysis method and then the effect of the variables on each other and the determination of causal variables were investigated using the Dematel method.

4. EXPERIMENTAL ANALYSIS OF FINDINGS

This research has been done in the industrial part of Tabriz piece making company, and the expert members of this group have been interviewed and surveyed as experts introduced by the headquarters of Tabriz Piece making Association.

4.1. Results

Based on the purpose of the first study, according to the identified criteria and sub-criteria, an appropriate model of network analysis has been designed. According to this model, the network analysis process diagram will be in the form of Figure 1.

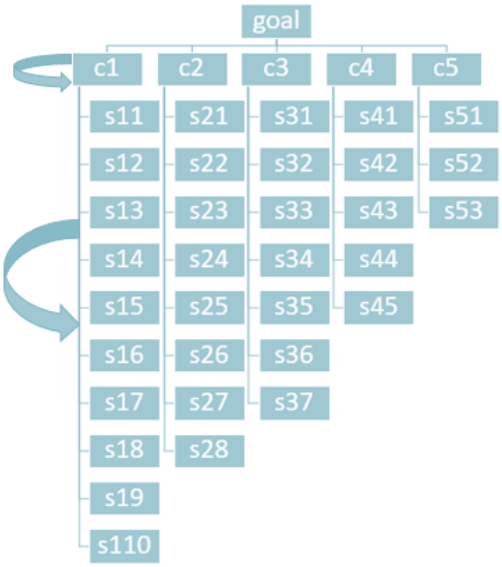

Figure 1. Criteria and sub-criteria of the model and symbols used

Table 1
Criteria and sub-criteria of the model and symbols used

Symbol	Sub-criteria	Symbol	Manin criteria
	Defining common goals among colleagues	S31	
	Comon making decision among colleagues	S32	
	Sharing infromation	S33	
C3	Contract management	S34	**Mechanisms of cooperation**
	Product standardization	S35	
	Process standardization	S36	
	Making inter-organizational teams	S37	
	Product manufacturing	S41	
	New product design	S42	
C4	Inventory adjustment	S43	**Coordination in tasks**
	Purchasing and logestics	S44	
	Transportation and logestics	S45	
	Financial flow	S51	
C5	Information flow	S52	**Type of coordination**
	Transportation of merchandise	S53	

Source: Authors

In order to aggregate comparisons and calculate the final weight, the geometric mean technique was used to finalize the views of experts. One of the best ways to combine group Tables is to use geometric mean. Geometric mean will help to measure the judgment of each

group, taking into account the judgment of each member (Momeni, 2020). Geometric mean is the most appropriate mathematical rule for combining judgments in AHP. Because this mean maintains the inverse property of the pairwise comparison matrix.

4.2. Parallel comparison of the main criteria based on the goal (W21)

In this research, five main factors were selected as decision criteria. These factors are: Level of cooperation, cooperation infrastructure, cooperation mechanisms, coordination in tasks and type of coordination. So, in the first stage, the pair of criteria are compared based on the purpose. The results of pairwise comparisons are shown in Table 2.

Table 2
Parallel comparison matrix of main criteria

	C1	C2	C3	C4	C5	Geometric mean	Special vector
C1	1	2.916	1.180	1.331	1.647	1.498	0.290
C2	0.343	1	0.710	0.960	0.994	0.747	0.144
C3	0.847	1.409	1	1.414	1.344	1.178	0.228
C4	0.751	1.041	0.707	1	1.434	0.955	0.185
C5	0.607	1.006	0.744	0.697	1	0.795	0.154

Source: Authors

So the special vector W_{21} will be as below:

$$\mathbf{W_{21}}= \begin{pmatrix} 0.290 \\ 0.144 \\ 0.228 \\ 0.185 \\ 0.155 \end{pmatrix}$$

The mismatch rate is also 0.01, which shows that pairwise comparisons are desirable. The prioritization of the main criteria based on the purpose of the research is indicated in Figure 2.

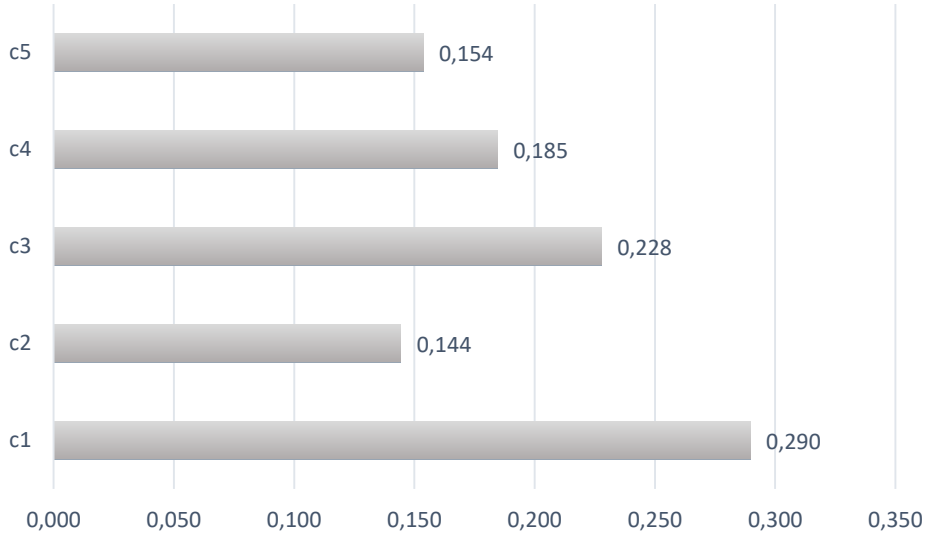

Figure 2: Prioritization of the main criteria based on the purpose of the research
Source: Authors

According to the conducted calculations:

The standard of cooperation level with a normal weight of 0.290 has the highest priority.The criterion of cooperation mechanisms with a weight of 0.228 is in the second priority.Coordination in tasks with a weight of 0.185 is the third priority. The material with a normal weight of 0.154 is in the fourth priority. Cooperation infrastructure with a weight of 0.144 is in the fifth priority.

4.3. Pair comparison of main criteria relationships (W22)

Based on the research model, the next step is to calculate the internal relations of the main criteria to obtain the W22 supermatrix. Dematel technique has been used to reflect the internal relationships between the main criteria. So that experts are able to express their views on the effects (direction and intensity of effects) between factors with more mastery. It should be mentioned that the matrix obtained from the Dematel technique (internal communication matrix) shows both the causal relationship between the factors and the effectiveness of the variables.

4.4. Calculation of direct connection matrix (M)

When using the views of several experts, a simple arithmetic mean of the comments is used and forms a direct correlation matrix, or M.

Table 3
Direct communication matrix (M) main criteria

	C1	C2	C3	C4	C5
C1	0	3.7	3	2.7	2.9
C2	2.1	0	2	1.8	1.5
C3	1.5	2	0	3.6	3
C4	2	2.2	3.3	0	4.2
C5	1.2	2	3.4	4.2	0

Source: Authors

4.5. Calculation of normal direct connection matrix: N = K*M

First, the total of all rows and columns is calculated. The inverse is the largest number of rows and columns k. According to Table 4, the largest number is 11/13, and all values in the table are multiplied by the inverse of this number to normalize the matrix.

$$k = \frac{1}{\max \sum_{j=1}^{n} a_{ij}} = \frac{1}{13.11} = 0.07$$

⇨ N = 0.07*M

Table 4
Normalized matrix (N) of the main criteria

	C1	C2	C3	C4	C5
C1	0	0.3	0.243	0.219	0.235
C2	0.17	0	0.162	0.146	0.122
C3	0.122	0.162	0	0.292	0.243
C4	0.162	0.178	0.267	0	0.34
C5	0.17	0.162	0.275	0.34	0

Surce: Authors

4.6. Calculate the complete correlation matrix

To calculate the complete correlation matrix, the same matrix (I) is formed. Then we normalize the same matrix minus the normal matrix and invert the resulting matrix. Finally, we multiply the normal matrix by the inverse matrix:

$$T = N \times (I - N)^{-1}$$

Table 5
Complete correlation matrix (T) of the main criteria

	C1	C2	C3	C4	C5
C1	0.639701	1.00361	0.83538	1.120766	1.091829
C2	0.601659	0.550989	0.642808	0.804414	0.760314
C3	0.68474	0.823496	0.603164	1.085069	1.019873
C4	0.786725	0.923541	0.893612	0.970898	1.184806
C5	0.796067	0.919116	0.906697	1.232392	0.938549

Source: Authors

4.7. Representing the map of network relations

In order to determine the network relation mape threshold value must be calculated (NRM). By this method, minor relationships can be ignored and a network of significant relationships can be drawn. Only relationships whose values in the T matrix are greater than the threshold value will be displayed in the NRM. To calculate the value of the threshold of relations, it is sufficient to calculate the average values of the T matrix. After the threshold intensity is determined, all values of the matrix T that are smaller than the threshold are zero, ie that causal relationship is not considered. In this study, the threshold value is 0.8. Therefore, the pattern of meaningful relationships is as shown in Table 6:

Table 6
Meaningful relationships pattern of the main criteria of the model

	C1	C2	C3	C4	C5
C1	*	1.00361	*	1.120766	1.091823
C2	*	*	*	*	*
C3	*	*	*	1.085069	1.019873
C4	*	0.923541	0.893614	*	1.184806
C5	*	0.919116	0.906697	1.232392	*

Source: Authors

According to the pattern of relationships, the causal diagram can be drawn based on Table 7:

Table 7
Pattern of causal relations. The main criteria of the model

	D	R	D+R	D-R
C1	4.691259	3.508893	8.200152	1.182366
C2	3.360184	4.220752	7.580937	-0.86057
C3	4.216342	3.881639	8.097981	0.334702
C4	4.759582	5.21354	9.973122	-0.45395
C5	4.79282	4.995363	9.788184	-0.20294

Source: Authors

In Table 7, the total of the elements of each row (D) represents the impact of that factor on other factors in the system. Based on it, the level of cooperation is the most influential. The cooperation infrastructure is in the last place. The total of the elements of the column (R) for each factor indicates the degree of impact of that factor from other factors in the system. Accordingly, the criterion of cooperation and then coordination is very effective. The level of cooperation criterion is less effective.

The horizontal vector (D + R) is the degree of influence of the desired factor in the system. In other words, the higher the D + R factor, the more it interacts with other system factors. Therefore, the criterion of coordination in tasks has the most and the mechanism of cooperation has the least interaction with other criteria studied.

-Vertical vector (D-R) shows the power of influence of each factor. overally, if DR is positive, the variable is a causal variable and if it is negative, it is considered a variable. Collaboration and type are as disabled variables. In the structural equation model methodology, it is first necessary for the resident to study the validity of the structure to determine that the selected markers have the necessary accuracy to measure their desired structures. That is, are the questions correctly chosen to measure the variables? In this study, five variables (level of cooperation, cooperation infrastructures, cooperation mechanism, coordination in tasks and type of coordination) are coded in the form of codes (C1, C2, C3, C4, C5). as Table 8 shows, the calculated AVE values for all structures have the mean value of the extracted variance higher than 0.5, so the items explain more than 50% of the variance of their respective structures. The desirability of the values of this index indicates the existence of convergent validity in the tests used.

Table 8
Measurement model parameters

Variable	AVE	CR	Cronbach's alpha
Collaboration	**0.55**	0.77	0.73
Collaborative infrastructure	**0.61**	0.75	0.78
Collaboration mechanism	**0.60**	0.81	0.8
Coordination in tasks	**0.58**	0.79	0.78
Coordianation type	**0.56**	0.76	0.76

Source: Authors

As we can see in Table 9, the correlation between the structures is less than the square of the mean of the extracted variance of each structure, which indicates that no two variables

are completely correlated with each other, and the composition of the items is such that all structures are well separated from each other.

Table 9
Correlation coefficients between structures and their comparison with AVE squared values

Variable	Collaboration level	Infrastructure	Mechanism	Coordiantion in tasks	Coordination type
Level of cooperation	0.73				
infrastructure	0.64	0.77			
mechansim	0.69	0.61	0.95		
Coordiantion in tasks	0.68	0.52	0.84	0.94	
Coordination type	0.64	0.68	0.69	0.59	0.79

Source: Authors

Therefore, the measurement tool has a divergent validity. Due to the confirmation of convergent validity and divergent validity, the measuring instrument has structural validity. On the other hand, all structures have a combined reliability higher than 0.7. so, there is an internal consistency between the indicators of each variable. Also, because the value of the root ave of the latent variables is greater than the value of the correlation between the latent variables, the validity is confirmed. The factor load of each indicator with its structure has a significant t value at the level of 5% error, ie its value is outside the range of 1.96 and -1.96, also the factor load of each indicator with its structure is higher than 0.5 (In this case, this variable has measured at least 25% of the variance of the hidden variable), then this indicator has the necessary accuracy to measure that hidden structure or attribute. For this purpose, confirmatory factor analysis was performed on the items of the questionnaire. All questions have a factor load above 0.7 and significance values above 1.96 and measure the variables predicted in the questionnaire. Their output in the form of standard coefficients is shown in Figure 3.

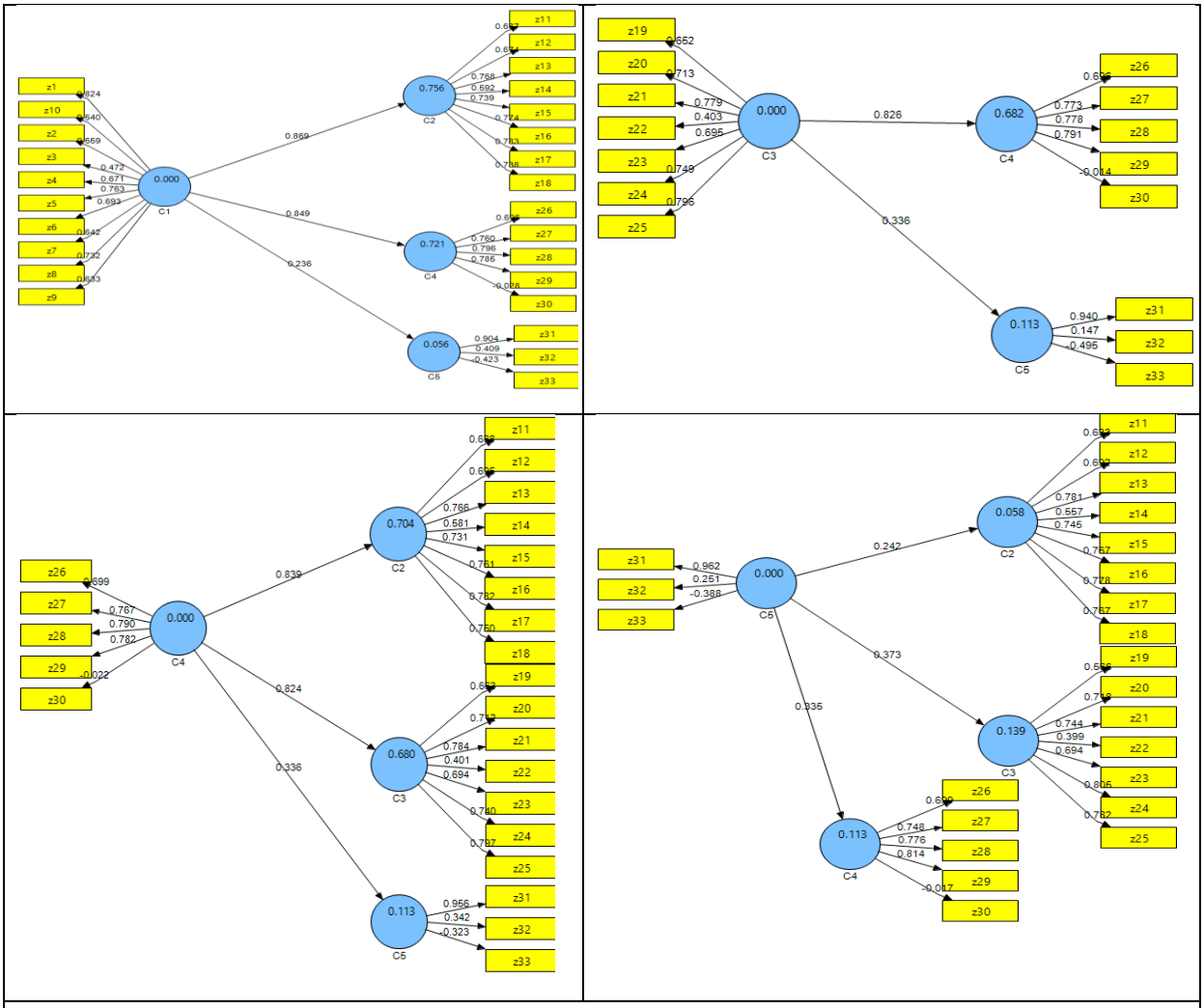

Figure 3. Externalmodel(fourpositions) in standard mode

Source: Authors

An internal model (structural model) explains the relationships between latent variables and determines the amount of the variance of a latent variable explained by other latent variables. To evaluate the model, regular indicators are used for the test, which include R^2, path coefficients and critical coefficients. In order to evaluate the significance of the path coefficient or beta, the resumption method was used. For this purpose, resumption was used in three cases of 100, 300 and 500 samples according to figure 2, that indicates the internal model of the study for research hypotheses in a significant state. It indicates that in both cases the parameters are significant or meaningless and the results are strongly valid.

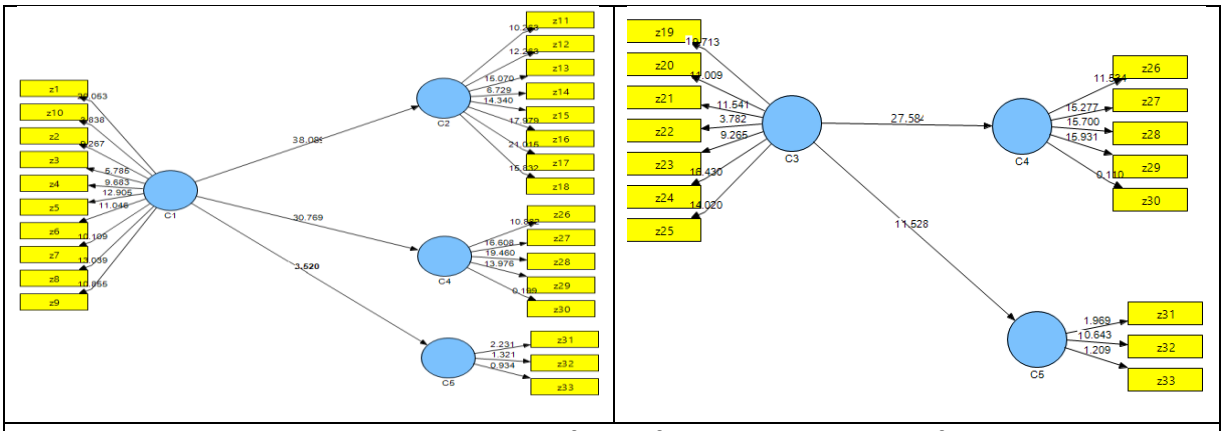

Figure 4. Internal model output for all four states in the significant state

Source: Authors

5. CONCLUSION

According to pairwise comparison between factors y using network analysis, the criterion of level of cooperation has the highest priority, and then respectively the criteria of mechanisms of cooperation, coordination of tasks, type of coordination; Collaborative infrastructures are a priority. The pattern of significant relationships obtained from Dimatel analysis represents that the level of cooperation influences the cooperation infrastructure, cooperation mechanism, coordination in tasks and type of coordination. Collaborative infrastructure is not affected by any of the other factors. The cooperation mechanism has impact in the coordination of tasks and the type of coordination. Task coordination affects collaboration infrastructure, collaboration mechanism, task coordination, and type of coordination. The nature of coordination affects the infrastructure of cooperation, the mechanism of cooperation, coordination in tasks. As the findings of the analysis of causal relationships between the main criteria indicated that the type of cooperation has the highest impact after coordination in tasks, coordination type, coordination mechanism and finally cooperation infrastructure. In terms of impact; Coordination in tasks has the most impact, followed by coordination, type of cooperation infrastructure, cooperation mechanism, level of cooperation. In terms of interactivity; Coordination in tasks, type of coordination, level of cooperation, cooperation infrastructure and cooperation mechanism are more interactive, respectively.

The variables of cooperation infrastructure, coordination in tasks and type of coordination are noticed as disabled variables and the level of cooperation and cooperation

mechanism are known as causal variables. In line with the achieved results and the relationships between the research variables, the following offers can be presented:

There need to be clear cooperation policies and the necessary infrastructure according with it, the necessity to consider to the role and importance of managers and decision makers of companies, consider the sharing the benefits of cooperation, participation of members in decision making is important. Specify the levels of cooperation in terms of strategic level or operational level should be specified and necessary measures should be taken in this regard, cuch as the necessity to consider planning, determining the amount of activities that are carried out jointly, controlling the activities of the performance appraisal system. Identify cooperation activities in terms of financial, information or logistics flows and freight transfers, and suggest the importance of coordination, communication, joint decision-making, information exchange, and resource sharing. Thus, setting contracts, standardizing products, standardizing processes, determining common areas of cooperation, determining the market, creating inter-organizational teams should be suggested. The cooperation mechanism should be determined based on the type of coordination. Therefore, the definition of common purposes should be determined through regular negotiations and meetings and during the conclusion of contracts. Provide technological infrastructure for information exchange and sharing. There are communication channels to track financial flows. Tasks should be coordinated based on the existing infrastructure. Selection of tasks and partners should be based on human resources, logistics, technology, structural and cultural infrastructure. The cooperation mechanism should be commensurate with the coordination of tasks, so it is necessary to design a new product and build a new product by standardizing the product and processes and arranging contracts. Inventory adjustment and purchase and sale of goods should be based on the sharing and exchange of information. Coordination of tasks should be coordinated based on type. In this case, it is suggested to design and build a new product using information flows, purchase items, adjust inventory based on the transfer of goods and financial statements, and buy and sell based on financial flows. Divide the company's activities based on financial flows, freight and technology. In a way, each of these currents strengthens the infrastructure of cooperation. In this regard, special attention should be paid to communication channels such as regular meetings with company managers, as well as improving the information technology and transportation infrastructure by creating appropriate information and logistics approaches. The type of coordination should be selected

based on the coordination mechanism. When the coordination type is information type, the information sharing and exchange mechanism, standardization of products and processes, and the creation of inter-organizational teams should be done. When coordination is financial, joint goal setting and decision-making should be used. In order to design and develop a new product through information flows, create a specialized database so that the results of work and research of each partner are archived and accessible and developed by other members. Improving transfer flows and logistics management also play an important role in creating coordination between members. The difference and innovation of this study with last researches is the emphasis on the relationships between supply chain members and the type of influence and its effectiveness. These findings can offer a specific relationship model for supply chain members and Tabriz piece making companies in general. According to the importance and priority of each of the factors in these relationships to strengthen them. Considering the breadth of the supply chain discussion from raw material suppliers to retailers, several levels of supply chain can be considered. In this research, only raw material suppliers, parts manufacturers and the warehouse sector are considered as three levels of supply chain. In future research, it is suggested that other levels and layers can be added to this chain and investigated. Also using a system dynamics method to analyze the relationships between variables affecting supply chain cooperation and classify supply chain members based on strategic cooperation is suggested to be considered in future research plans.

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