



Prioritizing the Determinants of Sour Lemon Marketing System Improvement Using Analytic Network Process (Case Study: Larestan County)

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Received: 11 May 2020,
Accepted: 11 October 2020

Abstract

Crop marketing has an important role in accomplishing goals such as agricultural development, production increase, and enhancement of farmers' income in developing countries. Citrus production, especially sour lemon, is one of the most important productions in Larestan County, Fars province in Iran. So, the determinants of the sour lemon marketing system improvement were prioritized in Larestan in this study using Analytic Network Process (ANP) in which data were collected through a questionnaire filled by experts in the region. Criteria were the 4Ps (Product, Place, Promotion, and Price) in the marketing mix and here were also some sub-criteria for each of the criteria. The criteria and sub-criteria were chosen based on other studies and also experts' views in the region. Results showed that product and promotion criteria had the first and last priorities in improving the sour lemon marketing system in Larestan County, respectively. In addition, proper packaging and designing to create a competitive advantage was the most important sub-criterion for improving the sour lemon marketing system in the region. Also, the creation of processing industries and using marketing cooperatives were the next most important sub-criteria, respectively. According to the results, it is suggested to develop proper packaging, processing industries, and marketing cooperatives in the region.

Keywords:

Agricultural marketing; analytic network process; marketing mix

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INTRODUCTION

Fluctuations in crop supply and demand cause price changes and threaten food production and security, even, in some cases, leading to crisis (Asadzadeh et al., 2011). An important factor that is responsible for failure to achieve goals such as developing agriculture and increasing production and income of farmers in developing countries is the agricultural marketing system failure. Gardeners face inconvenient conditions each year in the time of marketing their crops, with prices falling sharply every year at the time of citrus harvesting. This price drop, coupled with the high cost of harvesting, has always been a dissatisfaction factor of the current status to the gardeners. On the contrary, the middlemen buy these products at a cheap price from the producer and sell them to the consumer at an expensive price. Marketing encompasses all the efforts required from production planning to end-user consumption. The more the marketing system of agricultural products in a country is capable, the higher the level of producer and consumer welfare is, and the more employment it provides (Karimifard et al., 2011). The importance and role of crop marketing make it inevitable to examine the current status and structure of the market and its marketing. The marketing mix is one of the important instruments in planning and policymaking in the marketing field (Ghodoosi et al., 2015). Therefore, marketing mix factors (known as criteria in this study) were used to prioritize determinants of the sour lemon marketing system improvement in the region in this study.

The marketing mix is a set of controllable marketing variables that are merged by an enterprise or industry in its attempts to meet the needs of a target market (Ghodoosi et al., 2015). According to the Mc Carthy model, market variables are summarized in four basic dimensions of product, place, promotion, and price, known as 4Ps, which are the key and important marketing factors (Ghodoosi et al., 2015).

Product shows the goods and services offered by an organization. It can be a pack of advantages which a marketer offers to the customer for a price (Thabit and Raewf, 2018). Place relates to distribution activities of a firm. It involves distribution channels, location and coverage (Purohit et al., 2021). Promotion makes customers aware of product offerings. It includes advertising, personal selling, publicity, sales promotion, and word of mouth (Purohit, et al., 2021). Price is the value charged for any good or service (Thabit and Raewf, 2018).

Analytical Network Process (ANP) technique as a multi criteria decision making method has been used in many studies such as Poveda-Bautista et al. (2012), Hu et al. (2019), Li et al. (2020), kumar et al. (2021), Liu et al. (2021), Dubey and Tanksale (2021). Using ANP, Chaudhary and Suri (2020) investigated electronic agricultural marketing and factors affecting participation in it as a solution for the inefficient value chain in Indian agricultural marketing.

Due to the economic importance of citrus and the high production rate of citrus varieties in Iran, some research studies have been conducted on how to market citrus fruits in light of advances in agricultural products in Iran. For instance, Hosseini and Rafiee (2008), Ardestani et al. (2010), Ehsan et al. (2010), Mojaverian et al. (2013), Mohammadi et al. (2014), Najafi Alamdar Loo and Babania (2016), and Mohammadi and Rafiee (2020) have examined the marketing channels, marketing margins, marketing costs, marketing performance, and marketing characteristics for citrus products

Fars province in Iran has the second rate of citrus production in Iran and Larestan region in the south of Fars province with a cultivated area of more than 4500 hectares of citrus fruits and annual production of 18000 tons of sour lemon has the fourth place in sour lemon production among all counties in the province (Jihad-e-Keshavarzi Database of Larestan, 2015-2016). Therefore, the present study has investigated the factors affecting

the improvement of its marketing system using the ANP technique.

METHODOLOGY

Data required in this study were collected with questionnaires filled by experts. The questionnaires consist of pairwise comparisons between criteria with respect to goal and also with respect to each other (interrelations between criteria) and pairwise comparisons between sub criteria with respect to each criterion. Library documents, viewpoints of faculties at universities, and experts in marketing in Larestan were used to design the questionnaires. A 12-person group of local experts in the marketing of sour lemon in both the Agricultural Research Center and the Organization of Jihad-Keshavarzi in Larestan County filled the questionnaires whom have been selected according to their experiences. The validity of the questionnaire was confirmed by agricultural marketing and economics experts. Its reliability was confirmed by calculating the inconsistency rate. Super Decisions software was used to run the model.

Analytic network process

Analytic Network Process (ANP) is one of the Multi-Criteria Decision Making (MCDM) techniques. This model is based on a hierarchical analysis process and replaces the hierarchy with either a nonlinear network or feedback system. ANP considers any subject as a network of criteria, sub-criteria, and options that are gathered in a cluster. All criteria can have relations with each other. The ANP technique can be considered of two parts: control hierarchy and network relationship. The control hierarchy consists of the relationship between goal, criteria, and sub-criteria and affects the interrelations of the system. The network relation consists of the dependencies between criteria, sub-criteria, and clusters (Zebardast, 2010). So, the ANP technique was used in this study to prioritize determinants of marketing system improvement in this region. In an ANP model,

like the hierarchical process, the comparative spectrum 1-9 is used. Table 1 shows the scale of pairwise comparisons in the ANP model (Zebardast, 2010). Figure 1 depicts an example of a three-level ANP model with a goal, criteria, and sub-criteria (Hosnavi Atashgah et al., 2020).

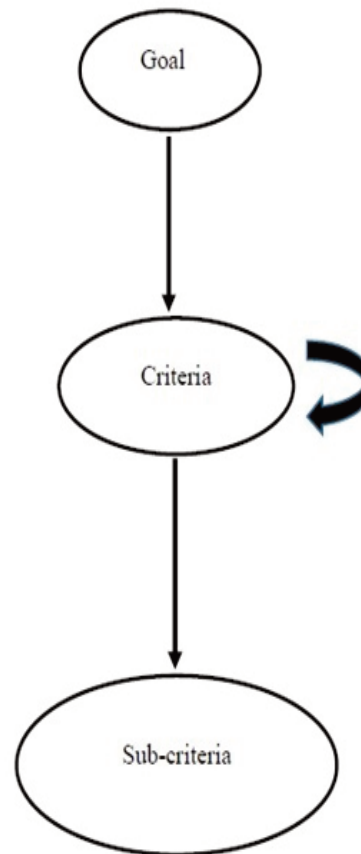


Figure 1. A Three Level ANP Structure Adjusted Based on Hosnavi Atashgah et al. (2020)

The conceptual and the network model used in this research to prioritize determinants of sour lemon marketing improvement in Larestan are displayed in Figure 2. As mentioned before, in this model, marketing mix factors are the criteria and all have their own sub-criteria. Table 2 also shows more details about the sub-criteria of the criteria used in this research.

There are five steps in modeling an ANP model that follows.

Table 1
Pairwise Comparisons

Importance	Equal importance	Relatively important	Important	Very important	Absolutely important	Middle preferences
Score	1	3	5	7	9	2,4,6,8

Table 2
The Criteria and Their Sub-criteria of Sour Lemon Marketing in Larestan

A		Product
A1	Proper packaging and design to create a competitive advantage	
A2	Production of new and various products of sour lemon	
A3	Creation of training classes for farmers regarding the correct method of planting and harvesting to enhance efficiency and product quality and prevent the waste increase	
A4	Packaging type suitable to target markets to maintain the current status and entering new markets	
A5	Setting up a cold storage for the crop	
A6	Creating processing industries	
B		Place
B1	Using a specialized workforce in the field of packaging and product sale marketing	
B2	Using electronic marketing	
B3	Expanding the sale network through co-operation with companies and suppliers in different markets	
B4	Identification of distribution channels in target markets	
B5	Using transport means with cold storage to improve product distribution	
C		Promotion
C1	Using advertisement tools to perform proper advertisement relying on product quality	
C2	Using marketing cooperatives by farmers to reduce marketing costs and increase sales	
C3	Participation in provincial and national exhibitions for proper supply of product	
D		Price
D1	Creating a product classification system proper to its quality and price	
D2	Developing a plan to reduce sour lemon production costs	
D3	Adjusting pricing methods in different markets (Price flexibility)	

First Step: Model establishment and structure of subject

Modeling establishment should be clearly and logically transformed into a logical system, such as a network. This network structure can be achieved through brainstorming (group problem-solving methods and means encouraging initiative and used to move the creativity and employ a number of thoughts), the Delphi method, or the nominal group method (in which group members argue and ultimately reach consensus without imposing on another's opinion). At this stage, the subject is transformed into a network structure

in which groups are referred to as clusters. A cluster may be associated with all of the other clusters. These relationships (external dependencies) are shown by an arrow. Also, mutual relationships may exist within a cluster (interdependence) (Zebardast, 2010).

Second Step: Matrix of paired comparisons and estimation of relative weight

Decisions in each cluster are compared on the basis of their importance in relation to the control criteria. The clusters themselves are compared on a pairwise basis based on their role and impact in achieving the goal. The decision-makers have to decide about al-

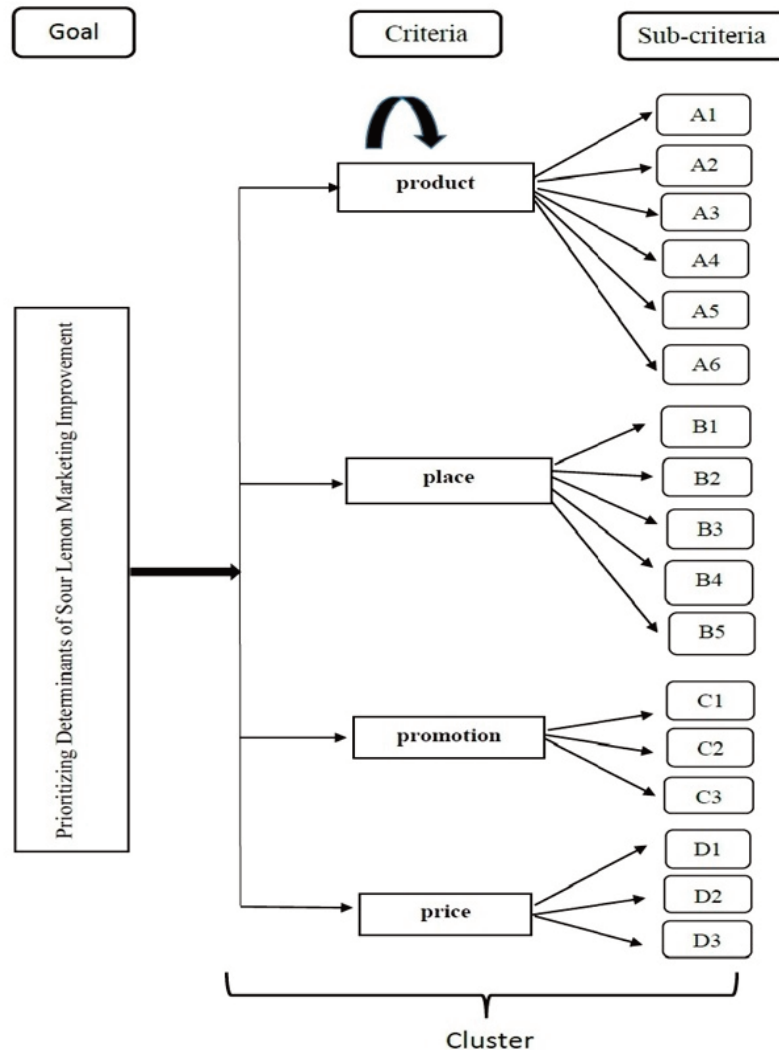


Figure 2. The conceptual and network model to prioritize determinants of marketing

alternatives using pairwise comparisons (Zebardast, 2010). These comparisons are as follows:

Clusters Comparisons for clusters that are affected by a specific cluster and are compared by one criterion. The weights from this process are used to assign weights to the block columns of a super matrix. There was only one cluster in this study that needed no comparison.

Criteria Comparisons used for paired comparisons within clusters. The criteria of a cluster are compared in terms of their effect on a criterion in the other cluster or in the same cluster with the others. There were four criteria in this study, i.e., the 4Ps.

Sub-criteria Comparisons: Sub-criteria are

compared according to the whole. There were several sub-criteria for each criterion in this study.

Third Step: Formation of the primary super matrix

The ANP clusters, criteria, or sub-criteria may interact with each other. The relative weight of each matrix is calculated based on pairwise comparisons similar to the AHP method. The resulting weights are entered into the super matrix, which shows the interaction inside the system (Reza Tabe Azgami and Heydari Chiyane, 2013).

Fourth Step: Weight matrix and general weight vector matrix calculation

In fact, the super matrix's columns consist of several special vectors. The sum of each

vector is equal to one. Therefore, the sum of each column of the primary super matrix may be more than one (depending on the feature vectors in each column). Each matrix column is standardized to make the column proportional to its relative weight and to make the column equal to one. The result is a new matrix in which the sum of each column is equal to one. The new matrix is called the weighted matrix. The weighted super matrix is large enough to allow the matrix to converge and its row values to be equal. The weight vector is determined based on this matrix (Reza Tabe Azgami and Heydari Chiyane, 2013).

Fifth Step: Calculation of the final weight of the sub-criteria

If the built super matrix covers the entire network, the priority weights of the alternatives are formed in the normalized super matrix alternative column, and the alternative with the highest final weight is selected, which is the alternative achieved by matrix computation and operations (Reza Tabe Azgami and Heydari Chiyane, 2013).

RESULTS

This study aimed to prioritize the criteria and their sub-criteria to improve the sour lemon marketing system in Larestan County. To this aim, ANP was used. There were four criteria (4Ps) and each criterion had its own sub-criteria. The results were as follows. The final weights for criteria were presented in Table 3. As the table shows, the product criterion with a weight of 0.428 is the most important criterion and has the highest priority. The place (0.236) and the price (0.174) are at the next levels of importance, and promotion (0.162) has the least priority in improving the sour lemon marketing system in Larestan according to the experts.

The weights of all sub-criteria of the criteria were also calculated according to all comparisons. The final weight of each sub-criterion is presented in Table 4. As the table shows, the proper packaging and design with a weight of 0.09 is the most important deter-

minant of the sour lemon marketing system improvement in Larestan according to the experts in the region. The results also show that creating processing industries with a weight of 0.086 is the second most important determinant of the sour lemon marketing system improvement in the region.

The use of marketing cooperatives by farmers to reduce marketing costs and increase sales with a weight of 0.082 is the next important determinant. The weights of the other sub-criteria are shown in Table 4.

On the other hand, results in Table 5 show that proper packaging and design to create a competitive advantage is the most important sub criterion among all sub criteria of Product with weight of 21 percent and creating processing industries with a little difference and weight of 20 percent has the next rank in this criterion. In place criterion, using a specialized workforce in the field of packaging and product sale marketing has the first priority with the weight of 32 percent and expanding the sale network through co-operation with companies and suppliers in different markets with the weight of 27 percent is in the next priority. Using marketing cooperatives by farmers to reduce marketing costs and increase sales has the first priority in the promotion criterion among all of its sub criteria with the weight of 50 percent and in the price criterion, developing a plan to reduce sour lemon production costs is the most important sub criterion with the weight of 41 percent.

CONCLUSION AND DISCUSSION

Using an ANP model and experts' views, the determinants of the sour lemon marketing system improvement in Larestan County were identified and prioritized. The results showed that proper packaging and design to create a competitive advantage had the highest priority in the improvement of this system in the region. It is usual to package sour lemons in big plastic or gunny sacks in the region. Therefore, if there are new designs of packaging, it will be possible to supply the

Table 3
Final Weights of the Four Criteria of the Marketing Mix

Criterion	Weight
Product	0.428
Place	0.236
Promotion	0.162
Price	0.174

Table 4
Final Weights of Sub-criteria for Improving Sour Lemon Marketing System in Larestan County

Sub-criteria	Weight
Proper packaging and design to create a competitive advantage	0.09
Creating processing industries	0.086
Using marketing cooperatives by farmers to reduce marketing costs and increase sales	0.082
Packaging type suitable to target markets to maintain the current status and entering new markets	0.08
Using a specialized workforce in the field of packaging and product sale marketing	0.076
Developing a plan to reduce sour lemon production costs	0.072
Creation of training classes for farmers regarding the correct method of planting and harvesting to enhance efficiency and product quality and prevent the waste increase	0.071
Expanding the sale network through co-operation with companies and suppliers in different markets	0.064
Setting up a cold storage for the crop	0.063
Creating a product classification system proper to its quality and price	0.056
Using transport means with cold storage to improve product distribution	0.054
Adjusting pricing methods in different markets (price flexibility)	0.046
Using advertisement tools to perform proper advertisement relying on product quality	0.041
Participating in provincial and national exhibitions for proper supply of product	0.039
Production of new and various products of sour lemon	0.038
Using electronic marketing	0.026
Identification of distribution channels in target markets	0.016

product according to the quality of the product to increase consumer welfare and also simplifying the pricing process of the product. On the other hand, if there are new materials in packaging, it is possible to transport the product with less wastage and also to preserve it more in the shops and also at homes. The other sub-criterion with the next highest priority is creating processing industries. There are a lot of processed products from sour lemons, such as sour lemon pickles and sour lemon jams, which increase the welfare of both consumers and producers of the sour lemon. Therefore, creating processing

industries improves the sour lemon marketing system in the region.

Using marketing cooperatives by farmers is the third most important sub-criterion, which shows that farmers need to use marketing cooperatives as supporting companies to decrease production costs and increase sales.

Other important sub-criteria such as creation of training classes for farmers regarding the correct method of planting and harvesting to enhance efficiency and product quality and to prevent waste increase, setting up a cold storage for the crop, and creating a product classification system proper to its quality

Table 5
Weights of Criteria and Sub-criteria for Improving Sour Lemon Marketing System in Larestan County

	weight (%)		weight (%)	
Product	42.8	A1	Proper packaging and design to create a competitive advantage	21
		A2	Production of new and various products of sour lemon	9
		A3	Creation of training classes for farmers regarding the correct method of planting and harvesting to enhance efficiency and product quality and prevent the waste increase	16
		A4	Packaging type suitable to target markets to maintain the current status and entering new markets	19
		A5	Setting up a cold storage for the crop	15
		A6	Creating processing industries	20
Place	23.6	B1	Using a specialized workforce in the field of packaging and product sale marketing	32
		B2	Using electronic marketing	11
		B3	Expanding the sale network through co-operation with companies and suppliers in different markets	27
		B4	Identification of distribution channels in target markets	7
		B5	Using transport means with cold storage to improve product distribution	23
Promotion	16.2	C1	Using advertisement tools to perform proper advertisement relying on product quality	26
		C2	Using marketing cooperatives by farmers to reduce marketing costs and increase sales	50
		C3	Participation in provincial and national exhibitions for proper supply of product	24
Price	17.4	D1	Creating a product classification system proper to its quality and price	32
		D2	Developing a plan to reduce sour lemon production costs	41
		D3	Adjusting pricing methods in different markets (Price flexibility)	27

and price confirms recommendations by [Mohammadi and Rafiee \(2020\)](#). On the other hand, the interesting point in the findings of this study was that the least priority among all sub-criteria belonged to the sub-criterion of identification of distribution channels in target markets. According to the results, it is much more important to have proper packaging in comparison to identification of distribution channels in Larestan County. This means that each marketing system for any crops and in any location needs its own exclusive assessment to be improved.

According to the results of this study, it is suggested that proper packaging and design is needed to create a competitive advantage in the market. Creating processing industries

is another suggestion for improving sour lemon marketing in the region. Using marketing cooperatives by farmers to reduce marketing costs and increase sales is also suggested. Using a specialized workforce in the field of packaging and product sale marketing also can improve the market and Holding training classes for farmers regarding the correct method of planting and harvesting to enhance efficiency and product quality and prevent the waste is another suggestion for sour lemon marketing improvement in the region.

ACKNOWLEDGMENTS

The authors appreciate the co-operations of all who helped to perform this research.

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How to cite this article:

Elmi, A., Mirzaei Khalilabad, H., Khajehpour, E., & Zare Mehrjerdi, M. (2021). Prioritizing the determinants of sour lemon marketing system improvement using analytic network process (Case study: Larestan County). *International Journal of Agricultural Management and Development*, 11(3), 371-380.

DOR: 20.1001.1.21595852.2021.11.3.4.0

