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Soft Modeling of Factors Affecting Export Development of Ornamental Plants and Flowers Industry in Mazandaran Based on Interpretive Structural Modeling (ISM)

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Abstract

Mazandaran's share of ornamental plants and flowers industry's exports has been decreasing over the past ten years, despite its proximity to CIS countries. The aim of research was to achieve a stratified model of effective factors in the export development of ornamental plants and flowers in Mazandaran in the form of a comprehensive stratified operational model that has a practical nature. By reviewing the research literature and attracting the opinions of experts, the subject was identified in the form of 22 factors and 98 indicators. The basis of the research was the judgments of a group of experts and export experts and export producers from Mazandaran, who were selected based on a purposeful judgmental sampling. The validity of the researcher-made questionnaire was confirmed by experts. The data obtained from the questionnaires were analyzed using interpretative structural modeling, and were drawn in terms of influence or impact on 6 levels in an interactive network. The findings showed that factors "International political and economic characteristic" and "Recreation of government in development of export" have the greatest impact on the export development of the flowers and ornamental plants industry and are considered the most basic factors and the factors "Improvement of commercial diplomacy", "Sustainable growth of economic" were also at the lowest level of effectiveness. Also, the driving force and dependence of other factors were also identifyed, in order to explain the effectiveness of the factors in the export development of this industry.

Keywords: Export, Flowers industry, ISM, Mazandaran, Ornamental plants, Soft modeling.

INTRODUCTION

The export of agricultural pruducts plays a significant role in non-oil exports and is more stable than other industries. Now days, production/growing of flowers and ornamental plants, as one of the important activities in the agricultural sector, play an essential role in aesthetic gratification, general decoration, beautification, employment opportunity, export growth, livelihood, trade and commerce, improving the environment etc. According to the geographical and agricultural conditions, production of flowers and ornamental plants have a suitable situation in Iran. Development of agricultural extension and education services, agricultural cooperatives and unions, development of infrastructure and facilities, export facilitation, marketing, practical research, etc., can contribute to the sustainability of this industry (Hajimirrahimi and Ghasemi, 2023).

Export of flower and ornamental plant is one the most commercial transactions in some countries in such a manner that a country like Netherlands gain a high amount of its income from export of flower and plant. This country is so similar to Mazandaran province in terms of climate and weather (Azarkish *et al*., 2015). According to the high quality of the produced flowers, export of different types of flower and plant is so low. Potential ability of Mazandaran province for producing ornamental plant and flower and excellence of this product in terms of quantity, quality, diversity of color, appropriate size, etc. makes Mazandaran province as the first rank in producing apartment flowers by producing 27.5 million vase per year and the second rank by producing 527 cutting branch per year (Agriculture Jihad, 2016).

Most of the transit of ornamental plants and flowers from Iran are to other countries. The flowers entered into those countries are packed again in new packages and new names and exported to other countries by their own name. Export flowers are sent to UAE, Saudi Arabia, Kuwait, Bahrain, Iraq, China, Japan, Vietnam, Taiwan, and a small amount to Germany and France (Khosh-Khoui *et al*., 2021). Despite the fact the Mazandaran is one of the important hubs of producing ornamental plants and flowers and has a high potential in practicing, they have no remarkable rile in the field of export and in the global markets (Zamanian, 2009). Most of the customers of Iran for purchasing flower are Iraq, Azerbaijan, Ukraine, Moldavia, Belarus, Georgia, Armenia, Tajikistan, Kyrgyzstan, Uzbekistan, Turkmenistan, Kazakhstan, and Russia that are mainly northern neighbors of Iran and Mazandaran. With this potential, almost 98% of the cutting flowers are used for domestic markets (Khosh-Khui *et al*., 2021). Also Mazandaran's share in the export of flowers and ornamental plants has been decreasing in the last ten years.

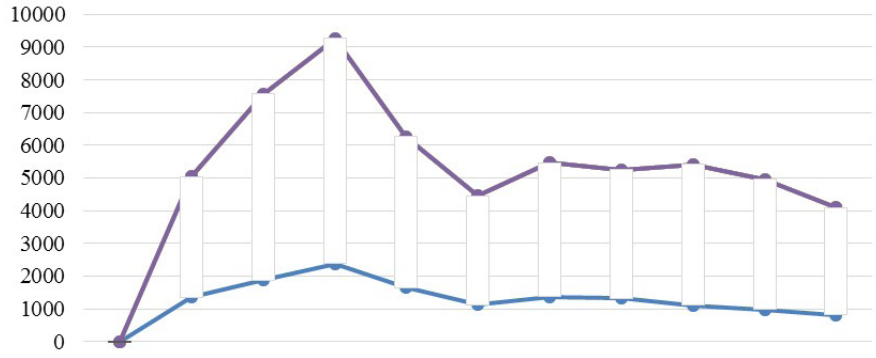

Fig. 1. The amount of ornamental plants and flowers export in Mazandaran province during last 10 years (Source: Agricultural Jihad of Mazandaran province).

Surveys show that the flower and ornamental plants industry in Iran and many different countries of the world is facing various problems and challenges (Darras, 2021). For example, research has shown that the scientific level of agricultural operators is very low and there is no optimal awareness and knowledge in the field of production, which emphasizes the need for training and the presence of specialist forces (Namvar and Ommani, 2022). Classified monitoring variables affecting the export development of ornamental plants and flowers industry in Mazandaran province can be a good action for achieving a reasonable export performance and cause access to the non-oil incomes. Since there is very few researches about the issue of export of ornamental plants and flowers especially in province, the mentioned study are studies that have the closes relationship with this field.

Spier's research results showed that the most important challenges facing ornamental plants and flowers industry are the low income of producers compared to production costs, transportation problems, compliance with quality standards and proper packaging (Spier *et al*., 2020). In another research, issues such as land ownership, pest and plant diseases management, lack of access to sufficient water sources and lack of sufficient support from the government had been identified as the most important challenges for flowers and ornamental plants industry in the Darossalaam from Tanzania (Pastory *et al*., 2020). By examining the sustainability challenges of the value chain of potted plants in Germany, the most important challenges of industry are explained as follows: The environmental aspect: Lack of water, the use of pesticides and carbon footprint, from the social aspect: low wages and difficult working conditions, and from the economic aspect: challenges related to profitability and compliance with standards (Havardi-Burger *et al*., 2020). In the review of orchid plants development strategies in Indonesia, the lack of technical recommendations for producers and lack of access to capital, were the most important internal factors and also lack of labor recruitment, lack of use of network marketing and online media for advertising, and lack of creativity in production through exhibitions had been the most important external factors (Sri *et al*., 2021).

Khosh-Khui *et al*. (2021) said that due to the high price of plants and flowers in Iran and lack of high amount of export, this industry has not important role in profitability and gaining foreign currency for Iran and according to the high quality of the produced plants and flowers in Iran, export of different types of plants and flowers is so low and we don't look at the production of ornamental plan as an strategic industry. Khalilabadi *et al*. (2016), concluded that economic factors and social factors have a positive effect on flower and ornamental plants export of Thran province. Azarkish *et al.* (2015), showed that there is a direct relation between the level of infrastructures and improvement of macroeconomic factors for both Iran and Kenya and infrastructures are effective in removing of limitations of small farmers, credits, warehousing, market distribution of product, insurance, access to new technology, services of promotion, roads and ports, telephone communications, irrigation, and rules. Amiri *et al*. (2014) categorized the impediments and problems of producers in sectors of producing, harvesting, packaging, processing and exporting and also marketing ornamental plant. Mostashar Nezami *et al.* (2013) classified the factors effective in export of Iranian plant and flower into two internal and external class. Dana *et al.* (2012) expressed that most of the persons active in this field have a look at the common allowances of the government and pay less attention to the commercial nature and content and responsible attention to the demand of customers and conditions of the target market. Estelaji and Pazoki (2012), show that the first priority in the global markting pattern is the product. Nikooie *et al.* (2010) said that share of producer from the price sold to the consumer and efficiency of marketing is so low. Zamanian (2009) reached that in more than

70 of the producers, the manner of production is traditional and the industrialized degree is so weak. This research aims to identify the driving and dependent factors of export development of ornamental plants and flowers industry in Mazandaran province and provide a classified structured model in order to determine that each of the factors are placed in what cluster of independent, bonder and autonomous factors.

MATERIALS AND METHODS

The current exploratory research is applied in terms of goal. Data of this study were collected via documenting and surveying methods. Questionnaires for the analysis of two-way relationships of the components, which included 18 effective components in the export development of this industry, were distributed among 14 expert participants. With targeted sampling, participants who had helped to identify the components in qualitative section of the study, evaluate the bilateral relationship among the factors and the analytical matrixes are designed. Participants in this research were exporters and traders of ornamental plants and flowers industry in the Mazandaran province, managers and experts of different levels of Industry, Mine and Trade Organization, Agriculture Jihad, export chamber of commerce, flower and plant union, transportation management in Amirabad port and airports of Mazandaran Province that have been collaborated with researchers in the qualitative part of the research. The participants cooperated in the best condition for collecting the research information and in evaluation of the questionnaire. At the rating section, the ISM pairwise comparison questionnaire. Interpretive Structural Modeling (ISM), which is an interactive learning process where a set of elements are structured into a comprehensive system model, is used as the approach. ISM helps in determining the sequence and purpose of complex relationships between elements in the system. According to the complexity of policy and foreign commerce and also number of factors effective in export production, ISM method is used for identification of relation between factors and diagnosis of impact and effect of each of them. The characteristic investigated in the ISM approach is the relationship between the elements. Since all possible relationships are examined in the form of a matrix, therefore, the structural-interpretive questionnaire in itself has validity. The characteristic investigated in the ism approach is the relationship between the elements. Since all possible relationships are examined in the form of a matrix, therefore, the structural-interpretive questionnaire in itself has validity (Habibi and Afridi, 2022). In order to implement the ISM modeling approach and determine the relationship between the factors as well as to create order in the elements of the problem, it is necessary to go through the following 7 steps:

1. **Identifying elements:** Identifying elements related to the topic. This step can be done by reviewing the theoretical literature or using any group problem solving technique.

2. **Field relations of SSIM:** Establishing contextual relationships between elements, considering which pairs of elements will be tested.

3. **Initial access matrix:** Creating a structural self-interaction matrix that shows how the elements of a system pairwise have relationships with each other.

4. **Final access matrix:** Production of SSIM matrix.

5. **Determination of level of variables:** Matrix commutability states that if element A is related to B and element B is related to C, then A is also related to C.

6. **Drawing ISM:** Matrix alignment to reach different levels. Draw a diagram of relationships and remove transitional links.

7. **Review on ISM:** Reviewing the ISM model, to discover conceptual mismatches and also to make necessary changes (Raut *et al*., 2018).

RESULTS

First stage: **"Identifying elements"**

In the research conducted by Mahdiee and Fani (2022) all the factors affecting export development of ornamental plants and flowers industry in Mazandaran province were identified.

Second stage**: "Field relations of SSIM"**

Experts examined the relationship between the factors. Evaluation of experts is shown in table 1.

Table 1. SSIM for factors affecting the export development of ornamental plants and flowers industry in Mazandaran province.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Global red ocean	❁	V	V	X	A	A	V	A	A	A	V	V	V	V	A	V	V	V
2	Global evaluation		❁	V	A	A	A	A	X	X	V	A	A	A	A	V	V	V	V
3	Development of hardware infrastructure for export			❁	V	A	A	V	A	V	A	V	A	V	A	A	V	V	V
4	Development of software infrastructure for export				❁	A	X	V	V	X	V	V	V	V	V	V	V	V	V
5	International political & economic characteristics					❁	V	V	V	V	V	V	V	V	V	V	V	V	V
6	Recreation of government in development of export						❁	V	V	V	O	V	O	V	V	V	V	V	V
7	Export terminal							❁	X	A	X	A	X	X	A	V	V	V	V
8	Managerial capabilities								❁	V	V	A	X	V	O	V	V	V	V
9	Competitive strategies									❁	V	A	A	A	A	A	V	V	V
10	Marketing and export branding										❁	A	X	X	V	V	V	V	V
11	Technology											❁	V	V	X	V	V	V	V
12	Making official and network for export												❁	X	V	V	V	V	V
13	Experience and Commitment in export													❁	A	V	V	V	V
14	Processing exported products														❁	V	V	V	V
15	Removing export Hydrocephalus & Export Barriers															❁	V	V	V
16	Targeted modeling from pioneer countries																❁	X	V
17	Sustainable growth of economic																	❁	X
18	Improvement of commercial diplomacy																		❁

Third stage: Initial access matrix

Access matrix or initial access is obtained from conversion of SSIM to zero and one matrix.

Fourth stage: Final access matrix

The secondary relation between elements should be analyzed so that the initial access matrix be combatable.

Fifth stage: Determination of level of variables

In this stage, the classification of element that is determination of early and late sets is performed that formation of the conical matrix is created. After determination of the output and input set for each of the elements by obtaining common area of two sets, their classification is done. For example, result of determination of input and output set, common in the first level of factors of export development of ornamental plant and flowers in Mazandaran, the factors No. 17 and 18 are recognized as the first level. By determination of the first level element, this element will be separated from other elements, then another level of element is formed vial a similar process. These determined levels are used in formation of diagram (Fig. 3) and final

model. Commonly, factors that have equal output set and bilateral relations set which means that the common set of them be the same with their output set; the first level or upper level creates a hierarchy. Therefore, on this basis, the upper level is not the source of other elements. Therefore, in determination of the second level factors, through the analyzed commons, the 16th factor as the second level and 1st, 2nd, 3rd, 7th, 9th, 10th, 12th, 13th, 14th, and 15th as the third level and 4th and 8th and 11th factors as the fourth level and 6th factor as the fifth level and finally, the 5th level as the 6th level.

Sixth and seventh stage: Drawing ISM and a review on ISM

In this step, according to the levels of factors and by considering the final access matrix, the ISM is drawn (Fig. 2). The final model is drawn in 6 levels that show that the factors of lower levels have more impact on other factors in form of a hierarchy.

Fig 2. ISM for determination of factors affecting the export development of ornamental plants and flowers industry in Mazandaran province.

At the end, the variables affecting the export development of ornamental plants and flowers industry in Mazandaran provinceare analyzed in terms of permeability and correlation. Purpose of this analysis is to determine the power of permeability and amount of correlation of variables. The 18 variables of the present study are classified in 4 clusters based on the driving number.

►Cluster 1 including autonomous factors that have weak driving and relation power and are separated from the system and their bond with the system is so weak and low.

►The dependent factors compromise the second cluster that have low driving power and high relation power.

►The third cluster includes bonders that have driving power and high relation power. This factors are not fixed since any change happened in the impact other variables and the feedback of these changes may be felt.

►The fourth cluster includes dependent factors that have high driving power but weak relation power.

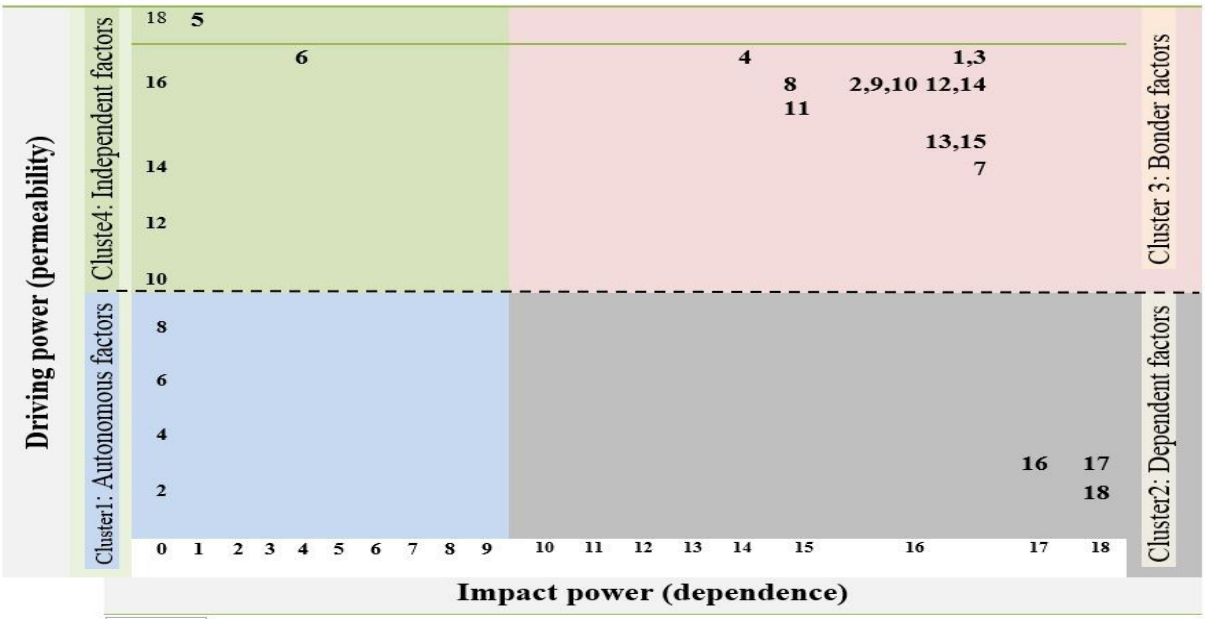

Fig. 3. Clustering factors affecting the export development of ornamental plants and flowers industry in Mazandaran province.

About the amount of driving of each of the factors: The result of the research show that the factors ″Recreation of government in development of export″ and ″International political and economic characteristics″ have the highest amount of driving power and are considered as the most fundamental items. Factors ″Sustainable growth of economic″ and ″Improvement of commercial diplomacy″ due to having high relation power and low driving power are affected by other factors. Other factors have equal driving and relation power.

About the relation of the driving factor with dependent factors that as per fig. 3: There is a unilateral relation between some of the factors like the ″Relation of recreation of government in development of export″ that is placed in dependent factors cluster with intermediate factors like ″Development of software and hardware infrastructure of export″. Relation of some of the factors was a bilateral relation like relation of factor ″ Making official and network for export ″ with factor ″Processing export products″.

The structure of the factors in 6 levels of importance in Fig. 2 and the diagram in the Fig. 3 clustered the variables affecting the export development of ornamental plants and flowers industry in Mazandaran province in 4 categories. The clusters expresses that the factors ″International political and economic characteristics″ and ″Recreation of government in development of export″ have high impact on other factors and other factors affect them a bit are place in cluster of independent factors and in terms of logic of relations of cause and effect, it is considered as cause and fundamental basis of other factors.

On the other hand, the factors of ″Sustainable growth of economic″ and ″Improvement of commercial diplomacy″ have low impact and affect high from other factors are placed in cluster of dependent factors and in logic relation of cause and effect, it is considered as effect of other factors. The factors ″Removing export hydrocephalus and export barriers″, ″Managerial capabilities″, ″Experience and commitment in export″, ″Export terminal″, ″Processing exported products″, ″Global evaluation″, ″Marketing and export branding″, ″Global red ocean″, ″Making official and network for export″, ″Competitive strategies″, ″Development of

hardware infrastructure for export", "Development of hardware infrastructure for export" and "Technology" are considered as intermediate variables and placed in cluster of bonder factors; therefore, these factors as the intermediate factors are non-sustainable factors that have high driving power and high relation power. But none of the factors of the present study are placed in cluster of autonomous factors which means that there is no autonomous variable in the research and all variables can be put in the cause and effect relations.

DISCUSSION

Mazandaran province is considered as one of the largest producers in the country's flower and ornamental plants industry. Unfortunately, despite the emphasis on export in sixth development plan (of Iran), amount of export of industry of ornamental flower and plant in Mazandaran was reduced remarkably. In this research, first, the bivariate relationships between 18 effective factors in the development of flower and ornamental plants export in Mazandaran province were examined by experts in this field, and the final matrix showed that the basic and principle of export of this industry in Mazandaran province is in "Improvement of International political and economic space" which confirms the findings of Mahdiee and Fani (2022), Mirrahimi *et al.* (2022), and Namvar and Ommani (2022). In other word, the major problems in the field of export is sanctions, fluctuation of foreign currency and other international factors that cast a shado on the export of ornamental plant and flowers industry. In general, in the planning and policies of this sector, the government should improve the political and economic environment of flower and ornamental plant industry, like other agricultural products, by thinking of solutions for sanctions and also reducing the production costs of this industry as Khosh-Khui *et al*. (2021), Pastory *et al.* (2020) and Khalilabadi *et al*. (2016) mentioned in their articles. The adoption of supportive policies by the government can be a good action for achieving a reasonable export performance and cause access to the non-oil incomes as Azarkish *et al.* (2015) mentioned in their article. Khosh-Khui *et al.* (2021) also considered development of foreign investment in Iranian flower industry, removing sanctions and joining the global flower industry as the most effective ways for realizing export goals and said that in the field of non-petroleum export, conditioned to preparing in frastructures, it will gain good foreign currency and has a good profitability.

As mentioned in the ISM model of this research, after the factors "International political and economic characteristics" and "Recreation of government", factors "Development of hardware, software and technological infrastructure for export" have had the greatest effect on the export of this industry. The meaning of infrastructures is the necessary facilities for reduce product waste, improving quality, volume of export, packaging and sorting industry, distribution and supply logistics chain, financial, insurance and Banking infrastructure for export. Azarkish *et al*. (2015), showed that for both Iran and Kenya, infrastructures are effective in removing of limitations of small farmers, credits, warehousing, market distribution of product, insurance, access to new technology, services of promotion, roads and ports, telephone communications, irrigation, and rules. The policies should be made in direction of removing infrastructure shortage relevant to production and export of ornamental plants like producing in traditional greenhouses, construct cold storage room, using mechanized system of standard packaging and fast, safe and appropriate transport. Estelaji and Pazoki (2012), showed that the first priority in the global markting pattern is the product. The elements of place, commendatory and persuasive activities and price are the next priorities. The factors of product: Producing

with a modern and industrial method, using pioneer countries, packaging, appearance, quality and diversity in production, the factors of place and distribution canals: Export terminal in the region, recognition of structure of foreign markets, existence of equipment and facilities of warehousing, sales agency in target market and finally activity of specialists of marketing. The factors of persuasive policies including experience of pioneer countries, advertising, international exhibitions, and persuasive policies of the government and finally for the price, and the factors of cost price in farm, financial support of family, foreign currency policies of government, impact of inflation in Iran and foreign investment. Nikooie *et al.* (2010) showed that due to existence of high waste, the technical efficiency is low but the price efficient is high due to high price of retailing than the sale at farm; therefore, the results of total efficiency is high. In the next degrees of importance, with less influence, factors ″Export barriers″, ″Managerial capabilities″, ″Experience and commitment″, ″Export terminal″, ″Processing exported products″, ″Global evaluation″, ″Global red ocean″, ″Networking″ and ″Competitive strategies″ were introduced in the ISM model. These results were consistent with the findings of Ghasemi and Hajimirrahimi (2023), Darras (2021), Sri *et al*. (2021), Khosh-Khui *et al.* (2021), Pastory *et al*. (2020), Havardi-Burger *et al*. (2020), Spier *et al*. (2020) and Amiri *et al*. (2014).

So, with pay more attention to the aspects related to the improvement of international political and economic space in the field of export, more than ever, to make Iran benefit from the abundant profits of this income-generating industry.

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