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Identify Supply Chain Risks in the Detergent Industry and

Rank it Using Hierarchical Analysis

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C H R O N I C L E	Abstract
Article history *Received: 02/02/2021* *Received in revised:* *10/04/221* *Accepted: 22/06/2021*	Factors such as globalization, outsourcing and increasing the diversity of products and services have led to increased complexity in the supply chain and with increasing business competition, the management of the company is not possible without considering the risks of the supply chain and the company's management needs to be identified.
Keywords: ** Risk,* **supply chain,* **hierarchical analysis* *method.*	Prioritize and monitor supply chain risks. The present study identified supply chain risks in the detergent industry and ranked it using hierarchical analysis. The research sample consisted of 55 experts and experts of Safflower Manufacturing Company. And the fourth is taken by producer risk, distributor risk and customer risk with weight coefficients of 0.308, 0.113 and 0.110, respectively.

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Introduction

A new approach to business operations management in recent years is the supply chain management approach. The supply chain includes all items related to the procurement network, including suppliers, production centers, warehouses, distribution centers and retailers, as well as raw materials, manufacturing inventory and final products (Mazaheri et al., 2011).

Factors such as globalization, outsourcing and increasing the diversity of products and services have led to increased complexity in the supply chain. As complexity increases, the level of uncertainty and risk in the chain also increases. Risks in the supply chain can be costly for organizations and cause delays in the delivery of products to the customer and as a result his dissatisfaction. Therefore, risk management has become a key issue in the supply chain and plays an important role in chain performance and continuity of organizational dynamics (Mirghfouri et al., 2012).

Supply chain risk management was introduced in the early 1990s (Alvinson and Johnsgard, 2015). Increased business competitiveness in the 1990s led organizations to pay more attention to improving efficiency in many respects. As a result, industry executives have come to the conclusion that producing a quality product alone is not enough, but that the supply of products should be considered according to the customer's wishes (when, where, how) and their quality and cost. Under such circumstances, companies found that they had to manage the units that provide corporate inputs, processes, as well as centers related to delivery and after-sales service to the customer (Sherwood, 2010).

In such an environment, the management of the company is not possible without considering the risks facing the supply chain and the management of the company needs to be identified.

Prioritize and monitor supply chain risks (Bunds and Hall, 2014). The purpose of risk management is to identify high-risk situations and prepare a strategy to reduce the probability of occurrence and impact of high-risk events (Mazaheri, 2011). There is a good literary richness in the field of risk in the fields of finance, insurance, marketing, decision theory, etc., while in the field of risk, the supply chain literature is not that wide (Tang et al., 2006). Possible but unknown events or situations that have a positive or negative impact on the organization's goals can be hedged for chain risk. Deluch points out that because risk is a dynamic concept, risk classifications are also interdependent, and therefore some risks can be a source for future risks to occur (Tong, 2006). Jutner (2005) distinguishes risk from sources of risk and the results or effects of risk and states that sources of risk are environmental, organizational or supply chain variables that are not definitively and reliably predictable and depend on the output variables of the chain. Provide effect; And divides organizational risk resources into three categories: resources outside the supply chain, resources within the supply chain, and network-dependent resources. With the performed researches, the models used in the field of risk assessment and measurement in the supply chain can be divided into qualitative and quantitative categories. Quantitative models are those models that assess risk using mathematical functions and formulas. But qualitative models generally express a mental or conceptual framework for assessing and reducing risk in the supply chain (Mazaheri, 2011), which in this study tried to use multi-criteria decision models to identify and rank the risks of supply chain industries. Detergent should be used.

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The detergent industry is one of the most important and vital industries in the world. Along with population growth and the inseparable human need for quality detergents, the importance of this industry from the perspective of governments and business activists in this field is increasing. It is important to examine the risks in the supply chain of the detergent industry and prioritize them in order to identify the most important risks in order to minimize and avoid these risks. Given the importance of the issue, considering that risk management in the supply chain is responsible for identifying, analyzing, providing appropriate solutions to respond to, control and monitor risks in economic and production cycles, the present study intends to identify And ranking the supply chain risks in Safflower Detergent Manufacturing Company, to enable the company's managers to better detect and deal with unexpected events, and with risk management, a suitable strategy to reduce the likelihood of full events. Develop a dialogue and thus contribute to the overall economic growth of the safflower detergent company and by generalizing these results to other manufacturing companies. So the question is, what are the supply chain risks of detergent companies and what is their priority in terms of importance?

Literature review

There are various definitions of supply chain risk. Risk of potential occurrence is an event or state of failure that seizes the opportunities for the advancement of the organization and its exit leads to financial losses for the organization (Sadeghi Moghaddam et al., 1397). Risk in the supply chain is the potential change in outputs that affects the reduction of value added in each active member of the chain, so the risk must be properly managed to stabilize the added value in each active member and throughout the supply chain

(Bogtaj, 2001). Risk occurs in the supply chain when unexpected events disrupt the flow of materials from primary suppliers to final consumers (Waters, 2007). Yan, Hugh, and Wangmy argue that supply chain risks are uncertainties or events that adversely affect one or more components of the supply chain, thereby reducing supply chain operational efficiency or leading to chain failure. Wang and Abarshi (2014) have shown that supply chain risk is any possibility that there is a mismatch between supply chain resources and market demand; So as to reduce supply chain performance. Guo, Fang, and Winston (2006) define supply chain risks as sudden events that cause significant deviations in supply, demand, costs, or targeted quality.

Sadeghi Moghadam et al. (2015), in a study, evaluated the risks of the service supply chain. The results showed that among the situational characteristics, the market risk component and financial risk were identified as the main components in the supply chain risk analysis.

Hayati et al. (2014) in presenting a model for assessing supply chain risks using multi-criteria decision-making techniques stated that supply chain management, planning process, implementation and efficient control of raw material flow, inventories in The flow of production, final products and also the flow of information related to it is from the initial point to the point of consumption and therefore affects all activities of the organization, therefore paying attention to the opportunities and threats in the industry. And business and evaluation of the ability of industries and companies in the face of existing uncertainties and risks is essential and the management of supply chain risks is very important. The final ranking of supply chain risk factors in the steel industry showed that supply and supplier process

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risks were identified as the most critical risks.

Pourmajib and Fadaei (2014) examined and prioritized supply chain risks in companies located in the Anzali Free Zone. The results showed that supply risk, demand risk, environmental risk, operational risk are the risks affecting the supply chain and prioritizing factors were: supply risk, environmental risk, demand risk and operational risk.

Shahbandarzadeh et al. (2013) in a study to identify the factors affecting supply chain risk and measure its effects in the country's dairy industry. The results showed that seven political factors, market, information technology, disruption, supply, production and cooperation and communication, affect the supply chain risk in the dairy industry. The results also showed that IT, production and supply factors have the greatest effect on the supply chain risk of these industries.

Zand Hesami and Savoji (2012) in their research concluded that the most important supply chain risks are environmental risk priority, financial resources, strategy, information and communication technology and equipment and technology and human resource risk, respectively.

In their research, Mazaheri et al. (2011) identified and prioritized supply chain risk in manufacturing organizations using multi-criteria decision making. The results showed that the importance of risks for the private manufacturing sector is 59.6% and for the public manufacturing sector is 40.4%.

Manian et al. (2010) in a study aimed at identifying the factors affecting the supply chain performance in the automotive parts industry, among 34 indicators affecting the supply chain performance, these factors are impact, customer factors, process, cost, flexibility, respectively. Flexibility,

suppliers and time determined, and supply chains that perform better in these 6 factors have higher pulse performance. For each factor, they provided indicators for measurement and evaluation, and customer indicators include how and quality of delivery, return rate and customer satisfaction.

Baharmand and Sadeghieh (2013) studied the roots and various factors in humanitarian supply chain uncertainty and presented a structure of risks and finally evaluated the importance of supply chain risks using a hierarchical analysis process to be able to Provide a prioritized structure of the risks at different levels of the supply chain of organizations participating in humanitarian activities. Finally, the risk of timely delivery of goods has the highest priority in the whole chain, and the risk of timely supply of raw materials, quality of materials, correct forecast of demand, are the main risks associated with other levels of the humanitarian supply chain.

Sharafati (2009) conducted a study with the aim of reviewing and integrating different approaches to supply chain risk management, and with a case study on Mapna Power Plant Engineering and Construction Company focusing on managing the risks posed by suppliers in the supply chain It offers various solutions to manage and reduce these risks.

Troung and Hara (2018) in a study aimed at comparing the impact of different risks on the performance of manufacturing and service companies from a supply chain perspective concluded that manufacturing companies should pay close attention to risks.

Abd al-Basit and Reihab (2020) conducted a study with the aim of managing sustainable supply chain risk using TOPSIS technique in the telecommunications industry. Risks included production risk,

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environmental risk, financial risk, supply risk, control risk and information risk. The results showed that the most important criteria are: price and cost fluctuations, supply uncertainty, energy consumption, low quality, inefficient use of resources and risks of information sharing. The results showed that financial risk was the highest and supply risk factors were the lowest.

Junaid et al. (2020) conducted a study to identify and evaluate supply chain risks and establish criteria for managing these risks in the automotive industry. Supply chain flexibility, supply chain agility and strength were identified as the criteria for supply chain risk management. Taj showed that supply chain flexibility is the most important criterion for managing supply chain risks. In addition, supplier delivery delays, supplier quality problems, supplier communication risks, and forecast errors were among the most vulnerable risks in the automotive supply chain.

Gupta et al. (2014) classify supply chain risks into two categories of risks of internal origin including sub-dimensions of potential risk, operational risk, organizational risk and technological risk, and risks of external origin including sub-dimensions. They categorize environmental risk, economic risk, and political risk, and finally rank the risks associated with sub-dimensions, according to which the risk associated with disturbances caused by environmental factors, the risk associated with the forecast, the risk associated with the delay. And quality-related risk is the top four among the 28 risk factors.

Haller (2006) states that today risk assessment methodologies are not limited to a specific group or company and have become a practice for the academic community, companies and governments. In this paper, the role and importance of multi-criteria decision making techniques

in critical decisions and the ease of their application in the field of risk assessment, is discussed and then evaluated by using the technique of hierarchical analysis and risk indexing process. A comprehensive list of risks is stated.

Briggs (2010) assesses risk upstream of the crude oil supply chain using a three-tier hierarchical analysis process. The results showed that the most important risk is transportation risk and then exploration and production risk is the most important risk and in the next priority, risk transfer and sharing is preferred.

Sufialiglo and Kartal (2012) conducted a study aimed at risk management to avoid global supply chain failure using a fuzzy hierarchical process. Prioritization of risks and their factors, respectively, are: Supply risk (working with wrong or inappropriate suppliers, delays in delivery of bank documents, port capacity, shipping time, dependency and opportunism, financial stability of suppliers) Operational risk (high shipping costs, production capacity problems, service quality, inventory maintenance cost, low product quality, human resource risk, IT failure), demand risk (excessive consumer demand, consumer demand fluctuations, risks Related to repurchase order), environmental risk (economic risk, natural disasters, law, government and regulations, and social uncertainty).

Wu et al. (2006) identified and investigated eleven potential risks to domestic security. The results of their prioritization using AHP technique show the higher priority of factors such as cost, quality, timely delivery, supply flow continuity and risk associated with production engineering factors.

Studying the research literature as well as conducting semi-structured interviews with experienced and expert experts in the

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detergent industry has helped the researcher to identify and compile research components, which can be seen in Table (1).

Table 1. Detergent supply chain risks

Source	sub scale	Supply chain risks
Guido et al. (2008) - Rostamzadeh et al. (2018)	Problems in technology and product innovation	**Supplier risk**
Guido et al. (2008) - Junaid et al. (2020)	Insufficient inventory in stock	
Baharmand and Sadeghieh (2013) - Guido et al. (2008) - Rostamzadeh et al. (2018) - Junaid et al. (2020)	Quality of raw materials	
Guido et al. (2008) - Abdolbaset and Rihab (2020) - Junaid et al. (2020)	Rising prices for raw materials	
Rostamzadeh et al. (2018) - Abdolbaset and Rehab (2020) - Junaid et al. (2020) - Sufialiglo and Kartal (2012)	Bankruptcy of the supplier	
Baharmand and Sadeghieh (2013) - Guido et al. (2008) - Rostamzadeh et al. (2018) - Sufialiglo and Kartal (2012)	Speed and accuracy of the supplier company	
Mazaheri et al. (2011) - Abdolbaset and Rihab (2020) - Junaid et al. (2020)	Improper production control	**Manufacturer risk**
Rostamzadeh et al. (2018) - Abdolbaset and Rihab (2020)	Dependence on a supplier	
Abdul Basit and Rihab (2020)	Detergent quality	
Hasheminejad et al. (1399) - Ashtari (2013)	Package quality	
Ashtari (2013) - Abdul Basit and Rihab (2020)	Safety risk of using chemicals	
Abdul Basit and Rihab (2020) - Junaid et al. (2020)	Detergent price change	**Distributor risk**
Hasheminejad et al. (1399) - Guido et al. (2008) - Rostamzadeh et al. (2018) - Junaid et al. (2020) - Briggs (2010)	Shipping risk	
Colic and estrus (2011) - Rostamzadeh et al. (2018) - Junaid et al. (2020)	Ordering risks	
Ashtari (2013) - Guido et al. (2008) - Wu et al. (2006)	Improper delivery time	
Junaid et al. (2020) - Sufialiglo and Kartal (2012)	Sudden bankruptcy of a detergent manufacturer	
Guido et al. (2008) - Junaid et al. (2020)	Risks related to the storage and storage of detergents	
Mazaheri et al. (2011) - Abdolbaset and Rihab (2020)	Inappropriate price	**Customer risk**
Hasheminejad et al. (1399) - Rostamzadeh et al. (2018) - Sufialiglo and Kartal (2012)	Lack of quality assurance	
Sufialiglo and Kartal (2012)	Economical detergent	
Rostamzadeh et al. (2018) - Abdolbaset and Rihab (2020) - Junaid et al. (2020)	Compatibility with humans and the environment	

Materials and methods

The present research is applied in terms of purpose and in terms of method, analytical and in the form of case study and in terms of method of data collection is field-survey.

The statistical population of this research consists of experts and experts of Safflower Production Company. Due to the small size of the statistical population in this study, there is no need for sampling and using the pairwise comparison questionnaire and interviewing experts from the point of view to identify and rank the risk components of Safflower Company supply chain is used. In order to collect information, the tools of paired comparison questionnaire were used and the data obtained from the collection of paired comparison questionnaire were used

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to examine the questions. In this study, the inconsistency rate criterion was used to determine the reliability and validity of the responses. If the inconsistency of the judgments is less than 0.1, then it can be said that the opinion of the decision makers is consistent and prioritization can be done. According to the output of EC software, it was observed that the questionnaire has the necessary reliability and the rate of incompatibility of decision makers' opinions was less than 0.1, so it is possible to prioritize.

Based on the generalities, the conceptual model of the present study is presented in Figure (1). The proposed model is taken from the framework introduced in the study of Mazaheri et al. (2013). Based on the proposed model, the present study seeks to answer the question of what are the risks in the supply chain of Safflower Detergent Manufacturing Company and what are their priorities in comparison? In the proposed model, each of the factors under study is assigned to these elements according to which of the four main elements of the supply chain, namely supplier, manufacturer, distributor and end customer, are most assigned to these elements. And this allocation does not mean the effect of a single factor on the relevant element, and each of the 28 factors studied in the present study have an effect on all elements of the supply chain that the intensity of these effects are different. For example, changes in the technology of detergent production, although most of the manufacturers in the industry are threatened, but the scope of this impact is not limited to manufacturers and will affect suppliers of raw materials, distributors and buyers of finished products with less intensity. Was. Finally, all of these factors are considered in comparison to determine which will create the greatest risk for the entire supply chain. The amount of risk created by each agent for the supply chain will be the sum of the amount of risk created by that agent for the various elements of the supply chain.

In this study, using the information obtained from the pairwise comparison questionnaire to identify supply chain risks in the detergent industry and rank it, after using the Delphi technique and obtaining the opinion of experts and reaching an agreement, the method of hierarchical analysis was used. Data analysis was performed using EXPERT CHOICE software.

Findings

In the first phase of this study, in order to identify supply chain risks in the detergent industry and rank them, using the opinions of experts, a number of criteria were included, which included general criteria in selecting supply chain risks in the detergent industry. The hierarchical analysis process can be used when the decision-making action is faced with several competing options and decision-making criteria, and the proposed criteria, as mentioned, can be quantitative or qualitative. This process first requires drawing a hierarchical tree in such a way that when it is difficult for humans to understand a problem in a general and complex way and different and important dimensions of the problem may be forgotten, breaking down a general problem into several more detailed problems in identification The issue is very effective. In fact, the breakdown of a larger problem into smaller problems reflects the relationships between the smaller elements, so that by doing so, the relationships and concepts of the problem to be decided, as well as the relationship of each element with other elements, are carefully understood. The figure below shows the hierarchical problem tree.

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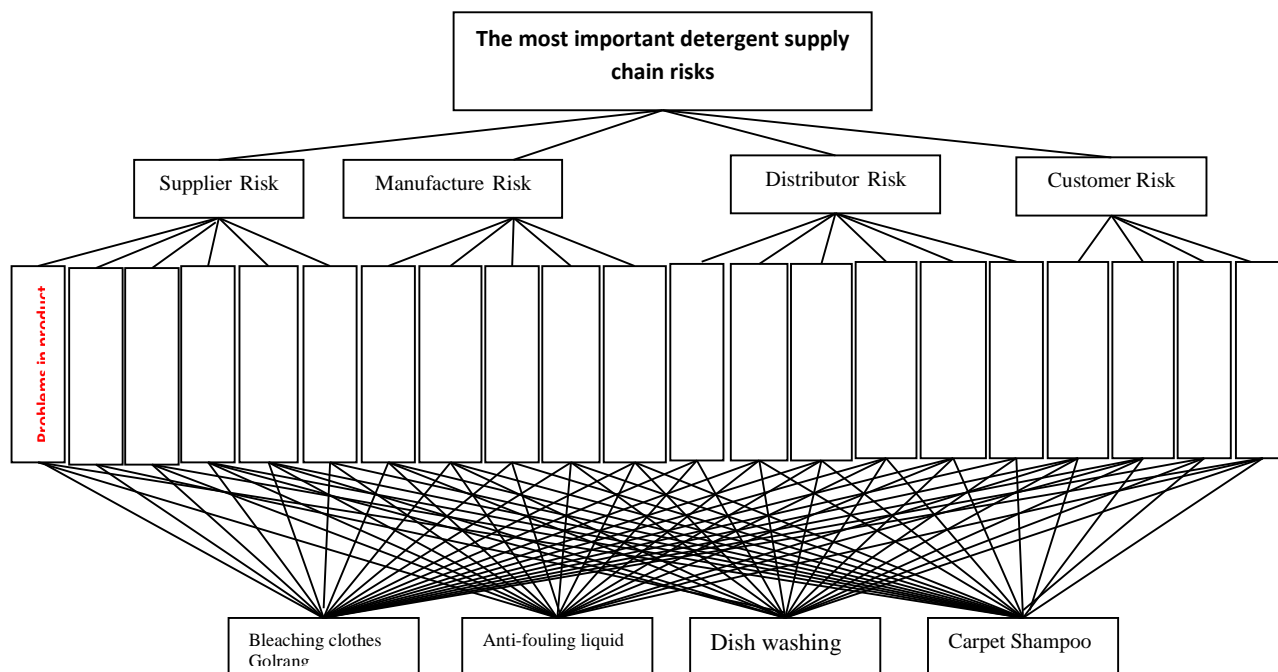**Majid Moatamedi, Mohammad Hossein Darvish Motevalli**

Figure 1. Hierarchical Tree for Ranking Supply Chain Risks in Safflower Detergent Industries

In this research, according to the hierarchical tree structure, the level of indicators is composed of two parts: indicators and sub-indicators, which divides the hierarchical process into three stages. In the first stage, the weight of each supplier is determined in relation to the sub-indicators and in the second stage, the weight of each of the sub-indicators is determined in relation to the main indicators and the weight of each of the main indicators is determined in relation to the research goal. Third, by multiplying the weights matrix of these three steps, the total weight of each supplier to the main goal is determined, which is done by Expert Choice software.

Review of research questions

What are the supply chain risks of Safflower Detergent Manufacturing Company and what is the weight of each decision?

In order to identify supply chain risks in the detergent industry, after reviewing the

research literature and using the opinions of experts, a number of criteria were identified, including general criteria in selecting supply chain risks in the detergent industry, which are: customer risk, distribution risk. Manufacturer, manufacturer risk, supplier risk. After comparing the criteria by experts and using the hierarchical analysis technique, the weight coefficients relative to the target were obtained by Choice Expert software according to Table (2).

Table 2. Weight of detergent supply chain risks

Criterion	Characteristic	weight
Customer risk	R1	0.110
Distributor risk	R2	0.113
Manufacturer risk	R3	0.308
Supplier risk	R4	0.470

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According to the weighting coefficients of Table (2), the asset supplier risk is the highest weighting coefficient of 0.470 and the most important is the supplier risk, which is in the first place and the 2nd, 3rd and 4th ranks belong to the producer risk, respectively. Distributor risk and customer risk with weighting coefficients of 0.308, 0.113 and 0.110.

What are the supply chain risks of Safflower Detergent Manufacturing Company and what weight and rank does each of them have in making decisions based on hierarchical analysis technique?

After reviewing the research literature and using the opinions of experts, the supply chain risks in the detergent industry were identified, which include: problems in product innovation, insufficient inventory in stock, supplier bankruptcy, speed and accuracy of the supplier company, rising material prices Primary, quality of raw materials. After comparing the criteria by experts and using the hierarchical analysis technique, the weight coefficients relative to the target were obtained by Choice Expert software according to Table (3).

Table 3. Values obtained from AHP method

Criterion	Characteristic	weight
Quality of raw materials	TA1	0.406
Rising prices for raw materials	TA2	0.119
Speed and accuracy of the supplier company	TA3	0.119
Bankruptcy of the supplier	TA4	0.119
Insufficient inventory in stock	TA5	0.105
Problems in product innovation	TA6	0.132

According to the weight coefficients of Table (3), the risk of quality of raw

materials is the highest weight coefficient of 0.406 and the most important risk is the supply chain supplier, which is in the first place and ranks 2 as the risk of problems in product innovation with a weight coefficient of 0.132. Rank 3 is taken by the risks of rising raw material prices, speed and accuracy of the supplier company and supplier bankruptcy by all three with a coefficient of 0.119, and finally rank 4th with the risks of insufficient inventory in the warehouse with a weight coefficient of 0.105.

What are the supply chain risks of Safflower Detergent Manufacturing Company and what weight and rank will they gain in decision making based on the hierarchical analysis technique?

After reviewing the research literature and using the opinions of experts, the risks of the manufacturer of supply chain of Safflower Detergent Manufacturing Company were identified, which are: improper production control, dependence on a supplier, detergent quality, packaging quality, safety risk of material use Chemical. After comparing the criteria by experts and using the hierarchical analysis technique, the weight coefficients relative to the target were obtained by Choice Expert software according to Table (4).

Table 4. Table of values obtained from the AHP method

Criterion	Characteristic	weight
Improper production control	TV1	0.199
Dependence on a supplier	TV2	0.133
Detergent quality	TV3	0.421
Package quality	TV4	0.136
Safety risk of using chemicals	TV5	0.110

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According to the weight coefficients of Table (4), the risk of detergent quality is the highest weight coefficient of 0.406 and the most important risk is the supply chain manufacturer, which is in the first place and ranks 2, 3, 4 and 5 respectively, improper production control risk, risk Package quality assumes the risk of dependence on a supplier and the safety risk of using chemicals with weight coefficients of 0.199, 0.136, 0.133 and 0.110.

What are the distribution chain risks of Safflower Detergent Manufacturing Company and what weight and rank will they gain in decision making based on the hierarchical analysis technique?

After reviewing the research literature and using the opinions of experts, supply chain distributor risks in the detergent industry were identified, which include: detergent price change, shipping risk, ordering risks, appropriate delivery time, sudden bankruptcy Detergent manufacturer, detergent storage risks. After comparing the criteria by experts and using the hierarchical analysis technique, the weight coefficients relative to the target were obtained by Choice Expert software according to Table (5).

Table 5 . Table of values obtained from the AHP method

Criterion	Characteristic	weight
Detergent price change	TZ1	0.138
Shipping risk	TZ2	0.130
Ordering risks	TZ3	0.135
Proper delivery time	TZ4	0.260
Sudden bankruptcy of a detergent manufacturer	TZ5	0.218
Risks related to the storage and storage of detergents	TZ6	0.118

According to the weight coefficients of Table (5), the risk of appropriate delivery

time is the maximum weight coefficient of 0.260 and the most important risk is the supply chain distributor, which is in the first place and ranks 2, 3, 4, 5 and 6 respectively, the risk of sudden bankruptcy of the manufacturer Detergents, detergent price change risk, ordering risks, transport risk and storage and storage risks of detergents with weight coefficients of 0.218, 0.138, 0.135, 0.130 and 0.118. Take.

What are the final customer risks of the supply chain of Safflower Detergent Manufacturing Company and what weight and rank will they gain in making decisions based on the hierarchical analysis technique?

After reviewing the research literature and using the opinions of experts, the final customer risks of the supply chain in the detergent industry were identified, which are: compatibility with humans and the environment, cost-effective detergent, quality assurance, reasonable price. After comparing the criteria by experts and using the hierarchical analysis technique, the weight coefficients relative to the target were obtained by Choice Expert software according to Table (6).

Table 6. Table of values obtained from AHP method

Criterion	Characteristic	weight
Compatibility with humans and the environment	M1	0.533
Washed material	M2	0.225
Quality assurance	M3	0.091
The price is right	M4	0.149

According to the weight coefficients of Table (6), the risk of compatibility with humans and the environment is the highest coefficient with a weight of 0.533 and the most important risk is the supply chain customer, which is in the first place and

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ranks 2, 3 and 4 respectively. Being a detergent assume the risk of reasonable price and quality assurance risk with weight coefficients of 0.225, 0.149 and 0.091.

Given that the incompatibility rate for decision makers' response is 0.04 and less than 0.1, therefore these weighting coefficients are appropriate and can be used in the selection process. Finally, G1 to G4, which represent the options in the hierarchical tree, are categorized in Figure (2).

Synthesis with respect to:
Goal: entekhab mohemtarin risk tamin konnde
Overall Inconsistency = .04

G1	.508
G2	.237
G3	.105
G4	.150
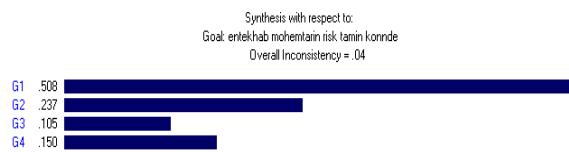
Figure 2. Weighting coefficients obtained from Expert Choice software

Table (7) shows the weights obtained from Expert Choice software for each option and the amount of the incompatibility rate, the incompatibility index, the random incompatibility index and the largest specific value.

Table 7. Table of values obtained from AHP method

Criterion	Characteristic	weight	
Safflower carpet shampoo	G1	0.508	$\lambda \max = 12.476$ $C.R = 0.04$ $C.I = 0.0624$ $R.I = 1.56$
Safflower dishwashing liquid	G2	0.237	
Safflower scaling liquid	G3	0.105	
Safflower clothing bleach	G4	0.150	

Model sensitivity analysis

After ranking the options in this section, we will analyze the sensitivity of the model. Sensitivity analysis performed on the target node, which is the same as the supply chain risk ranking in the detergent industry, was performed with the aim of assessing the sensitivity of the options to all model criteria. In this study, among the sensitivity analyzes, performance sensitivity analysis was performed on the model, the results of which are shown in Figure (3).
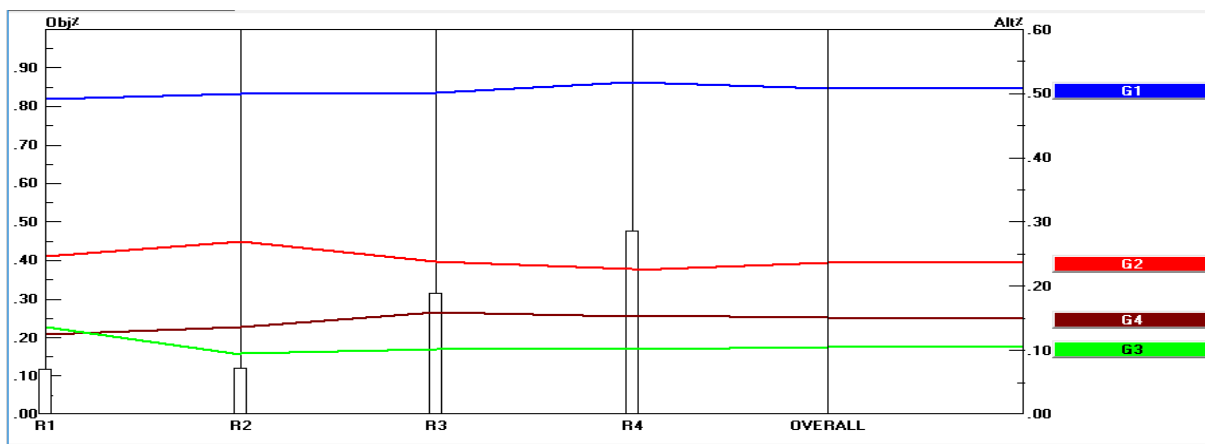

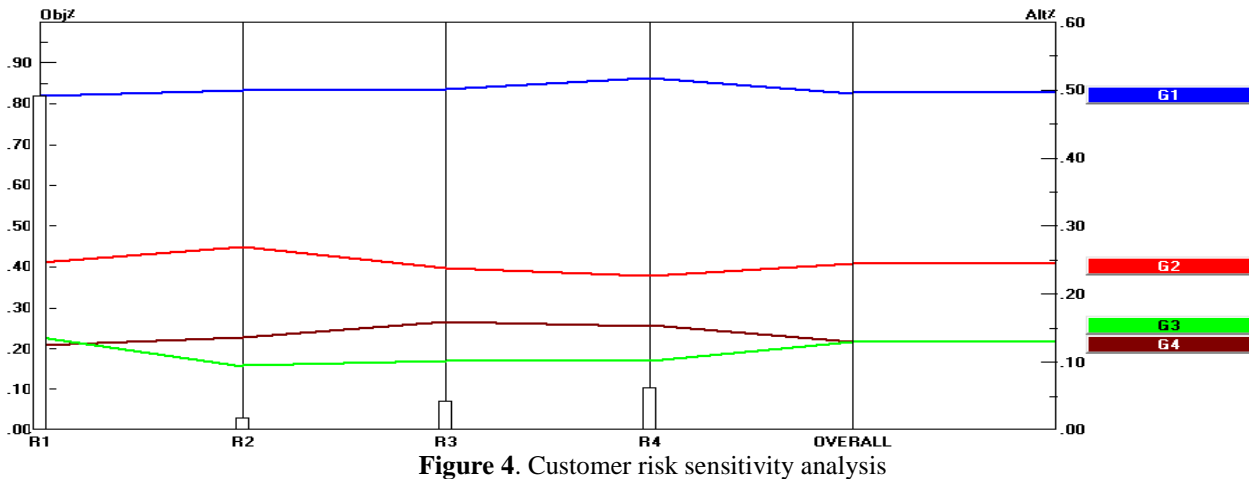
Figure 3. Performance Sensitivity Analysis

Figure 4. Customer risk sensitivity analysis

The results of sensitivity analysis showed that by increasing the weight of criterion R1 more than 0.82, it changes the rank of options G3 (safflower scaling liquid) and G4 (safflower bleach) so that G3 is ranked third and G4 is ranked fourth. شد. In other words, an increase in the weight of R1 increases the referral of option G3 (Fig 4).
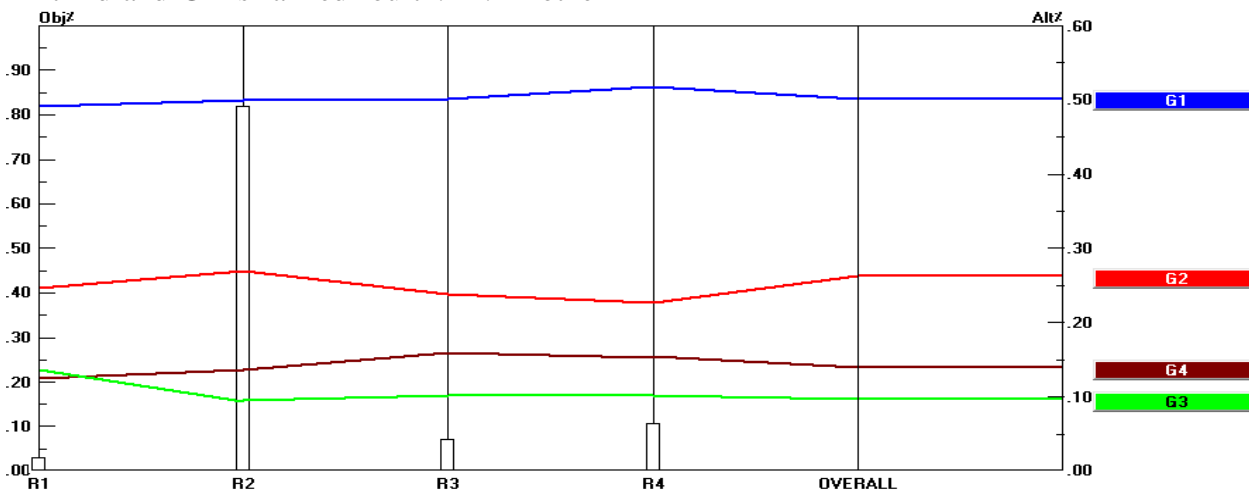
Figure 5. Distributor risk sensitivity analysis

By increasing or decreasing the weight of R2, only the weight of option G2 (safflower dishwashing liquid) changes directly (decreasing or increasing) but will not change in its rank. In other words, increasing the weight of R2 increases the weight of G2 and vice versa, but still its position in The second rank remains and the weight gain of this criterion does not change the rank of the other options (Figure 5).

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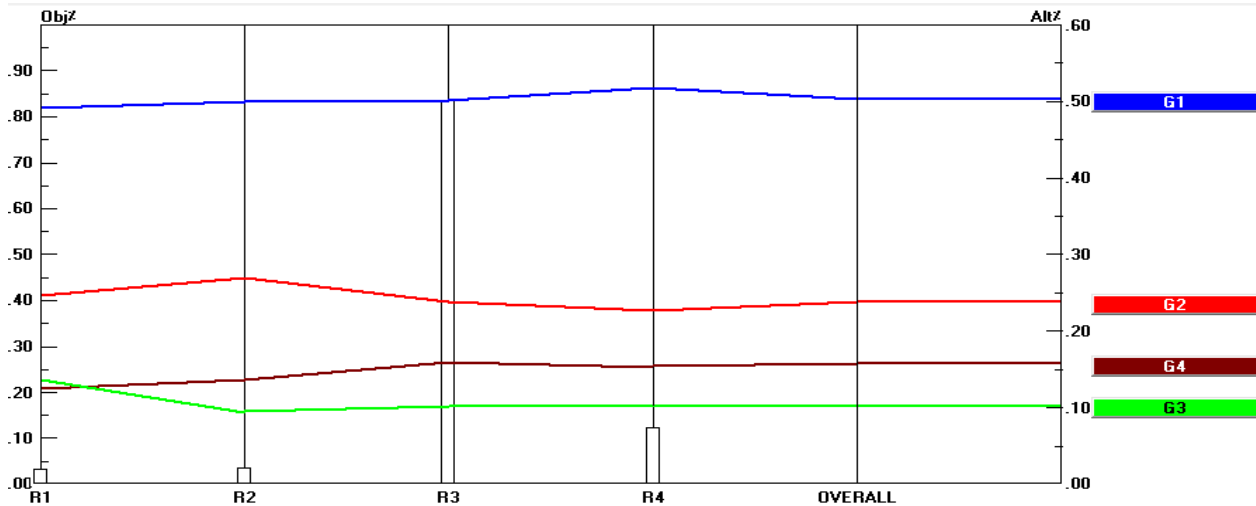**Majid Moatamedi, Mohammad Hossein Darvish Motevalli**

Figure 6. Analysis of producer risk sensitivity

According to Figure (6), by increasing or decreasing the weight of R3, the weight of option G2 (safflower dishwashing liquid) changes directly (decreasing or increasing)

but will not change in its rank, and conversely, increasing the weight of R3 decreases the weight of option It will be G4, but there will be no change in their ranking
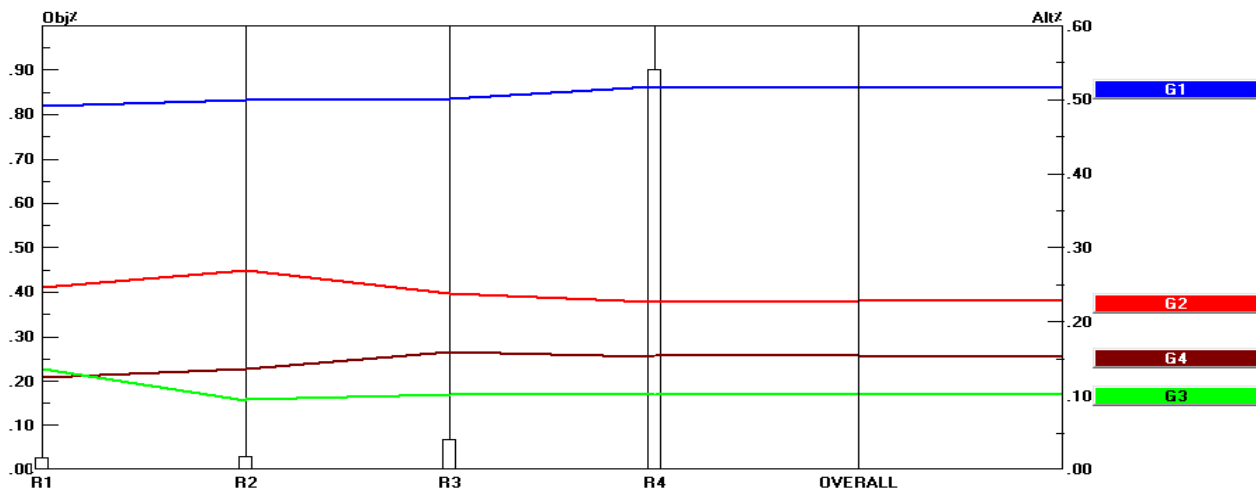
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Figure 7. Supplier risk sensitivity analysis

Finally, by increasing or decreasing the weight of R4, the weight of option G1 (safflower carpet shampoo) will change directly (decrease or increase) but will not change in its rank. Conversely, increasing the weight of R4 will reduce the weight of option G2, but in the position of rank. It does not change. In other words, increasing the weight of R4 increases the weight of G1 and decreases the weight of G2 (Figure - 7).

Discussion

In this study, the supply chain risks of Safflower Detergent Manufacturing Company were ranked using hierarchical analysis technique. Factors such as globalization, outsourcing and increasing the diversity of products and services have led to increased complexity in the supply chain. As complexity increases, the level of uncertainty and risk in the chain also

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increases. Risks in the supply chain can be costly for organizations and cause delays in the delivery of products to the customer and as a result his dissatisfaction. Therefore, risk management has become a key issue in the supply chain and plays an important role in chain performance and continuity of organizational dynamics (Mirghfouri et al., 2012).

In line with the results of this study, Pour Mujib and Fadaei (2014) stated that supply risk, demand risk, environmental risk, operational risk are the risks affecting the supply chain and prioritizing factors are supply risk, environmental risk, respectively. Demand risk and operational risk.

Zand Hesami and Sajoji (2012) The most important supply chain risks were environmental risk, financial resources, strategy, information and communication technology, equipment, technology and human resource risk, respectively. Manian et al. (2010) expressed the effective factors for measuring supply chain performance as impact, customer factors, process, cost, flexibility, supplier and time, respectively, and supply chains that perform better in these 6 factors have performance. They are higher than the pulse. Also, customer indicators including how and quality of delivery, return rate and customer satisfaction were expressed. In his research, Wu et al. (2006) identified and examined eleven potential risks in the field of internal security, the results of which were prioritized using the AHP technique to indicate the priority of factors such as cost, quality, delivery to At the time, supply chain continuity and risk were related to production engineering factors. Gupta et al. (2014) categorize supply chain risks into two categories of risks of internal origin including sub-dimensions of potential risk, operational risk, organizational risk and technological risk, and risks of external

origin including sub-dimensions of risk. They categorized economic risk and political risk, and finally ranked the risks related to sub-dimensions, according to which the risk related to disturbances caused by environmental factors, the risk related to forecasting, the risk related to delay and quality-related risk are the first four priorities among risk factors. In another study, having a tested and proven system for risk prevention and assessment states that today risk assessment methodologies are not limited to a specific group or company and as a procedure for the academic community, the company and governments have become. In this study, the role and importance of multi-criteria decision making in critical decisions and the ease of their application in the field of risk assessment, and then using the technique of hierarchical analysis and risk indexing, evaluation A comprehensive set of risks is stated (Haller, 2006). Briggs (2010) assesses risk upstream of the crude oil supply chain using a three-tier hierarchical analysis process. The results of this study show that the most important risk is transportation risk and then the risk of exploration and production is the most important risk and in the next priority, risk transfer and sharing is preferred. The results of risk prioritization and their factors in Sufialiglo and Kartal (2012) research are: Risk of supply (working with wrong or inappropriate suppliers, delays in delivery of bank documents, port capacity, transport time, respectively). Dependence and opportunism, financial stability of suppliers), operational risk (high shipping costs, production capacity problems, service quality, inventory maintenance cost, low product quality, human resource risk, IT failure), demand risk (over demand Consumer limits, fluctuations in consumer demand, risks of re-ordering), environmental risk (economic risk, natural disasters, law, government and regulations, and social uncertainty).

One of the risks identified in the supply chain of Safflower Detergent Manufacturing Company, the results of which have shown its high importance and priority, is the supplier risk. These types of mistakes are often more sensitive due to the significant impact they can have on problems in product innovation, insufficient inventory, supplier bankruptcy, speed and accuracy of the supplier company, increase in raw material prices and quality of raw materials. be. In the detergent industry, overproduction of market demand, which is one of the common misconceptions in production planning, does not simply lead to warehousing costs and related problems. Corruption of surplus products due to the nature of detergents, which often results in the loss of the ability to sell those products, makes the cost of production planning mistakes in the detergent industry even heavier. One of the suggestions for reducing supplier risk is to define and implement formal mechanisms for documenting suppliers and analyzing their results. Such a mechanism helps the organization to analyze its past mistakes and the reasons for their occurrence accurately based on the collected documents, and this procedure.

Resources

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