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Evaluation of Cooperation Strategy in Financial Services Supply Chain Based on Prospect Theory and Game Theory

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Abstract

Based on the prospect theory, the current research evaluated the cooperation strategy in the financial services supply chain. This research was descriptive in data collection and quantitative in terms of method. The game theory approach in this research was modeled using the Stackelberg approach. Cooperation strategies in the supply chain included reducing sensitivity, expanding profits, avoiding losses, and relying on references. The 4-player game was used to achieve the best cooperation path. The statistical population of the research was specialists, experts, and managers of companies providing financial services, among which 135 participants were selected as the statistical sample. According to the results, some of the paths of the cooperation model in financing were eliminated, and 24 paths remained out of 81 available options. Then, using the Stackelberg competition, the weights of each route were determined. Finally, with Stackelberg's competition calculations, the best cooperation path was determined, which included the guidance of financing management, the flexibility of financing service providers, the attraction of partners' support policies, and the allocation of financial resources based on the profit expansion prospect. Unlike most empirical studies of supply chain management, which use partners' data at the business unit or strategic partner level, in this research, game theory based on prospect theory was used to evaluate the cooperation strategy. The supply chain of financing services is created to solve financial problems, and different companies, according to the characteristics of their industry, adopt different cooperation strategies based on maximizing their profit in this chain of cooperation.

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1. Introduction

Cooperation in the supply chain (SC) is a collaborative strategy in which one or more companies or business units create mutual benefits (Abapour et al., 2020). This strategy has changed the traditional paradigm of bargaining based on the lowest possible price to increase profits to a new paradigm where integrated solutions that are more focused on a standard product for end customers are considered (Abdellaoui et al., 2020). In cooperation, a collective agreement has been formed between business partners (Amin et al., 2020), based on which information is shared (Ageron et al., 2012) and cooperate mutually to reach a set of shared and collective goals (Ansari and Kant, 2017). Collaboration is the proper method for when SC partners face opportunities or issues that are difficult or complex to solve individually and when there is a need for joint decision-making and planning, sharing of information, the flow of creative ideas, and rich communication through face-to-face meetings (Abapour et al., 2020). Cooperation can benefit business partners facing complex and interdependent problems or opportunities. Very complex problems are difficult to solve and require much effort. Interdependent opportunities and issues are those opportunities and issues that depend on other companies to solve effectively by exploiting them. That is when the knowledge or skills of other companies are needed (Amin et al., 2020). The benefits of inter-organizational cooperation include economies of scale, access to specific resources, cost and risk sharing, learning, and flexibility (Ageron et al., 2012). In general, the level of cooperation in the SC between partners is influenced by various factors. From one point of view, these factors can be placed in two general categories: inter-organizational and intra-organizational factors (Ansari and Kant, 2017). Collaboration in the SC and making the SC agile are two critical issues that managers and researchers pay attention to. The main factor for the importance and attention of these two issues is the changing conditions in the business environment and consumer markets (Abapour et al., 2020). Today, the conditions of the business environment are realized with features such as rapid technology change (Abdellaoui et al., 2020), short product life cycles (Amin et al., 2020), long lead times (Ageron et al., 2012), changes in supply and demand (Ansari and Kant, 2017), the unpredictability of customer needs (Bai and Sarkis, 2010), and increased demand for personalized products (Brandenburg et al., 2014). Another critical factor is the transfer of competition from companies to SCs; now, individual companies are not competing with each other, but SCs are competing (Chen et al., 2019).

In this turbulent and changing environment, which is mixed with all uncertainties and disturbances, and the competition is increasing increasingly, the only constant is "change". Hence, companies need the ability and capabilities to effectively and efficiently adapt to these changes and maintain and improve their competitive advantage. In this situation, a close relationship is established between the two concepts of cooperation and agility (De Boer et al., 2015). To achieve competitive advantage and operational efficiency, SC members must be able to quickly align their joint capabilities to respond to changes in supply and demand. In this regard, Hong et al. (2018) point out two basic lessons in their research to achieve a competitive advantage in the modern business environment (Ansari and Kant, 2017):

[1] Companies should align with their suppliers, suppliers' suppliers, customers' customers, and even their competitors to make their operations more efficient. This importance also originates from the fact that the competition is no longer at the level of companies. Still, the competition has been transferred to cooperative and coordinated chains or networks.

[2] Within each SC, all members must work together to achieve agility beyond the agility of each company. All manufacturers, distributors, suppliers, and even customers must be involved in the process of achieving an agile SC. On the other hand, due to insufficient resources and knowledge, companies need to cooperate with other SC members. Accordingly, cooperation is a process that two or more independent companies plan to achieve common goals and

interests of SC operations.

Companies beyond their borders seek cooperation opportunities with SC members to ensure the SC's efficiency and responsiveness to the market's dynamic needs (Eskandarpour et al., 2015). These companies try to achieve a higher level of cooperation by leveraging suppliers' and customers' knowledge and resources (Bai and Sarkis, 2010). Cooperation in the SC improves risk sharing, and access to resources reduces transaction costs and increases productivity and competitive advantage over time. In this case, companies achieve benefits, but each cannot achieve them alone (Brandenburg et al., 2014).

But the main issue is the SC's relationship between cooperation and profitability. In many studies, the necessity of creating cooperation for profitability based on prospect theory in the chain has been emphasized, and the creation of cooperation in the SC has been considered as the background and prerequisite for achieving profitability based on prospect theory (Chen et al., 2019). Companies have realized that internal operations are insufficient to succeed (Gelsomino et al., 2016). Hence, suppliers' participation in enhancing the quality and meeting customers' demands is required to improve performance and productivity (Gimenez and Tachizawa, 2012). This partnership and alliance crystallize in the form of an SC. The use of service SC management leads to cost reduction, active response to customer needs, better use of resources, and process efficiency improvement (Neuber, 2016).

Also, behavioral decision-making is one of the new topics currently receiving the attention of scientific circles (Hong et al., 2018). While criticizing the rational decision-making method, this model believes that the rational point of view is ineffective because mental and behavioral characteristics influence the decision-making process. For this purpose, the behavioral approach, using prospect theory, seeks to evaluate the actual pattern of decision-making (Kouvelis and Zhao, 2018). Now the question arises whether it is possible to provide a better definition for the risk assessment model of investors with the rate of return on investment in psychology and actual conditions. Exclusively, we can mention the prospect theory (Lee and Tang, 2018). Iran's services and added value share are about 11% less than developed industrial countries (Madani and Rasti-Barzoki, 2017). This shows the importance of services in the economy of developed countries. For this reason, sufficient attention should be paid to the development of service SCs in Iran (Mani et al., 2018) to reduce the gap between Iran and developed countries (Rajeev et al., 2017).

In addition, in the current economic situation where we are facing inflationary stagnation, currently, in Iran, companies are having problems due to negative cash flow, lack of liquidity, and attracting capital or increasing capital through shareholders' contribution. They cannot attract capital for working capital, their development plans, and other investments related to producing their goods and services. Therefore, the capital market is desirable to attract capital for these companies (Gelsomino et al., 2016). As a result, providing capital from the capital market is very important for venture capital companies, investors, and financial intermediaries through financial service SCs in Iran and the world. Therefore, it is necessary to model players' financial service SCs' strategies to help decision-making (Mani et al., 2018).

This research focuses on the SC application with two main topics of cooperation strategy based on prospect theory and game theory. The first point is that the possible outcomes are the complete set of all possible outcomes that players might realize, even if, for example, they are not motivated to do so. Identifying this collection and its properties is an important step. Once this set is created and defined, the stakeholders of the financial SC will ask how the players will achieve an outcome from this set of actions. Another critical issue is stability. When players decide on allocations from the set of possible outcomes, independent of the process (e.g., bargaining), some can pursue options such as joining together as a coalition and agreeing on a typical course of action. Two questions immediately

arise: (i) How do the players in an alliance share the profits from their SC? and (ii) what are the alliances/sustainability outcomes that emerge in a particular setting?

This research considers a service SC for financing with the elements of bonds plus investors. Considering the importance of services in the growth of the GDP, the need to provide capital for companies, as well as the small share of providing capital with and without the use of mortgage bonds, Murabaha, and rent from the capital market, it is possible to show the importance of issuing mortgage bonds, Murabaha, and rent. If the current conditions continue, the companies will finance themselves through capital increases or facility agreements. If they do not have the profit expected by the shareholders, they cannot implement the capital increase. If they do the capital increase under these conditions, they will face many problems, one of which is the non-participation of the shareholders in the capital increase. Or if they are through the facility agreement, they often have problems repaying the facilities and operations due to the high rate and non-negotiable facility.

Suppose it is possible to model the demands of the bond issuers and investors in the service SC according to each other's demands. In that case, appropriate strategies can be used to understand the equilibrium point for bond issuance, which will lead to the expansion of financing from It becomes the capital market. As a result, the decrease in the cost of money and the positive growth of goods and services align with the company's goals. Bargaining always takes place in the process of issuing mortgage bonds, Murabaha, and rent between members and investors, and each of them seeks to maximize profits and minimize costs.

Therefore, calculating the equilibrium point based on the prospect and profit and loss of investment is very important for SC elements. Using the prospect theory, risk aversion and risk-taking of service SCs are determined in the elements of issuing mortgage bonds, leasing, and investors. Hence, a game can be modeled, and finally, the equilibrium point can be determined. According to the above assumptions, before starting the negotiation for financing, the conditions for financing with the help of issuing mortgage bonds, Murabaha, and rent can be modeled to help make the right decision.

2. Theoretical Principles and Framework

Service SC. It is an SC that manages information, processes and capacities, service performance, and capital from the lowest (primary) level of suppliers to consumers (Sarkar et al., 2018). Available studies (Mani et al., 2018; Rajeev et al., 2017; Sarkar et al., 2018) on SC quality control only include the risk attitude of a SC member (they have investigated the issue from one dimension). For this reason, a discussion about the different attitudes on the game theory of quality control in the SC, especially the logistics service SC (LSSC), is needed (Stindt, 2017). Therefore, Liu and Wang have studied this field. Also, in recent years, with the increasing attention of the general public to product quality, SC quality management has focused on research in this field. Very few papers have been done in this field (Tanrisever et al., 2015). Hay et al. have investigated quality improvement through the SC channel and its reference effects. Leo et al. have investigated risk aversion in an SC in optimal two-channel SC policies with complete information and asymmetric information in different conditions (Tsao et al., 2017).

In their article, Feng and Zhang modeled behavioral strategies in the SC regarding the problems of a new supplier in a competitive environment with the help of game theory. They conducted a field and experimental investigation (Tunca and Zhu, 2018). In their article, Chen Lin et al. investigated the pricing and effects of decisions in a SC with incomplete information (Van der Vliet et al., 2015). By referring to studies on the prospect theory index in the financial field, it is possible to mention the issues related to the risk assessment of bonds and to answer the question of why some bonds have a higher-than-average rate of return on investment. The best-known framework is the CAPM model (Wuttke et al., 2016).

This model is generally derived from the assumptions and conditions that investors evaluate based on the utility theory. Bonds whose return rate variance is higher than expected compared to the return rate of the entire market are called high-risk investments (gambling). Unfortunately, this prediction lacks empirical and practical support (Yang et al., 2016). In recent years, the prospect theory has been used for the average rate of return on investment in confirming empirical observations. The first group of studies used different techniques to measure the skewness (Zhao et al., 2018).

The second research category on predicting prospect theory biases can identify other experimental patterns. For example, the prospect theory states that an initial public offering at a below-average price with all assumptions can be higher than the expected return bias based on the higher initial price, which means that in the long run, the rate of return is low. (Wu et al., 2021). The best application of prospect theory can be seen in the stock market; for example, Benartzi and Thaler studied the theory of the relationship between perspective and risk aversion and presented the most famous stock pricing (Rajeev et al., 2017).

Also, Dimock and Kuenberg presented a method to measure the prediction of risk aversion in American families with different income levels in the stock market (Stindt, 2017). Most recent studies on modeling the above attitude have been to determine the decision-making based on the level of expectations. Researchers are working on their research on the value function. The value function needs more experimental investigation on convexity and concavity in different conditions (Tsao et al., 2017). Most researchers (Tunca and Zhu, 2018; Van der Vliet et al., 2015; Wuttke et al., 2016) studied the tendency effect of the stock and real estate market, which can have a better understanding of the consequences of the realization utility. The idea is that people's preferences are to sell assets and earn a profit over the purchase price (disadvantage of selling at a loss) because they think that selling assets and earning a profit over the purchase price is an excellent idea to gain wealth in the long term. According to Barbris and Xiang, it has been shown that the time discount rate is significantly positive. Even the linear utility function can create the desired effect in practical business behavior patterns. At the same time, this definition of the propensity effect differs from the basis of the prospect value function curve (Wu et al., 2021).

Finally, examining the prospect theory: the certainty that the investors' utility function is determined by the profit and loss relative to the definite level of wealth. The decision with three choices of TWD, reflected in the risk attitude in the definition of decision rules, is an important phenomenon. In decision-making with three choices of the classical model, failure functions (cost) have been specified to measure risks and define decision-making rules with Loss Function Minimum-Cost. In this error, the utility function is used as a risk measurement tool to define the maximum utility of the decisive role. Therefore, most studies show that the utility theory may create some contradiction and cannot show the genuine risk attitude. A model based on prospect theory, called the triple decision, shows this problem. In this scenario, prospect theory defines decision makers' risk attitudes, and the value function is used as a new risk measurement tool. The decision-making rules are defined based on the rules of maximizing the value prospect. The existence and uniqueness of thresholds (risk tolerance and risk aversion) have been analyzed and proven. Two analytical solutions calculate the thresholds of simplified decision rules and those decisions derived from them; a case study examines the impact of the proposed model on other previously related models. (Van der Vliet et al., 2015).

3. Research Methodology

The method used in this research is practical in terms of its purpose, and because it uses library and field studies, this research can be considered descriptive survey research. In the rational decision-making model, the expected utility function is used to evaluate people's preferences in this research

to meet the optimal financing of people, which is based on the following equation.

$$\sum_{i=-m}^{n} P_i U(W + X_i) \quad (1)$$

In this formula, W represents the current wealth, and (0) U represents the incremental and concave utility function. This function is the sum of benefits a person obtains from different choices. According to prospect theory, people's preferences in decision-making depend on the value function v(x_i) and the weighted probabilities π_i of each decision. The value function determines the reward amount, and the weighted probability function also indicates the importance of each decision (Wuttke et al., 2016).

$$\sum_{i=-m}^{n} \pi_i v(x_i) \quad (2)$$

The value function shows the features of prospect theory. In this function, the zero point is considered a reference point (0 = (0) v); at points higher than the reference point, the shape of this function is concave. In other words, the second derivative of the value function is negative at this point (v^"≤0; x≥0). However, it is convex at points below the reference point, and the function's second derivative is greater than zero (v^"≥0; x≤0). This feature shows the reduction of the sensitivity of this function. The value function is also more horizontal for the profit region than for the loss region; that is, the slope in the positive region of the horizontal axis is less than the slope in the negative region of the horizontal axis (v^' (x)≤v^' (-x); x≥0).

Another critical factor that affects the weighted probability function is attractiveness. Attractiveness shows the degree of importance of different decisions. Desensitization specifies the shape of the function, which is first concave and then convex. Still, attractiveness specifies that the weighted probability function sometimes lies above the 45° line and sometimes below the line. This property is related to the rise or fall of the weighted probability function. Kahneman and Torsky proposed the weighted probability equation as follows.

$$w(p) = \frac{p^{\delta}}{(p^{\delta} + (1-p)^{\delta})^{\frac{1}{\delta}}} \quad (3)$$

In this function, w(p) represents the weighted probability function, δ represents the stretch of the weighted probability function, and p represents different probabilities. By using the function of the prospect theory, it is possible to explain the four criteria of the financing model based on the application of the prospect theory.

- **Reference dependence.** The prospect theory defines the decision to make a profit or loss according to a reference point. As evident in the prospect theory function, the value function is written based on x_i, not W+x_i; at points higher than the reference point, the shape of this function is concave and lower than the reference point convex. In other words, the profit and loss of a decision are compared according to each person's mentality regarding profit and loss. Based on this, the individual's desirability of that decision is evaluated. It should be said that the reference point is usually formed based on the mentality of people over time. Therefore, it can differ from each person's point of view, and mental stereotypes sometimes affect and distort it (Abdellaoui et al., 2020).
- **Avoiding loss.** According to prospect theory, the feeling of dissatisfaction with losses is more than the feeling of satisfaction in gaining profits. This issue shows the loss aversion of people in decision-making. Loss aversion refers to people being more sensitive to reducing their wealth than increasing it, so they always try to avoid losses and reduce them (Abdellaoui et al.,

2020).

- **Reducing sensitivity.** The reason for naming this component is the sensitivity of the decision maker's utility to changes in profit and loss. In the prospect equation, due to the concaveness of the profit area and the convexity of the loss area, the sensitivity of the amount of profit or loss is different for the decision maker. The decision maker's value function in the profit region is sensitive to its decrease. In other words, the amount of utility a person gets for receiving profit is much less than the utility he loses for accepting the loss. Also, the sensitivity difference in profit and loss is different (Abdellaoui et al., 2020).
- **Probability coefficient.** The fourth and final prospect theory component is the probability coefficient. Unlike rational decision-making theory, the objective coefficient of probabilities, pi, is not used in prospect theory. Still, these coefficients are converted into decision coefficients, π_i, using the weighted probability function. Accordingly, the weighted probability function has given too much weight to low probabilities and too little weight to high probabilities (Abdellaoui et al., 2020).

4. Data Analysis and Research Findings

The purpose of finding the answer and solving the game is to predict or explain and explain how the players behave in a game. In other words, we want to know which of the combination of players' strategies in which the strategy of all players is determined, which combination occurs or should occur in practice. That combination of strategies that occurs in practice is called equilibrium. This combination of strategies is based on the rationality of the players in the game.

Several games have this vital feature that for some or all players in the game, the choice of one strategy is entirely preferable to the choice of all his other strategies because the consequence of choosing this strategy for that player is greater than the choice of other strategies. It is natural that, in this case, each player chooses the same strategy regardless of other possible strategies for himself and his competitors. In other words, this strategy is called the dominant strategy, and other strategies of that player are called his inferior strategies. The strategy combination, which consists of the dominant strategies of the players, is called dominant strategy equilibrium. In this study, we have used a 4-player game where each player has three strategies. To achieve the equilibrium equations, first, the Latin square plan should be formed as follows:

In the above scheme, package 35 indicates that the first player enters the game with strategy 2, the second player with strategy 1, the third player with strategy 3, and the fourth player with strategy 2. In this type of game, each player can enter the game with only one strategy at each stage. The values of W_i^j and $\bar{W}$ are calculated as follows according to the population ratio and exchange value.

$$W_1^1 = F_1^1 + P_1\Delta F(1,1,1,1) + P_2\Delta F(1,1,1,2) + P_3\Delta F(1,1,1,3) + \cdots + P_{25}\Delta F(1,3,3,1) + P_{26}\Delta F(1,3,3,2) + P_{27}\Delta F(1,3,3,3) \quad (4)$$

Where P_i is a proportion of the population who have chosen the i^{th} package, W_i^j is the average compatibility of strategy i for player j, $\bar{W}_i$ is the average compatibility of the entire population for the i^{th} player, F_k^j is the initial fitness of each individual in the population, representing the value of strategy k chosen by player j, and ΔF (s_1, s_2, s_3, s_4) presents compatibility changes. According to this relationship, the first player with the first strategy is assumed to be fixed. The following relationships are as follows.

Table 1. Latin square layout for a four-player game

		Player 2								
		1			2			3		
Player 1	1	Package 1 (1 and 1)	Package 2 (1 and 2)	Package 3 (1 and 3)	Package 10 (1 and 1)	Package 11 (1 and 2)	Package 12 (1 and 3)	Package 19 (1 and 1)	Package 20 (1 and 2)	Package 21 (1 and 3)
		Package 4 (1 and 2)	Package 5 (2 and 2)	Package 6 (2 and 3)	Package 13 (2 and 1)	Package 14 (2 and 2)	Package 15 (2 and 3)	Package 22 (1 and 2)	Package 23 (2 and 2)	Package 24 (2 and 3)
		Package 7 (1 and 3)	Package 8 (2 and 3)	Package 9 (3 and 3)	package 16 (1 and 3)	Package 17 (2 and 3)	Package 18 (3 and 3)	Package 25 (1 and 3)	Package 26 (2 and 3)	Package 27 (3 and 3)
	2	Package 28 (1 and 1)	Package 29 (1 and 2)	Package 30 (1 and 3)	Package 37 (1 and 1)	Package 38 (1 and 2)	Package 39 (1 and 3)	Package 46 (1 and 1)	Package 47 (1 and 2)	Package 48 (1 and 3)
		Package 31 (2 and 1)	Package 32 (2 and 2)	Package 33 (2 and 3)	Package 40 (1 and 2)	Package 41 (2 and 2)	Package 42 (2 and 3)	Package 49 (1 and 2)	Package 50 (2 and 2)	Package 51 (2 and 3)
		package 34 (1 and 3)	package 35 (2 and 3)	package 36 (3 and 3)	package 43 (1 and 3)	package 44 (2 and 3)	package 45 (3 and 3)	package 52 (3 and 1)	package 53 (2 and 3)	Package 54 (3 and 3)
	3	package 55 (1 and 1)	package 56 (1 and 2)	package 57 (1 and 3)	package 64 (1 and 1)	package 65 (1 and 2)	package 66 (1 and 3)	Package 73 (1 and 1)	Package 74 (1 and 2)	Package 75 (1 and 3)
		package 58 (1 and 2)	package 59 (2 and 2)	package 60 (2 and 3)	package 67 (1 and 2)	package 68 (2 and 2)	package 69 (2 and 3)	Package 76 (1 and 2)	package 77 (2 and 2)	package 78 (2 and 3)
		package 61 (1 and 3)	package 62 (2 and 3)	package 63 (3 and 3)	Package 70 (1 and 3)	package 71 (2 and 3)	package 72 (3 and 3)	Package 79 (3 and 1)	package 80 (2 and 3)	Package 81 (3 and 3)

$$W_2^1 = F_2^1 + P_{28}\Delta F(2,1,1,1) + P_{29}\Delta F(2,1,1,2) + P_{30}\Delta F(2,1,1,3) + \cdots + P_{52}\Delta F(2,3,3,1) + P_{53}\Delta F(2,3,3,2) + P_{54}\Delta F(2,3,3,3) \quad (5)$$

$$W_3^1 = F_3^1 + P_{55}\Delta F(3,1,1,1) + P_{56}\Delta F(3,1,1,2) + P_{57}\Delta F(3,1,1,3) + \cdots + P_{79}\Delta F(3,3,3,1) + P_{80}\Delta F(3,3,3,2) + P_{81}\Delta F(3,3,3,3) \quad (6)$$

$$W_1^2 = F_1^2 + P_1\Delta F(1,1,1,1) + P_2\Delta F(1,1,1,2) + P_3\Delta F(1,1,1,3) + \cdots + P_9\Delta F(1,1,3,3) + P_{28}\Delta F(2,1,1,1) + P_{29}\Delta F(2,1,1,2) + \cdots + P_{36}\Delta F(2,1,3,3) + P_{55}\Delta F(3,1,1,1) + \cdots + P_{62}\Delta F(3,1,3,2) + P_{63}\Delta F(3,1,3,3) \quad (7)$$

$$W_2^2 = F_2^2 + P_{10}\Delta F(1,2,1,1) + P_{11}\Delta F(1,2,1,2) + P_{12}\Delta F(1,2,1,3) + \cdots + P_{18}\Delta F(1,2,3,3) + P_{37}\Delta F(2,2,1,1) + P_{38}\Delta F(2,2,1,2) + \cdots + P_{45}\Delta F(2,2,3,3) + P_{64}\Delta F(3,2,1,1) + \cdots + P_{71}\Delta F(3,2,3,2) + P_{72}\Delta F(3,2,3,3) \quad (8)$$

$$W_3^2 = F_3^2 + P_{19}\Delta F(1,3,1,1) + P_{20}\Delta F(1,3,1,2) + P_{21}\Delta F(1,3,1,3) + \cdots + P_{27}\Delta F(1,3,3,3) + P_{46}\Delta F(2,3,1,1) + P_{47}\Delta F(2,3,1,2) + \cdots + P_{54}\Delta F(2,3,3,3) + P_{73}\Delta F(3,3,1,1) + \cdots + P_{80}\Delta F(3,3,3,2) + P_{81}\Delta F(3,3,3,3) \quad (9)$$

$$W_1^3 = F_1^3 + P_1\Delta F(1,1,1,1) + P_2\Delta F(1,1,1,2) + P_3\Delta F(1,1,1,3) + P_{10}\Delta F(1,2,1,1) + P_{11}\Delta F(1,2,1,2) + P_{12}\Delta F(1,2,1,3) + P_{19}\Delta F(1,3,1,1) + P_{20}\Delta F(1,3,1,2) + P_{21}\Delta F(1,3,1,3) + P_{28}\Delta F(2,1,1,1) + P_{29}\Delta F(2,1,1,2) + P_{30}\Delta F(2,1,1,2) + P_{37}\Delta F(2,2,1,1) + P_{38}\Delta F(2,2,1,2) + P_{39}\Delta F(2,2,1,3) + P_{46}\Delta F(2,3,1,1) + P_{47}\Delta F(2,3,1,2) + P_{48}\Delta F(2,3,1,3) + P_{55}\Delta F(3,1,1,1) + P_{56}\Delta F(3,1,1,2) + P_{57}\Delta F(3,1,1,3) + P_{64}\Delta F(3,2,1,1) + P_{65}\Delta F(3,2,1,2) + P_{66}\Delta F(3,2,1,3) + P_{73}\Delta F(3,3,1,1) + P_{74}\Delta F(3,3,1,2) + P_{75}\Delta F(3,3,1,3) \quad (10)$$

$$W_2^3 = F_2^3 + P_4\Delta F(1,1,2,1) + P_5\Delta F(1,1,2,2) + P_6\Delta F(1,1,2,3) + P_{13}\Delta F(1,2,2,1) + P_{14}\Delta F(1,2,2,2) + P_{15}\Delta F(1,2,2,3) + P_{22}\Delta F(1,3,2,1) + P_{23}\Delta F(1,3,2,2) + P_{24}\Delta F(1,3,2,3) + P_{31}\Delta F(2,1,2,1) + P_{32}\Delta F(2,1,2,2) + P_{33}\Delta F(2,1,2,2) + \quad (11)$$

$$P_{40}\Delta F(2,2,2,1) + P_{41}\Delta F(2,2,2,2) + P_{42}\Delta F(2,2,2,3) + P_{49}\Delta F(2,3,2,1) + P_{50}\Delta F(2,3,2,2) + P_{51}\Delta F(2,3,2,3) + P_{58}\Delta F(3,1,2,1) + P_{59}\Delta F(3,1,2,2) + P_{60}\Delta F(3,1,2,3) + P_{67}\Delta F(3,2,2,1) + P_{68}\Delta F(3,2,2,2) + P_{69}\Delta F(3,2,2,3) + P_{76}\Delta F(3,3,2,1) + P_{77}\Delta F(3,3,2,2) + P_{78}\Delta F(3,3,2,3)$$

$$W_3^3 = F_3^3 + P_7\Delta F(1,1,3,1) + P_8\Delta F(1,1,3,2) + P_9\Delta F(1,1,3,3) + P_6\Delta F(1,2,3,1) + P_{17}\Delta F(1,2,3,2) + P_{18}\Delta F(1,2,3,3) + P_{25}\Delta F(1,3,3,1) + P_{26}\Delta F(1,3,3,2) + P_{27}\Delta F(1,3,3,3) + P_{34}\Delta F(2,1,3,1) + P_{35}\Delta F(2,1,3,2) + P_{36}\Delta F(2,1,3,2) + P_{43}\Delta F(2,2,3,1) + P_{44}\Delta F(2,2,3,2) + P_{45}\Delta F(2,2,3,3) + P_{52}\Delta F(2,3,3,1) + P_{53}\Delta F(2,3,3,2) + P_{54}\Delta F(2,3,3,3) + P_{61}\Delta F(3,1,3,1) + P_{62}\Delta F(3,1,3,2) + P_{63}\Delta F(3,1,3,3) + P_{70}\Delta F(3,2,3,1) + P_{71}\Delta F(3,2,3,2) + P_{72}\Delta F(3,2,3,3) + P_{79}\Delta F(3,3,3,1) + P_{80}\Delta F(3,3,3,2) + P_{81}\Delta F(3,3,3,3) \quad (12)$$

$$W_1^4 = F_1^4 + P_1\Delta F(1,1,1,1) + P_4\Delta F(1,1,2,1) + P_7\Delta F(1,1,3,1) + P_{10}\Delta F(1,2,1,1) + P_{13}\Delta F(1,2,2,1) + P_{16}\Delta F(1,2,3,1) + P_{19}\Delta F(1,3,1,1) + P_{22}\Delta F(1,3,2,1) + P_{25}\Delta F(1,3,3,1) + P_{28}\Delta F(2,1,1,1) + P_{31}\Delta F(2,1,2,1) + P_{34}\Delta F(2,1,3,1) + P_{37}\Delta F(2,2,1,1) + P_{40}\Delta F(2,2,2,1) + P_{43}\Delta F(2,2,3,1) + P_{46}\Delta F(2,3,1,1) + P_{49}\Delta F(2,3,2,1) + P_{52}\Delta F(2,3,3,1) + P_{55}\Delta F(3,1,1,1) + P_{58}\Delta F(3,1,2,1) + P_{61}\Delta F(3,1,3,1) + P_{64}\Delta F(3,2,1,1) + P_{67}\Delta F(3,2,2,1) + P_{70}\Delta F(3,2,3,1) + P_{73}\Delta F(3,3,1,1) + P_{76}\Delta F(3,3,2,1) + P_{79}\Delta F(3,3,3,1) \quad (13)$$

$$W_2^4 = F_2^4 + P_2\Delta F(1,1,1,2) + P_5\Delta F(1,1,2,2) + P_8\Delta F(1,1,3,2) + P_{11}\Delta F(1,2,1,2) + P_{14}\Delta F(1,2,2,2) + P_{17}\Delta F(1,2,3,2) + P_{20}\Delta F(1,3,1,2) + P_{23}\Delta F(1,3,2,2) + P_{26}\Delta F(1,3,3,2) + P_{29}\Delta F(2,1,1,2) + P_{32}\Delta F(2,1,2,2) + P_{35}\Delta F(2,1,3,2) + P_{38}\Delta F(2,2,1,2) + P_{41}\Delta F(2,2,2,2) + P_{44}\Delta F(2,2,3,2) + P_{47}\Delta F(2,3,1,2) + P_{50}\Delta F(2,3,2,2) + P_{53}\Delta F(2,3,3,2) + P_{56}\Delta F(3,1,1,2) + P_{59}\Delta F(3,1,2,2) + P_{62}\Delta F(3,1,3,2) + P_{65}\Delta F(3,2,1,2) + P_{68}\Delta F(3,2,2,2) + P_{71}\Delta F(3,2,3,2) + P_{74}\Delta F(3,3,1,2) + P_{77}\Delta F(3,3,2,2) + P_{80}\Delta F(3,3,3,2) \quad (14)$$

$$W_3^4 = F_3^4 + P_3\Delta F(1,1,1,3) + P_6\Delta F(1,1,2,3) + P_9\Delta F(1,1,3,3) + P_{12}\Delta F(1,2,1,3) + P_{15}\Delta F(1,2,2,3) + P_{18}\Delta F(1,2,3,3) + P_{21}\Delta F(1,3,1,3) + P_{24}\Delta F(1,3,2,3) + P_{27}\Delta F(1,3,3,3) + P_{30}\Delta F(2,1,1,3) + P_{33}\Delta F(2,1,2,3) + P_{36}\Delta F(2,1,3,3) + P_{39}\Delta F(2,2,1,3) + P_{42}\Delta F(2,2,2,3) + P_{45}\Delta F(2,2,3,3) + P_{48}\Delta F(2,3,1,3) + P_{51}\Delta F(2,3,2,3) + P_{54}\Delta F(2,3,3,3) + P_{57}\Delta F(3,1,1,3) + P_{60}\Delta F(3,1,2,3) + P_{63}\Delta F(3,1,3,3) + P_{66}\Delta F(3,2,1,3) + P_{69}\Delta F(3,2,2,3) + P_{72}\Delta F(3,2,3,3) + P_{75}\Delta F(3,3,1,3) + P_{78}\Delta F(3,3,2,3) + P_{81}\Delta F(3,3,3,3) \quad (15)$$

$$\bar{W}_1 = (P_1 + P_2 + \cdots + P_{27})W_1^1 + (P_{28} + P_{29} + \cdots + P_{54})W_2^1 + (P_{55} + P_{56} + \cdots + P_{81})W_3^1 \quad (16)$$

To achieve three strategies in each criterion, a two-way questionnaire was used, which questions the two parameters of the existing situation of that strategy in that organization and the extent of its impact on the organization. Five weak, very weak, average, good, and very good scales have been used to measure the current situation, with 5, 4, 3, 2, and 1 points, respectively. The reason for this scoring is that the worse the existing strategy situation in the organization, the more chances it has to be selected. Five very low, low, medium, high, and very high scales have been used to determine the impact of strategies on the organization's current state, with points of 1, 2, 3, 4, and 5, respectively. In this way, the more effective strategy is more likely to be selected. Therefore, the strategies in this questionnaire are scored from 2 to 10. Three strategies with the highest average score are selected to enter the following stages. In the diagram shown, L_1, L_2, and L_3 represent three strategies defined in the prospect of profit expansion.

Similarly, I_1, I_2, I_3, and C_1, C_2, C_3, and F_1, F_2, and F_3 represent the three strategies chosen from the

previous stage for the criteria of reducing sensitivity, reference dependence, and avoiding loss. As can be seen, the cause-and-effect relationships between each strategy at the same level with three strategies at a higher level should be investigated. For this purpose, measurable data should be available for each strategy. Therefore, a measurement index is determined for each strategy. Using the past data of these indicators, the cause-and-effect relationships between these strategies can be determined. Eighty-one general paths (3x3x3x3 general mode) can be considered among the variables. Many of these paths cannot help improve each other and cannot be used.

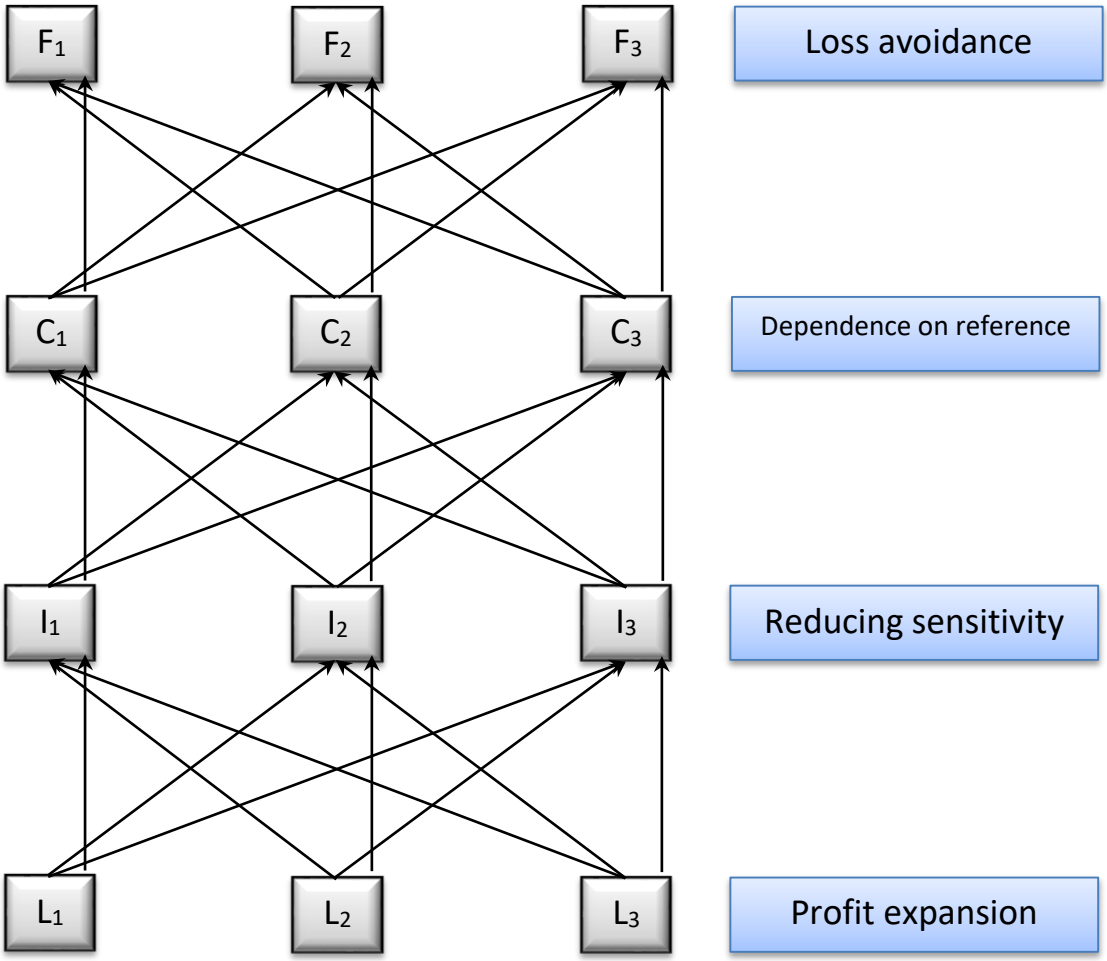

Figure 1. The Basic path analysis model

Considering this step and removing meaningless relationships will reduce the number of investigated routes. After determining the paths of the cooperation model in the meaningful financing chain and obtaining the Shipley values related to each path, it is time to determine the best path of cooperation. Each prospect theory criterion is considered a player in this research, and a 4-person game theory is used to achieve the best cooperation path. In this case, each player has three strategies they use in the game. As can be seen, the criterion of avoiding loss as the first player, the prospect of reference dependence as the second player, the prospect of reducing sensitivity as the third player, and the prospect of profit expansion as the fourth player has been selected.

In this research, we assumed that we distributed 1000 decision-makers in these houses for selection, representing the first generation. These 1000 people are placed equally in each house. That

is, the value of Pi, which is the proportion of the population that chose package 1, is equal to $\frac{1}{81}$ for i=1,...,81. Then, by writing the relations given in chapter 2, which include w_i^j, which is the average value of compatibility of the ith strategy for the jth player, so that i=1,2,3 and j=1,2,3,4 and $\bar{W}$ The values of Pi', a proportion of the second-generation population who have chosen the ith package, can be obtained for each player. In this algorithm, we assumed the values of F_k^j, which represents the initial compatibility of each population member and the value of the kth strategy chosen by the jth player for all situations equal to zero. This means that there is no difference between the strategies for the players, which are the same criteria as the prospect theory.

Accordingly, in the prospect of avoiding loss, six strategies were proposed, which are: focusing on reducing information transmission costs, facilitating investment, allocating financial resources, improving the rate of return on investment, improving the level of supplier activities to reduce the cost, and the improvement of the profit received through the progress of the mechanism of providing financial services. For the prospect of dependence on the reference, seven strategies were examined, which are: improving the provision of financial services, attracting the support policies of partners, developing new products to the daily needs of customers, and more flexibility in service systems to meet the specific needs of customers, analysis of competitors' activities, having appropriate interaction with customers by developing customer surveys, and research and development on the success of financing services.

Table 2. The strategies discussed in the case study

Subject area	Factors and indicators	Number of respondents	Average	Standard deviation	Subject area	Factors and indicators	Number of respondents	Average	Standard deviation
Avoiding loss	F_1: Facilitation of investment	120	5.85	0.78	Dependence on reference	C_1: Attracting partners' support policies	120	5.75	1.49
	F_2: Allocation of financial resources	120	6.5	0.70		C_2: Analysis of competitors' activities	120	5.55	1.44
	F_3: Managing the cost of financing	120	6.35	0.98		C_3: Research and development on the success of financing services	120	5.78	1.39
Reducing sensitivity	I_1: Involvement of financing service providers	120	6.27	1.31	profit expansion	L_1: Financial management guidance	120	4.36	1.10
	I_2: Technical expertise in financing service providers	120	5.88	1.30		L_2: Monitoring and control	120	4.63	1.12
	I_3: Flexibility of financing service providers	120	5.7	1.25		L_3: optimal management of contracts	120	4.16	1.07

To measure the SC in the prospect of reducing sensitivity, six strategies were analyzed, (i) creating more effectiveness in the main financing program, (ii) reducing the planning cycle time, (iii) technical

expertise of financing service providers, (iv) improving the accuracy of forecasting techniques, (v) reducing the overall costs of inventory maintenance and (vi) developing, and improving the order registration method. For the prospect of profit expansion, it is also necessary to improve the ability to provide supplies in the face of quality problems, improve cooperation between buyers and suppliers in solving problems, develop practical training in line with the duties of distribution personnel, manage financial supply strategically, and increase the level of information sharing and optimal management of contracts. These questionnaires were distributed among 135 specialists, experts, and managers of companies providing financial services. Among these, 120 questionnaires were returned. After reviewing and analyzing the results of these questionnaires, three strategies were selected in each field.

In this way, the paths of the cooperation model in the financing chain are adjusted from 81 modes to 24 modes, shown in Table 3.

Table 3. Paths of the cooperation model in the financial SC

1	$L_1 \rightarrow I_1 \rightarrow C_1 \rightarrow F_1$	9	$L_1 \rightarrow I_3 \rightarrow C_1 \rightarrow F_2$	17	$L_2 \rightarrow I_3 \rightarrow C_1 \rightarrow F_1$
2	$L_1 \rightarrow I_1 \rightarrow C_1 \rightarrow F_2$	10	$L_1 \rightarrow I_3 \rightarrow C_3 \rightarrow F_2$	18	$L_2 \rightarrow I_3 \rightarrow C_1 \rightarrow F_2$
3	$L_1 \rightarrow I_2 \rightarrow C_1 \rightarrow F_1$	11	$L_1 \rightarrow I_3 \rightarrow C_3 \rightarrow F_3$	19	$L_2 \rightarrow I_3 \rightarrow C_3 \rightarrow F_2$
4	$L_1 \rightarrow I_2 \rightarrow C_1 \rightarrow F_2$	12	$L_2 \rightarrow I_2 \rightarrow C_1 \rightarrow F_1$	20	$L_2 \rightarrow I_3 \rightarrow C_3 \rightarrow F_3$
5	$L_1 \rightarrow I_2 \rightarrow C_2 \rightarrow F_2$	13	$L_2 \rightarrow I_2 \rightarrow C_1 \rightarrow F_2$	21	$L_3 \rightarrow I_3 \rightarrow C_1 \rightarrow F_1$
6	$L_1 \rightarrow I_2 \rightarrow C_3 \rightarrow F_2$	14	$L_2 \rightarrow I_2 \rightarrow C_2 \rightarrow F_2$	22	$L_3 \rightarrow I_3 \rightarrow C_1 \rightarrow F_2$
7	$L_1 \rightarrow I_2 \rightarrow C_3 \rightarrow F_3$	15	$L_2 \rightarrow I_2 \rightarrow C_3 \rightarrow F_2$	23	$L_3 \rightarrow I_3 \rightarrow C_3 \rightarrow F_2$
8	$L_1 \rightarrow I_3 \rightarrow C_1 \rightarrow F_1$	16	$L_2 \rightarrow I_2 \rightarrow C_3 \rightarrow F_3$	24	$L_3 \rightarrow I_3 \rightarrow C_3 \rightarrow F_3$

In the next step, we obtain the weights of each component in the routes using the Shipley value. First, we should calculate each strategy's V(Si) values. As mentioned, the Stackelberg competition has been used for this purpose. The obtained values are shown in Table 4.

Table 4. V(Si) values calculated by Stackelberg competition

V(L1)	0.035	**V(C1)**	0.145
V(L2)	0.013	**V(C2)**	0.091
V(L3)	0.025	**V(C3)**	0.062
V(I1)	0.047	**V(F1)**	0.145
V(I2)	0.066	**V(F2)**	0.201
V(I3)	0.021	**V(F3)**	0.149

As can be seen, the values of Pi have decreased, which are related to the first and third strategies of the first player, which are the same measure of loss avoidance in prospect theory. And the P_is related to the first player's second strategy has increased. After repeating these relationships in the subsequent iterations, P_i values related to the first and third strategies become zero, and only the P_i related to the second strategy has a value. Therefore, the second strategy is the optimal strategy for the first player. For the first player, the values of $P'_1, P'_4, P'_5, P'_7, P'_8, P'_9, P'_{76}, P'_{77}, P'_{79}, P'_{80}, P'_{81}$ are zero, and the rest of P_i, which is related to the second strategy of the first player, is equal to 0.0769.

For the second player, the values of $P'_{40}, P'_{41}, P'_{49}, P'_{50}, P'_{52}, P'_{53}, P'_{54}, P'_{76}, P'_{77}, P'_{79}, P'_{80}, P'_{81}$ have taken the value of zero, and the rest of the P_is, which are related to the first strategy of the second player, is equal to 0.0833. For the third player, the values are $P'_1, P'_4, P'_5, P'_{28}, P'_{31}, P'_{32}, P'_{40}, P'_{41}, P'_{49}, P'_{50}, P'_{76}, P'_{77}$ have taken the value of zero, and the rest of the P_is, which are related to the third strategy of the third

player, is equal to 0.0833. For the fourth player, the values are $P'_5, P'_8, P'_9, P'_{32}, P'_{35}, P'_{36}, P'_{41}, P'_{50}, P'_{53}, P'_{54}, P'_{77}, P'_{80}, P'_{81}$ have zero value, and the remaining P_is related to the fourth player's first strategy are equal to 0.0833. Therefore, the optimal cooperation path is related to the 34th package, which is the path $L_1 \rightarrow I_3 \rightarrow C_1 \rightarrow F_2$ and is as follows, which is placed in the territory of the profit expansion (risky) group based on the prospect theory.

- L_1. Financial management guidance
- I_3. The flexibility of financing service providers
- C_1. Attracting partners' support policies
- F_2. Allocation of financial resources

5. Conclusion

Today, one of the most critical challenges in SC management is creating cooperation despite conflicting goals and demands, diversity in products and services, and different management styles. Otherwise, one of the updating factors resulting from non-cooperation in the SC will be a bullwhip effect that will reduce the SC's profitability and all levels over time. Suppose each level of the SC, in a non-collaborative state, has an estimate of the amount of demand due to the lack of cooperation. In that case, a bullwhip effect will be created. In an overview at the SC level, companies can be viewed as sub-systems that communicate and cooperate to maintain the integrity of the collection. Considering the SC as a system, business partners must cooperate to perform their tasks and use common input resources such as skilled human resources by using standard recruitment systems, information, and raw materials. This attitude creates a comprehensive view of the SC as a coherent and integrated whole. Companies that operate in a chain have a common field of activity and work together to produce a standard product. The type of strategy that organizations follow in the SC will affect the level of cooperation in the chain. The more the strategies are demand-oriented, the more the SC will be directed towards the chain's customers, increasing the need for cooperation at the chain level. The core in the SC system often defaults on the upstream companies' loans and prepays the downstream companies' loans because of the substantial leverage. The company's financial condition is worse due to less working capital. However, developing the financial SC can help solve this problem. For the leading company, SC financing services can reduce the financial cost of SC operations and improve the competitiveness of the entire SC in the market; therefore, it also tends to develop SC management.

In this context, financial institutions, especially commercial banks, develop an integrated framework to solve the problem of financing chain management based on traditional trade financing. This will eliminate the asymmetric information problems of companies and commercial banks by turning the original companies and logistics companies into key "intermediaries". While simultaneously increasing the credit of small and medium-sized commercial companies in the SC to obtain short-term financing at a lower price. It improves the SC by introducing a guarantee mechanism to create a win-win situation to reduce financial problems. Since the SC of financing services is produced to solve the financial problems of the SC, different companies adopt different operation modes of the financing chain according to the characteristics of their industry. Hence, the node of the SC, the coordination of the parties involved, its benefits, and its price is different.

Researchers had little research on the definition and concept of the financing service price, and most of them believed that financing service SC cooperation is the financing rate of the company. Zhonggang and Fengjun (2015) believed that the main component in the SC cooperation model of financing services is the risk and reward or profit obtained from investors' risk. They stated that the service price mainly includes the financing and management fee rates in reverse factoring research. Zhou et al. (2014) argued that loan pricing should include two levels: the loan interest rate and the

other is various fees that banks charge for loans, including management fees, advisory fees, value, etc. As is clear to everyone, the traditional loan price is the financing rate, but compared to traditional loans, the financing service SC pays more attention to risk sharing. Therefore, for companies, the financing service SC's total cost and price risk can be reduced compared to direct financing. SC financing services is a complex system with multiple partners, including capital applicants (SMEs in the SC), capital providers (financial institutions, companies, or principals), guarantee companies, logistics companies, etc., each of which in/directly affects the price of the SC of financial services.

As stated, today's organizations must have an efficient cooperation model system to survive in the SC, where there are many new competitors, and there is a possibility of replacing those competitors with those organizations in the SC at any moment. Therefore, cooperation model systems in the SC have attracted much attention. A collaborative model system is a system that helps SC management control performance indicators related to products, services, and operations. Performance indicators show the relative change of a situation in a specific time interval or at different points. In the definition of each index, it should be noted what the purpose of measuring the index is, the result of measuring the index, and whether it is possible to collect the necessary information for measuring the index.

Limitations and Future Recommendations

Every organization needs to adjust the use of its resources and human resources in line with its organization's goals. Institutions need a cooperation model system to evaluate the consumption of resources and then, with the help of analyzing the results, manage their company strategically and apply the necessary control to achieve the expected goals. In designing a cooperation model system, it should always be noted that it is appropriate when balanced and covers different dimensions of the organization's processes. Therefore, a suitable cooperation model system should include non-financial and financial indicators. In this situation, a good view of the organization's performance and then the performance of the SC will be obtained. A suitable cooperation model system should not only pay attention to the current situation of the organization and the position of the organization in the SC, but it should also be a plan for the improvement and future strategic analysis of the organization. Therefore, a cooperation model system can be a suitable strategy for the future, a program that helps organizations improve in all aspects.

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