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Identification and classification of influencing factors on selection of cosmetics supplier in factor analysis method (Case study: east of Fars)

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Abstract: The goal of this study is identification and classification influencing factors on selection of cosmetics supplier in factor analysis method in east of Fars. Statistical society of this research is 490 cosmetics sellers in east of Fars, included Estehban, Fasa, Darab and Neiriz cities and according to Morgan table; sample size was selected as 359 sellers. Data has been collected using a researcher made questionnaire; questionnaire validity was obtained through conducted content and reliability was obtained by Cronbach's alpha 85.7 percent. Data analysis was conducted using SPSS and factor analysis. Results show that business history of supplier (validity of supplier) has the greatest impact in selection of supplier using factor analysis method. Also using clustering, we concluded that continuity of goods by supplier, quality of supplier services, and cosmetics products quality in cluster have high importance and how supplier manage and organize, supplier planning system for sale, goods control systems by supplier in delivering them, impact of supplier gender have lowest importance that continuity of goods by suppliers has The most important factor in a supplier selection.

Key words: Supply chain management; Evaluation and selection of suppliers and factor analysis

1. Introduction

After introduction supply chain management term, it has attracted a lot of researchers and craftsmen attention significantly (Razmi et al., 2004). In decades of 1990, many of manufacturers and suppliers of services had achieved this vision that they can achieve a combination of modern methods of procurement through greater integration with suppliers and enhance quality and quantity of order and procurement activities related to management of administrative of its old officials and organizational role that is called supply chain management. Since this aspect of supply chain management is prior to purchase and activities related to materials supply management in industrial buyers part. This definition states that sum of these activities can be found in purchasing and future materials in supply chain management (Tan, 2001). Also, supply chain management is a hierarchical approach and strategic planning of supply and demand, sourcing of raw materials and combiner, making products and semi-finished goods, inventory tracking and ordering, timely delivery goods to customers and ultimate consumer (Chav et al., 2008). Tan refers to different perspectives in the field of supply chain management like purchasing and logistics view, transportation and transportation perspective and integrated view of supply chain management strategy (Tan, 2001). In today's

competitive market, manufacturers not only seeking to improve internal situation, but also selection and evaluation best suppliers (due to globalization) is located at the top of their agendas (Razmi et al., 2004). Evaluation and selection suppliers in manufacturing organizations success are very important. Because price and quality of sold products is directly related to price and quality of purchased raw materials. Thus order and evaluation part and supplier selection has a key role in supply chain management (Desoza et al., 2000).

We express the main issue of this research according to role and importance of supply chain management and selection and evaluation suppliers in today's competitive environments and the impact that these choices can have on the cost and quality of produced goods on the other hand, due to lack of a model for evaluation and selection of suppliers in cosmetics industry in east of Fars.

2. Research literature

2.1. Supply chain

After introduction supply chain management term, it has attracted a lot of craftsmen and researchers' attention significantly (Razmi et al., 2004). Supply chain management is a new approach that has dominated in operations management in recent years supply chain is a network of distribution centers that one of its tasks is converting raw materials into finished products and

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their distribution them among customers. Supply chain management coordinates activities so that customers are able to obtain high quality products at low cost. Supply chain management can provide a competitive advantage for the company. Supply chain management increases company's desire to cooperation and competition (Feizabadi, 2003). In today's global markets, corporate aren't entities with unique and brand names that can operate independently, but instead are part of a supply chain. Here, ultimate success of a company depends on its management ability in organizing and coordinating a complex network of business relationships between members of supply chain (Lambert and Cooper, 2000). The ultimate goal of these companies to manage their suppliers throughout supply chain is faster deliver, reducing production latency, reduce costs and improve quality (Choi and Hartl, 1996). In recent decades, management is task of purchasing in supply chain challenge for most companies and need to achieve a globally competitive level in field of supply has increased substantially (Kumar et al., 2001). Since it is already suppliers exert a major impact on the success or failure of a company's, order has already been considered as a tactical tool is known as a strategic task (Goofin et al., 1997). Supplier selection decisions determine suppliers which must be selected as sources order and how values of order shall be allocated among selected suppliers (Karpak et al., 2001). An accurate supplier selection is a critical decision with a wide range of conclusions in a supply chain. Suppliers play an

important role in achieving objectives of supply management. Suppliers increase customer satisfaction in value chain. However, strategic partnership with suppliers that works better must be integrated into supply chain to create performance improves in many ways (Koomar et al., 2004).

Managers in past two decades have observed a milestone in history and changes in technological advances, globalization markets and consolidation of economic and political activities. Organizations due to increasing number of competitors in international category were forced to quickly improve their internal processes in order to stay in competitive area. So over these years, companies were forced to focus on their market strategies, strong engineering, robust design and strong support to keep their customers. Manufacturing organizations were required to increase flexibility of act ability about modified products, improved processes and develop new products to respond to customers' requirements change. Whatever production capability was developed in the 90s, most managers realize materials inner importance and presented services by suppliers also, ability of present time, place and giving products to customer (Mirghafoori, 2003), and organizations have found that well presenting of their outcomes is depends on organization ability for handling materials process, information and inner and outer organization's money. This progress is known as supply chain (Poya, 2004). Fig.1 shows a supply chain.

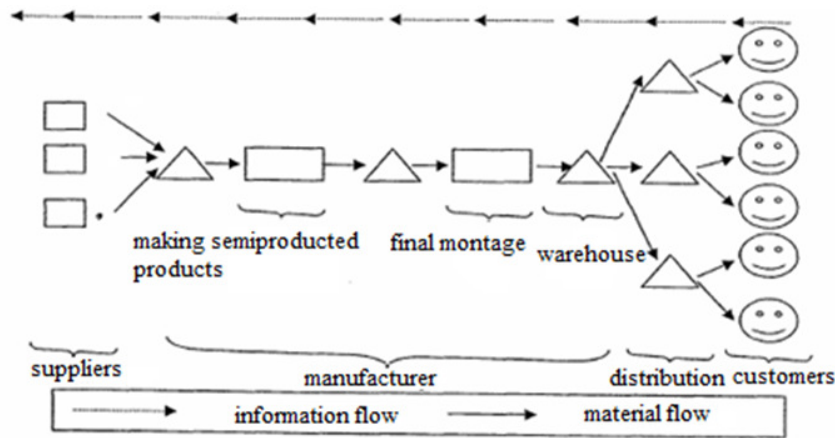


Fig.1: A sample of supply chain (Stadtler and Kilger, 2005)

2.2. Supply chain management

Nowadays, organizations try to survive in market due to globalization markets and increasing competency in global markets. This has created the philosophy of supply chain management. Purchase and service management is an area that less work has been done on it. Customers' growing and variable needs, recent improvements in communication technology and information systems,

international competence and increasing environmental knowledge all are factors that have forced companies to focus on supply chain management (Tersi and Tan, 2001).

Supply chain management studies various aspects of supply chain consist of chain information system management, sourcing (selecting suitable suppliers), timing production, order processing, supply management, selection of the best

distribution center and finally after selling services (Mirghafouri, 2003).

2.3. Evaluation and Selection of Suppliers

With the increasing importance of the purchase issue, it has been added on the importance of decisions relevant to the purchase. In most of industries, the cost of raw materials and used components make the main part of product costs, so that in some cases this share can be 70% (Ghobadian et al., 1993) and even in high technology companies, more than 80% of the total cost of the product includes of materials and purchased services (Weberand et al., 1991) and since today, the organizations have been more dependent to the suppliers, direct and indirect consequences of poor decision appear to worse. Therefore the decisions related to strategies and purchase operations play a determinant role in profitability. Some of the most important present issues in the purchase

management area includes the issues of a supplier selection, a trade partner selection and determining the optimal order size and etc.(De Boer et al., 2001).

3. The research method

In the present research, the research method has been classified based on two bases. This research in terms of purpose is considered as an applied research, a kind of research that is done about the individual and collective, occupational and social daily life issues. Moreover the present research in terms of the nature and methods is located in descriptive-survey research category. The statistical population in this study consisted of 490 of cosmetic services vendors of east of Fars state which includes of Estahban, Darab, Fasa and Neyriz cities.

Table 1: The information related to the statistical population and sample

City	Society Number	Sample Number
Estahban	85	70
Darab	110	86
Fasa	200	127
Neyriz	95	76
Total	490	395

In this study, the data was collected by field research method. In the field research method, the questionnaire is one of the most common ways of data collection. For preparation of a questionnaire, the researcher attempts to receive the required information from respondent, through drawing number of questions.

In this study, the required data and information has been collected by a questionnaire.

These questionnaires were designed to identify of the effective factors on the evaluation and selection of suppliers, with respect to the subject background in relation to the evaluation criteria. This questionnaire which was designed on open-ended question was distributed among retailers of cosmetics products of east of Fars and collected.

In order to measure the validity of the designed questionnaires, the content validity assessment methods have been used. For this purpose, the advisory comments of masters of Shiraz Public University, Estahban Payam Noor and Estahban High Education Center were gathered and used as modification and questionnaire completion criterion. In this study, in order to evaluate the validity (Internal consistency) of the questionnaire, Cronbach's alpha coefficient[†] was used. The obtained Cronbach's alpha value for the research questionnaire has been showed 85.3%. Also the questionnaire's reliability based on split half method

equals 75.1%. In this research, the data analysis and interpretation is performed by using of factor analysis and SPSS software.

3.1. The Data Analysis

At first, for accuracy analysis of the factor analysis method, we calculate the KMO statistic. This index of the measure of sampling adequacy in terms of downsizing, examines the partial correlations between variables.

The KMO statistic indicates that the sampling size has been appropriate for this analysis. Rejection of the hypothesis of H0 Bartlett test also confirms the same issue. Bartlett test investigates when the correlation matrix has been identified and structure identification (Factor Model) due to not being a unit matrix and coordination between the components is most appropriate

4. Specifying of the Existing Variables in Each Factor

According to Table (3), it can be determined that each of the examined components are in which one of the factors. This analysis is determined based on the correlation amount of each component with factor. For example, component 1 is placed in factor 9; as well as component 4 in factor 3, and component 17 is in factor 1; because it has the greatest correlation in comparison with other factors with it.

[†] This method mainly is used for questionnaires that their questions are designed in Likert spectrum (and also distance or ratio) and their responses are multiple choices.

Table 2: Sampling Adequacy Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		837
Bartlett's Test of Sphericity	Approx. Chi-Square	2712.973
	df	435
	Sig.	0.000

4.1. Specifying of the Existing Variables in Each Factor

According to Table (3), it can be determined that each of the examined components is in which one of the factors. This analysis is determined based on the

correlation amount of each component with factor. For example, component 1 is placed in factor 9; as well as component 4 in factor 3, and component 17 is in factor 1; because it has the greatest correlation in comparison with other factors with it.

Table 3: Vectorized matrix of factors

	Factors									
	1	2	3	4	5	6	7	8	9	10
VAR00001	.113	.069	.393	.018	.283	.197	-.169	.184	.431	.015
VAR00002	-.077	.009	.751	-.074	-.022	.241	.105	.225	.018	.098
VAR00003	.295	.167	.641	.069	.057	-.016	.115	-.059	-.042	-.029
VAR00004	-.151	.277	.538	.118	.245	.195	.048	-.206	-.111	.086
VAR00005	.158	.112	.388	.306	.490	.019	.104	.207	.120	-.008
VAR00006	.412	.157	-.065	-.161	.496	.078	-.283	.204	-.108	.171
VAR00008	.082	.146	.088	-.019	.028	.009	.187	.721	-.100	.210
VAR00009	.503	.045	.094	.095	.424	.171	.064	.020	-.172	-.008
VAR00010	.176	.162	.187	.176	.552	.066	-.148	.131	.194	.088
VAR00011	-.035	-.005	-.037	.167	.747	.012	.212	-.115	.040	-.004
VAR00012	.377	.225	.419	.257	-.026	.080	-.172	-.182	.091	.244
VAR00013	.401	.540	.369	.152	-.100	-.085	.038	-.030	.039	.047
VAR00014	.117	.616	.259	.236	.171	-.036	.036	.238	-.207	-.094
VAR00015	.024	.579	.168	.214	.262	.119	-.051	.293	.144	-.023
VAR00017	.693	.109	.081	.174	.073	.022	-.036	.212	-.031	.038
VAR00018	.647	.143	.007	-.145	.105	.171	.270	.028	-.094	.017
VAR00019	.098	.213	.186	-.070	.002	.048	.728	.052	-.175	-.106
VAR00020	-.008	.685	.073	.091	.040	.186	.391	-.051	.019	-.071
VAR00021	.247	.632	-.020	-.093	.010	.245	-.040	-.031	.087	.232
VAR00022	.076	.034	-.049	.632	.140	.257	-.091	.223	-.136	-.097
VAR00023	-.107	.164	-.032	.658	.163	.090	-.125	.027	.106	.301
VAR00024	.012	.029	.119	.167	.018	.108	-.026	.089	-.038	.827
VAR00025	.182	-.057	-.030	.028	.185	.024	.558	.103	.042	.466
VAR00026	.196	.005	.094	-.021	-.025	.116	.040	.055	-.754	.055
VAR00027	.131	.112	.235	.692	.106	-.107	.219	-.058	.104	.104
VAR00028	.211	.159	.149	.399	.162	.051	-.208	.214	.451	.212
VAR00029	.151	-.022	-.079	.341	.045	.190	-.140	.618	.212	-.089
VAR00031	.278	.151	.197	.231	.110	.586	-.023	.109	.005	.073
VAR00032	.492	.012	.070	.089	-.047	.513	.178	-.023	.316	-.055
VAR00033	.024	.163	.132	.005	.065	.779	.039	.060	-.124	.111

4.2. Factorization

According to Table 4, it is clear that the respondent's tendency characteristics compared to buy from a special supplier, the business history of a supplier (validity of supplier), the impact of advertisement on supplier selection and the impact of supplier gender in terms of the respondents purchase is located in factor 1, which is the most important priority of the features of cosmetic products supplier. On the other hand, the features of respondents sufficient information on behalf of supplier is located in factor 10, that is the lowest priority and importance in the respondent's opinion.

4.3. Clustering

The cluster analysis is a statistical method for data grouping, according to the degree of similarity or their closeness. Through cluster analysis, data is divided into homogeneous and distinct categories. In cluster analysis, decision about cluster numbers is often based on Bayesian and Akaike information criterion. The answer that is obtained at the least level of Bayesian and Akaike information criterion could represent best balance between accuracy and complexity which considers the most important impacts and doesn't ignore their significance. In this research, by making 3 clusters, Bayesian and Akaike

criterion are very much reduced, so total 3 clusters are considered for respondents.

Another point is that Cluster 2 compared to the other two clusters, is considered all the factors more important except the variable 19 which has been considered more important in cluster 1.

According to Table 6, the present people numbers have been identified in each cluster. According to this table, the largest cluster is the cluster number 1 and the smallest cluster is the cluster number 3.

Table 4: The Factors' Identification

	Features	Explained Percent
Factor 1	Your tendency to purchase from a special supplier, business history of a supplier (Validity of supplier), the impact of advertisement on supplier selection and the impact of marketer gender in your purchase.	7.985
Factor 2	The management and the organizing of the supplier, products' control system in delivering time by the supplier, control system of goods' quality by supplier, sales planning system of the supplier, the impact of environment and present conditions on the supplier selection.	7.735
Factor 3	The time duration of arriving of the goods, performance and working relationships of the supplier, the supplier products compatibility with purchase process, the way of interaction of supplier's marketer with good introduction	7.509
Factor 4	The existence of mitigations (volume, cash, etc) on the supplier's goods, the possibility of returning of goods to the supplier, after sale services of the supplier towards cosmetics products.	7.178
Factor 5	The supplier's commitments to goods' delivery, the supplier's status among the other competitors, trust to the supplier, the continuity of goods from the supplier.	6.463
Factor 6	The variety of supplier's products, presence of brands in supplier's goods basket, your modernism (Following new goods from the supplier).	5.646
Factor 7	The amount of human resources of supplier, recommendation of the others to purchase of a particular supplier.	5.092
Factor 8	The vicinity of supplier to your place, the cosmetics products' prices.	5.046
Factor 9	The quality of cosmetics products, the quality of supplier's services.	4.675
Factor 10	Your enough information of the supplier	439.4

Table 5: The clusters' final centers

	Clusters		
	1	2	3
VAR00001	3.56	4.03	2.00
VAR00002	3.01	3.54	2.69
VAR00003	3.11	3.55	1.94
VAR00004	3.04	3.61	2.38
VAR00005	3.25	4.06	1.88
VAR00006	3.20	3.86	2.44
VAR00008	3.00	3.48	2.50
VAR00009	3.14	3.80	1.75
VAR00010	3.32	4.19	2.00
VAR00011	3.58	3.88	2.69
VAR00012	3.03	3.67	1.69
VAR00013	2.94	3.67	1.81
VAR00014	2.99	3.75	1.88
VAR00015	3.07	4.16	2.06
VAR00017	3.29	4.08	2.19
VAR00018	3.29	3.76	2.00
VAR00019	3.04	2.99	1.81
VAR00020	2.96	3.45	2.13
VAR00021	3.16	3.59	1.94
VAR00022	3.31	4.08	3.00
VAR00023	3.22	3.98	2.50
VAR00024	3.17	3.71	2.81
VAR00025	3.22	3.46	2.50
VAR00026	2.99	3.27	2.81
VAR00027	3.25	3.98	2.31
VAR00028	3.49	4.36	2.06
VAR00029	3.46	4.32	3.44
VAR00031	3.20	4.10	2.44

VAR00032	3.27	3.85	2.25
VAR00033	3.24	3.97	3.00

Table 6: The member's number of each cluster

Cluster	1	190.000
	2	153.000
	3	16.000
Valid		359.000
Missing		.000

5. Results

5.1. Results of Factor Analysis

For answering to this question that what the criteria is for choosing the best supplier in the sellers' point of view, at first by library sources search, related articles about evaluation and selection criteria of suppliers were examined. One of the most important and effective models which was mentioned in classified efforts on the literature of supplier selection subject, was factor analysis models and clustering method, so that most of the researchers had seen the evaluation and selection of suppliers as an decision making issue.

Factor analysis method is one of the decision making methods. Regard to mention content, for evaluation of cosmetic products' suppliers, a model based on factor analysis method was established in the east of Fars. To do this, a questionnaire was designed and distributed among the sellers of this region. In this questionnaire, by noting some of the identified reasons in the discussion of evaluation and

selection of suppliers, it was asked from sellers to state their opinions about factors. After completing the questionnaires, it was found that the majority of the samples were single men with age 20- 30 with BA degree, and the income of less than 530.000 Toman. After the examination of primary amount of subscription and removal of 3 variables which were closeness of supplier to seller location, product packaging ability by supplier and compatibility of supplier's products with seller's business, other variables remain in the analysis because subscription is less than 0.5. These variables are in 10 factors.

Regarding to the explained percent, factor 1 is of the most importance among other factors.

Results of this step led to identifying of effective factors of evaluation and selection of suppliers. The result has been shown in Table 7 as below:

In regards to Table 8, history of supplier (credit amount of supplier) factor has the most effect in supplier selection.

Table 7: Identifying the most important factor

	Features	Explained percent
Factor 1	Seller's tendency to purchase from certain supplier, business history of supplier (validity of supplier), impact of advertisement on supplier selection, impact of supplier's gender on buying	7.985

Table 8: Factor's ranking

Seller's tendency to purchase from certain supplier	VAR00009	.503
Business history of supplier (validity of supplier)	VAR00017	.693
Impact of advertisement on supplier selection	VAR00018	.647
Impact of supplier's gender on buying	VAR00026	.196

5.2. Results of Clustering Method

Cluster analysis is a statistical method for classifying data based on their similarity or degree of closeness. Through cluster analysis, data is divided into homogeneous and distinct categories. In cluster analysis, decision about cluster numbers is often based on Bayesian and Akaike information criterion. The answer that is obtained at the least level of Bayesian and Akaike information criterion could represent best balance between accuracy and complexity which considers the most important impacts and doesn't ignore their significance. In this research, by making 3 clusters, Bayesian and Akaike criterion are very much reduced, so total 3 clusters are considered for respondents. Cluster 2 compared to the other two clusters, is considered all the factors

more important except the degree of human resources of supplier variable which has been considered more important in cluster 1.

In cluster 1, features of the continuity of goods from the supplier, the service quality of the supplier, quality of cosmetic products have the most important and the management and organization of the supplier, sales planning system of the supplier, products' control system in delivering time by the supplier, and the impact of supplier's gender are of the least importance. Continuity of goods from the supplier has the most important variable in supplier selection. In analysis of clusters' relation with respect to ecological features, we note that, in all clusters, most people aged 20 to 30 but the rate of this aged group has been more in cluster 2. In all clusters, most of these people are males, but the rate

of this gender groups was higher in cluster 3. In all clusters, most people are in the group of graduate education degree but the rate of this educated group was higher in cluster 3. In all clusters, most people are in the group of single people but the rate of this group of people was higher in cluster 2. In all clusters, most people are in the group of low income (less than 530.000 Toman) but the rate of this group was higher in cluster 3. The achieved results are same by the results of the factor analysis.

The distance between clusters shows how different clusters are in terms of features that consider being important for a supplier of cosmetics products and in other words, they have distance in this regard.

Table 9: Distance between clusters

Clusters	1	2	3
1		3.589	5.420
2	3.589		8.681
3	5.420	8.681	

Distance between clusters is examined in Table 9. As shown, clusters 2 and 3 have more distance from each other and clusters 1 and 2 have less distance from each other.

6. Recommendations

In the recommendation part of the research, we can refer to the following actions:

1. Evaluation and assessment of suppliers' performance at different intervals.
2. A qualitative comparison of suppliers continuously in terms of price, quality, delivery time, innovation and technology level, work culture and flexibility for sale.

To encourage producers to participate in designing new products and acceptance of problems and providing special facilities for suppliers who transfer good benefits to the sellers with their suggestions.

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