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A Comprehensive Decision Framework for Optimizing Cooperative Performance Through a Development Strategies

Mobin.Mokhtari[1]*, Mojtaba.Rahimi[2],Nikbakhsh Javadian[3]

ABSTRACT

As the chain stores grow, crop cooperatives are in danger of being destroyed In this study, strategies for increasing the efficiency of crop cooperatives in one of the northern provinces of Iran are studied. A knapsack problem mathematical model was presented, and then The fuzzy analytic hierarchy process (FAHP) method calculated the desirability (weights) of the identified criteria. Field survey, structured interview,status analysis questionnaire,intra-system strengths and weaknesses, opportunities and threats(SWOT)were evaluated. Results from the study indicated that, the total number of cooperative companies in the general indicators of productivity (10 criteria), 66 points, in the specific indicators of productivity (3 criteria),64 points, and in the seven cooperative principles (7 criteria), scored 500 out of 700.Therefore, according to the results obtained in this study Criterion(Member Investment -Training-5S-Productivity and Problem Solving-Customer Orientation) made the most investment. The most important point in this issue is limited financial resources .For this reason, considering the utility of the criteria with the expert opinion and the current status of each cooperative in each criterion are two crucial factors. Finally, the strategic goals of the research, using the SWOT matrix analysis,are based on the results of the interviews all cooperatives form of success packages and executive policies.

Keywords*:Knapsack Problem , Co-operative Ranking , Performance Evaluation , Development Strategies*

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1.Introduction

Strategic and well-informed decision-making is one of the most crucial responsibilities of senior managers in organizations. Its importance is growing today due to the rapid pace of economic and social changes, as well as increasing competition. For businesses and organizations to survive, they must pay close attention to this area.today, many businesses face numerous challenges for various reasons. These challenges may include a lack of proper managerial skills among their leaders, insufficient knowledge and application of modern methods, inadequate support and oversight from higher-level institutions, poor recognition and understanding of changes, and lack of support from team members, among others.one consequence of this lack of capability, skills, and support in cooperatives is a downturn in profitability, leading to stagnation and, ultimately, their collapse. The three most important factors influencing this are: upstream cooperative entities, consumer and customer cooperative entities, and internal and external cooperative environments and conditions. The main vacuum in these firms is the lack of accurate, scientific and accurate assessment of the current situation and the provision of appropriate and practical solutions to overcome this crisis. In this study, we seek to identify the factors that influence the performance of these

*Corresponding Author
[1] Department of Industrial engineering ,University of Science and Technology, Babol, Iran , Email: mobin.mokhtari@Yahoo.com
[2] Department of Industrial engineering ,University of Science and Technology,Babol, Iran, Email: mojtaba.tm.1992@gmail.com
[3] Department of Industrial engineering ,University of Science and Technology, Babol, Iran, Email; nijavadian@ustmb.ac.ir

capabilities and then to evaluate cooperatives based on these factors. By presenting a mathematical model, we seek to optimally allocate financial resources to each of the factors contributing to the improvement of the performance of these firms (consumer cooperatives).Firstly, the rescuing cooperatives are saved and secondly, the static cooperatives are on the right track of growth and development. Therefore, in order to establish the relationship accurately and precisely, the decision-making process must be correct, consisting of three main steps, namely: Firstly, identify and identify the factors affecting the performance of these cooperatives and evaluate them accordingly Secondly, to present a mathematical model for optimal allocation of cost to each of the factors contributing to the improvement of cooperatives' performance and third, choose the right strategy to change these cooperatives so that the path is in line with the goals. Given the above and the factors affecting the success or failure of businesses (consumer cooperatives) in today's highly competitive environment, The key question is, what are the factors driving any business out of this crisis and investing in growth and prosperity? In this applied research we seek to solve this important problem and provide an operational solution to it. The rest of the paper is organized as follows. Review of major works in the literature is presented at Section 2, the process under study and its statistical relationships are described at Sections 3 and 4. Finally, a numerical example is presented in Section 5 to optimize the inspection costs by using the double sampling method and the concluding remarks are given at Section 6.

2. Literature review

Today, given the important role of cooperatives in improving the economic, social and cultural status of society, paying attention to their performance is of particular importance. Therefore, in this section, we first review some of the studies on the performance of cooperatives. In the next step, concerning the solving methods used in this study, we present some of the research that used these methods. Sala-Ríos, M [1] this study focuses on the analysis of the determinants of Spanish cooperatives' profitability. The data span 13 years (2008–20). We approach the analysis including: (i) firm-specific factors, (ii) industry-specific factors, and (iii) location factors. There is a main research question: Are there significant differences in cooperatives' profitability depending on firm-specific, industry-specific and/or location factors? The results emphasize that firm-specific effects are the most important for cooperatives' profitability. Summarizing our findings, cooperatives' profitability is positively affected by size, liquidity, indebtedness, regional specialization in cooperatives, location economies, and lagging profitability, and negatively affected by age and presence in international markets. Guzmán et al. [2] This study builds a theoretical model that relates cooperative principles, entrepreneurial orientation, and performance from the perspective of corporate governance and human resource management practices, in order to study the links that may exist between these elements. Using data from a survey on 155 worker cooperatives in the Basque Country (Spain) and applying the partial least squares technique, we find that cooperative principles positively affect the performance of cooperatives, both directly and via entrepreneurial orientation. Rismayani et al [3] the recent economic slump due to the COVID-19 pandemic causes major problems for cooperatives in West Java in maintaining their business activities. The pandemic significantly impacts the cooperatives and Small and Medium Enterprises (SMEs). developing strategies for cooperatives to recover, respond, and renew the issue becomes increasingly necessary. The collected data were analyzed using the Strength, Weakness, Opportunity, and Threat (SWOT analysis) approach .The results show five strategy alternatives to exploit opportunities with the cooperatives' strengths (SO strategy). Seven strategy alternatives were identified to overcome the cooperatives' weakness with external opportunities (WT). There are six strategy alternatives to anticipate external threats using cooperatives' strengths (ST). Last, seven strategy alternatives are found to overcome both cooperatives' weaknesses and external threats. Pratiknyo et al [4] ،The study aims to identify production function equation between labour and capital also optimal cost of labour and capital of the cooperatives. Cobb Douglass production function equation of labour and capital is applied in this research. Optimal cost using partial differential equation also used between cost of wage of labour and cost of capital .This study highlights the important of the use of economic analytical of the capital and labour to

the cooperatives in Philippines and Indonesia. Both cooperatives have significant correlation between output and capital, but did not correlate significantly to labour.

Buenos et al [5] ،In a multi-stage study, they presented a performance dashboard for cooperatives to evaluate their performance using the 'money matrix'. To achieve their research goal, they divided the research process into three stages. Firstly, with an extensive review of studies in this area, they identified relevant performance indicators and made a preliminary classification . Chawviang et al. [6] In this paper, us propose the sustainable development smart co-operative framework, which specifically applies to all types of co-operatives which use information technology in their organization, enabling transformation to improve their services, management, and governance.The findings suggest that the smart and sustainable development co-operative framework is suitable for co-operatives, providing a comprehensive framework for value creation through the smart co-operative concept.The element design of this proposed framework has considered three key principles, which are (1) smart members, (2) the smart economy, and (3) smart governance. Nasrallahi et al [7] , They examined the reasons for the failure of the Tea Party cooperatives in Guilan Province, Iran. In this study, to collect data, a questionnaire with a statistical population consisting of all CEOs, employees, board of directors and ordinary members of Guayaran cooperative companies in Guilan province was prepared. The results show that the most important factors affecting the failure of the Tea Party cooperatives were: Inadequate government support, inadequate linkage between production and marketing, inadequate marketing of products, incorrect credit policies, lack of correlation between members unfamiliar with cooperatives, lack of government credit and facilities, and neglect of high investment Period.Trisniarti et al [8]. The number of cooperatives in Indonesia reaches hundreds of thousands, but of the many cooperatives only 40% are active. The data also shows that employment in these business entities isless than 1% of the total workforce absorbed in various business sectors in Indonesia. The main objective of this study is to measure the efficiency of cooperatives in Indonesia and see the longterm relationship between cooperative productivity and employment in Indonesia. This research is quantitative by using two data analysis tools of envelopment analysis (DEA and cointegration test.Oliveira Junior [9] the Brazilian cooperative agribusiness is in a transitional phase . This study aimed to identify and describe the main success or failure factors affecting agricultural cooperatives. The results pointed to the existence of 10 main success factors for agro-industrial cooperatives: conciliation of the dual agenda: social and economic goals; professionalisation of management; meeting the interests of multiple stakeholders; transaction cost management; risk and volatility management; improved commercialisation; competitiveness against traditional companies; technology adoption; sustainable development; and social responsibility. However, there is a gap regarding the existence of studies analysing, in an integrated manner, the prevalence and benefits of the success factors identified for agricultural cooperatives, especially those based in Brazil. Wei et al. [10] Under the environment of collaborative innovation network, a dynamic and flexible cooperative strategy can help enterprises improve cooperation efficiency and innovation performance.this study uses game and simulation methods to examine three different cooperative strategies considering the change of network environment, namely decreasing, maintaining, or increasing the number of cooperative connections.Finally, according to the results of a series of numerical simulations, we provide further managerial insights for the optimization of enterprise cooperative strategies on the basis of dynamic collaborative innovation networks.Ibikoule et al [11] this research uses a comparative case study approach to analyze maize producer cooperatives' (MPCs) institutional environment and internal governance at different levels in two districts of Benin: Kandi and Djidja. Analysis showed that MPCs' development follows different trajectories influenced by specific contexts and multiple factors. MPCs in the district of Djidja proved to be more effective than those in Kandi. In both cases, institutional factors—such as the government's role, source of establishment initiative, political and administrative context, and support system—have greatly affected the current condition of MPCs.Abd Majid et al. [12] This study empirically measures and analyzes determinants of productivity changes of the co-operatives across all 34 provinces in Indonesia over the 2015-2020 period using a-two stage approach. In the first stage, the study measures the

productivity of the co-operatives using Data Envelopment Analysis (DEA). the study recorded that the co-operatives in Indonesia have experienced a 9.7% increase in their Total Factor Productivity (TFP), contributed mainly by the technical efficiency progress. Furthermore, the study found that the business volume has contributed to the improvement of the co-operatives' TFP.

Kusmiati et al [13] This study employs a two-stage quantitative approach. Exploratory factor analysis (EFA) is used to determine the factors in the first step. The next step is to conduct a multivariate regression analysis to determine the impact of these factors on the cooperative success variable in Indonesia.The components produced include Member Participation, Membership, Cooperative Governance Structure, Board of co-ops, Vertical Integration, Collective Action and Transaction Cost, according to the EFA results. A further study utilizing multiple regression techniques reveals that four elements, namely Member Participation, Board of Coops, Vertical Integration and Collective Action, have a major impact on the performance of Indonesian cooperatives.Tanjung et al [14] The purpose of this study is to examine the economic impact of Covid-19 on the performance of micro, and small enterprises (MSEs) and cooperative institutions The analysis shows that in the pandemic Covid-19 period, all MSEs decreased performance, most experienced a decrease in business turnover (6 percent) and similarly with cooperative institutions, their turnover decreased to 55%.The strategy of the cooperatives to maintaining its performance is to provide relaxation, improve efficiency by reducing employees, and ask for a reduction in profit-sharing payments to creditors.Geroso et al [15] This study aimed to determine the level of organizational, social, economic and financial performance of cooperatives when taken altogether and when grouped according to variables and to determine if there is significant difference on the level of organizational, social, economic and financial performance of cooperatives when grouped according variables. This aims to know whether or not organizational, social, and economic performance of cooperatives significantly predict financial management performance of cooperatives. Cooperatives maybe encouraged to sustain excellent organizational, social, economic and financial management performances while very satisfactory and satisfactory performances needs improvement. Programs on the improvement of financial performance of cooperatives may be initiated by cooperatives or by proper authorities' in-charge. Lastly, close and intensive monitoring of Cooperative performance is recommended.Marcoux et al [16] Based on the AMO bundles model (for Abilities, Motivation and Opportunity to participate) and on the three-component model of organizational commitment, this study collected data from 578 respondents of financial service co-operatives in eastern Canada. This research had two primary objectives. First, it seeks to examine if employees perceive a co-operative difference through HRM practices which influences their commitment. Second, it aims to evaluate the relations between HRM practices, employees' perception of a co-operative difference, and their organizational commitment through the influence of some socio-demographic variables. Arsić et al [17] in their study, they prioritized strategies for sustainable ecotourism development in Djerdap National Park (NPDJ), Serbia to this end, by examining the internal and external factors affecting the SWOT matrix, possible strategies of SO, WO, ST, and WT that enable the sustainable development of ecotourism in the national park were identified. Then, prioritized strategies and top options were selected using multi-criteria network analysis (ANP) and fuzzy network analysis (FANP). Ervural et al [18] In a study they analyzed energy planning in Turkey. In this regard, first, using the SWOT matrix, they identified the desired factors and sub-factors. Then, using the ANP approach, we calculated the weight of each of these factors and sub-factors and finally prioritized the energy strategy options using fuzzy TOPSIS method. Septiani et al.[19] This study aims to determine what kind of marketing strategy is implemented in order to achieve the best results that is in accordance with company's product marketing strategy. By conducting a SWOT analysis, i.e. by calculating IFAS and EFAS; the recapitulation results obtained are S-W= a score of 1.5 and O-T = a score of 1.25, these results show that the company's strategy is in quadrant I. Based on the analysis of internal strategic factors that can be seen in SWOT analysis diagram, the position of the saving and loan cooperatives is in quadrant 1 which shows the implementation of SO strategy in the SWOT matrix, namely the aggressive strategy. Shahba at el [20] In their study, they used multi-criteria criteria for SWOT analysis of waste management of Golgohar iron mine in Sirjan. For this purpose, we first identified the factors of strengths, weaknesses, opportunities, and threats for SWOT analysis of the mining situation.

In the next step, the fuzzy AHP approach is used to calculate the weight of the determining factors. Finally, sixteen strategies (strategies) based on SWOT prioritization and the best strategy for the development and improvement of mineral waste management are presented. Zare Mehrjerdi .Y [21] this study shows that joy and fun at the workplace will decrease the health care costs, enhances the customers' loyalty, and increases productivity and profits as a result. analyzing of provides key elements on JO, Quantitative strategic planning matrix (QSPM), and fuzzy hierarchical TOPSIS methodology. Since QSPM is used with SWOT by many practitioners and researchers in various fields of study, it was selected as a tool for validation purposes. The finding of this research points to the suitability of semi conventional organization strategy which means implementing about 50% of the rules of main cultural organizations.Moradi et al. [22] in this study considered efficiency for crucial economic factor for companies. The main objective of this study is to assess the technical and scale efficiency of 15 suppliers of a production unit over a three year (2020-2022) using data envelopment analysis (DEA).This study provides valuable insights into the differences between suppliers from a macro perspective and offers guidance for manufacturing units looking to expand their supply chain.Özel at el. [23] In their research, they proposed an integrated model of the knapsack problem and fuzzy TOPSIS for order selection in a bakery in Turkey. In other words, in this study, they considered an order process planning model for a bakery to determine a set of orders. Ragheb, G.A., [24] this study outlines a multi-criteria approach to decision-making for sustainable adaptive reuse of cultural heritage sites, focusing on the Cordahi complex in Alexandria, Egypt. It emphasizes the importance of considering various criteria to expand knowledge in heritage reuse. The research applies a combined SWOT analysis and Analytical Hierarchy Process (AHP) to evaluate internal and external factors, prioritize them, and develop strategies using the TOWS Matrix. The proposed strategies focus on protecting heritage, enhancing tourism, promoting economic development, fostering community engagement, and ensuring sustainable management through partnerships .Della Croce [25] a knapsack issue 0- 1 were investigated under settings. In their research, they used a detailed CPLEX solving approach to solve the linear programming problem.Meng et al [26] Proposed a multi-step multilevel/multilevel Knapsack optimization (MCMKOP) problem to minimize the total cost of select Knapsacks created by a set of Knapsack classes According to the proposed Np hardening problem, three heuristic approaches.It consists of a genetic algorithm (GA), refrigeration simulation (SA) and hybrid genetic simulation genetic algorithm (HSAGA) to solve the problem. CPLEX and Gurobi commercial precision solvents were also used. Díaz-Núñez et al [27] a new type of Knapsack optimization problem in which each item's share of total profit is determined by its specific function in the Knapsack through a specific function. While in the classic version this function can be considered constant. Zhou et al [28] presented a binary monkey algorithm to solve the 0 1 Knapsack problem. This algorithm uses greedy algorithms to enhance local search capability, introduces a collaboration process to accelerate convergence, introduces the organizing process by randomly selecting one monkey as another monkey axis to avoid collapsing into local optimal solutions. Niksirat et al. [29] This paper deals with knapsack problem in fuzzy nature, where both the objective function and constraints are considered to be fuzzy. Three different models for fuzzy knapsack problem are proposed including, expected value model, chance-constrained model, and dependent-chance model Dell'Amico et al [30] Consider a multiple Knapsack problem that calls for optimally assigning a set of high-gain and weight items to a set of max-capacity Knapsacks. In this issue, a basic mathematical model and several improvement techniques (branch and boundary decomposition, master/slave decomposition, Benders decomposition, constraint planning) are presented. Several new pseudo-polynomial formulas with proportional decomposition algorithms were also introduced. Computational experiments show the effectiveness of the problem in the form of a combination of the proposed techniques. In so doing, the upper boundaries obtained are stronger than the standard bounded linear programming boundary for the Knapsack problem. Zarei-Kordshouli, et al [31] this research develops a multistage decision-making framework to investigate the supply chain network design problem considering the sustainability and resiliency dimensions. In this way, the scores of the potential suppliers based on the sustainability and resilience dimensions were calculated using the MADM methods, and then, these scores were applied as inputs in the proposed mathematical model (the second stage), which determined which supplier should be selected. The proposed model aims to minimize the total costs, maximize the suppliers' sustainability and resiliency, and maximize

the distribution centers' resiliency. Based on the obtained results, the responsiveness and facilities reinforcement indicators are the most important indicators for the resilient aspect. On the other hand, reliability and quality are the most important indicators of sustainability aspect. Also, the results show that a large percentage of supply chain costs are related to purchasing and production costs. Besides, according to the outputs, the total cost of supply chain increases by enhancing the demand.

2.1. Research gap

The research gap in the study done is the lack of integrated studies combining advanced optimization techniques (like the knapsack problem) with multi-criteria decision-making methods (such as fuzzy AHP, SWOT, or FANP) specifically applied to improving cooperative performance. While various studies have analyzed cooperatives' financial performance, profitability, and response to external factors (e.g., the pandemic), there is a gap in research that: Combines optimization models (knapsack problem) with fuzzy or multi-criteria decision-making approaches (like fuzzy AHP) for cooperatives. Applies these methodologies in a comprehensive manner to improve cooperative efficiency and performance, particularly in sectors beyond agribusiness or financial cooperatives. Focuses on long-term development strategies, particularly cultural cooperatives, which are not adequately addressed in existing research. The passage highlights several studies that focus on profitability factors, performance evaluation, and external threats but lacks a clear connection to the specific optimization of resource allocation and development strategy formation for cooperatives through integrated models.

3. Problem Description

In this research, a mathematical model of the backpack is planned and developed for a limited time. Accordingly, the analysis time is performed. The proposed mathematical model considers three levels of cooperatives, the first level being the main indicators of the second level of criteria and the third level of sub-criteria.In this model, he develops two approaches: 1. An ideal program for a finite planning time that updates the program if data changes. 2 It is balanced by changes in the results of the annual evaluation and the amount of investment in each criterion and the number of criteria applied to maximize productivity in the set. Hypotheses are crucial in designing all topics in operational research. The following assumptions are considered in the design of the proposed model for this research:

1. The issue evaluates the top 10 cooperatives per year.

2. There is no relationship between the indices

3.The minimum and maximum cost of implementing each criterion vary each time.

4. The evaluation should be completely fair and accurate and based on the documentation on non-working days.

3.1. Model formulation

Each of the cooperatives to improve their situation considers budgets for change and improvement in their collection using the knapsack problem of cost allocation to implement each of these criteria in the cooperatives. According to the knapsack model, The cost of implementing each sub-criterion in the cooperative is as a parameter and must be specified and then modeled. But because of the large number of cooperatives and sub-criteria, the dimensions of the problem are large and take up a lot of time. On the other hand, during the evaluation of each cooperative were evaluated under the relevant criteria. The results of this evaluation can be used in this regard. And obtained the amounts of money needed to implement this sub-criteria in cooperatives and entered the model. Based on the developed model, the following is presented.

3.2. Notations and parameters

The following notations are used in this study to formulate the mathematical model.

i Criteria Index (i=1, ..., n)

j Cooperatives Index (j=1, ..., m)

r The number of points considered in the Likert spectrum (r=1, 2,3)

k Sub- Criteria Index (k=1, ..., p)

The following parameters are used in this study to formulate the mathematical model

w_i Weight of Criterion i

B_j Budget of Cooperatives j

C_i Implemention cost criterion i

U_i Maximum implementation cost criterion i

L_i Minimum implementation cost criterion i

S_r Fixed number of evaluation in interval r

M Penalty factor (very large number)

E_{ijk} Numerical value of co-operative j sub criterion k of criterion i

AV_{ij} Average total criterion assessment i for cooperatives j

The following variables are decision variables.

X_{ij} If the criterion i is applied to co-operative j 1, otherwise 0

Cap_{ij} If the criterion i exists in co-operative j 1, otherwise 0

C_{ij} Implemention cost criterion i in cooperatives j

Y_r Value of a binary decision variable that if the equation is set to 1 otherwise 0

3.3. Formulation in ideal model

Based on what has been said in the preceding sections, the mathematical programming model for the research problem is formulated as follows.

$$Max\ Z = \sum_{i=1}^{n}\sum_{j=1}^{m} W_i . X_{ij} \quad (1)$$

$$\sum_{K=1}^{P} E_{ijk} = P . AV_{ij} \quad (2)$$

$$AV_{ij} \geq S_1 + M(1 - Y_1) \qquad S_1 = 70 \quad (3)$$

$$AV_{ij} < S_2 + M(1 - Y_2) \qquad S_2 = 70 \quad (4)$$

(5)

(6)

(7)

$$AV_{ij} \le S_3 + M(1 - Y_3) \qquad S_3 = 40$$

$$C_{ij} - l_i \le M(1 - Y_1)$$

$$2C_{ij} - (l_i + U_i) \le M(1 - Y_2)$$

$$C_{ij} - U_i \le M(1 - Y_3) \tag{8}$$

$$Y_1 + Y_2 + Y_3 = 1 \tag{9}$$

$$\sum_{i=1}^{n} C_{ij}.X_{ij} \le B_j \tag{10}$$

$$C_i \le U_i \tag{11}$$

$$C_i \ge l_i \tag{12}$$

$$X_{ij} \le Cap_{ij} \tag{13}$$

$$Y_1, Y_2, Y_3 = 0,1 \quad X_{ij}, Cap_{ij} = 0,1$$

Relation (1) shows the objective function that maximizes the utility of the sub-criteria implementation . Constrain (2) ensures that assessment the average value of the sub-criteria . Constrain (3, 4, 5) ensures that the average value of cooperatives in the previous relationship is calculated and compared with the value of S_r that applies to one of the relationships then in that equation the value of Y_r is equal to 1 so that this equation enters into the constraint . The rest of the $Y_r$becomes zero and are subtracted from the equations with a large penalty coefficient Constrain (6, 7, 8) ensures that after selecting Y_r and inserting 1 instead of one of the constraints (6,7,8) are selected and entered into the model. This constrains Calculate the value of C_{ij} . constrain (9) represents the equilibrium relationship of the selection coefficients Y_r. Constrain (10) that we put the calculated C_{ij} in this equation, and given the limited budget of each cooperative, the value of X_{ij} is calculated. Constrain (11) shows the maximum cost of implementing U_i criterion. Constrain (12) shows the minimum cost of implementing l_i criterion .Constrain (13) that shows the allocation and implementation constraints of the Cap_{ij} criterion.

4. Methodology

In this section, we outline our approach to improving cooperative performance. We identified 20 key criteria that influence the evaluation of cooperatives and divided these factors accordingly. First, we calculate the weight of each criterion using the FAHP method. After applying these weights to the mathematical model, we solve the model using dynamic programming to determine the cost required for each criterion based on the limited budget of each cooperative.

Once the costs and criteria are identified, the implementation of effective operational plans is essential. We then utilize the SWOT matrix to extract the appropriate strategy, enabling these cooperatives to achieve maximum productivity

4.1 The methodologies for the measurement of weight

The Analytic Hierarchy Process is a well-known method that is only able to rank different alternatives according to their FAHP weights, accept/reject alternatives based on FAHP weights. In that method,

pairwise comparisons are performed by the Decision- Maker (DM) and then the pairwise comparison matrix and the eigenvector are derived to specify the weights of each parameter in the problem. The weights guide the DM in choosing the superior alternative. The fuzzy-AHP approach used in this paper is discussed as follows: If the object set is represented as P= {p1, . . . , pn} and the goal set as Q={q1, . . . , qm} then according to the concept of extent analysis (Chang 1991,1996), each object is taken and extent analysis for each goal Qi is performed respectively. The fuzzy sets and notations discussed in this section are same as discussed in main artic. The algebraic operations on triangular fuzzy numbers follow the same mathematical rule and definitions discussed in change article that show this below.

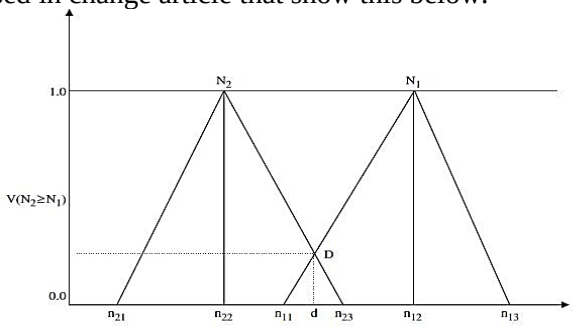

Figure 1. Intersection between N1 and N2

4.2 SWOT analysis

SWOT analysis is the most common techniques that can be used to analyze strategic cases [5]. SWOT is a frequently used tool for analyzing internal and external environments to attain a systematic approach and support for a decision situation [14]. The internal and external factors are referred to as strategic factors, and they are summarized within the SWOT analysis. Strengths and weaknesses constitute factors within the system that enable and hinder the organization from achieving its goal, respectively. Opportunities and threats were considered as external factors that facilitate and limit the organization in attaining its goals, respectively [15]. SWOT analysis suggests the appropriate strategies in four categories SO, ST, WO and WT. The strategies identified as SO, involve making good use of opportunities by using the existing strengths. The ST is the strategies associated with using the strengths to remove or reduce the effects of threats. Similarly, the WO strategies seek to gain benefit from the opportunities presented by the external environmental factors by taking into account the weaknesses. The fourth and last is WT, in which the organization tries to reduce the effects of its threats by taking its weaknesses into account [18].

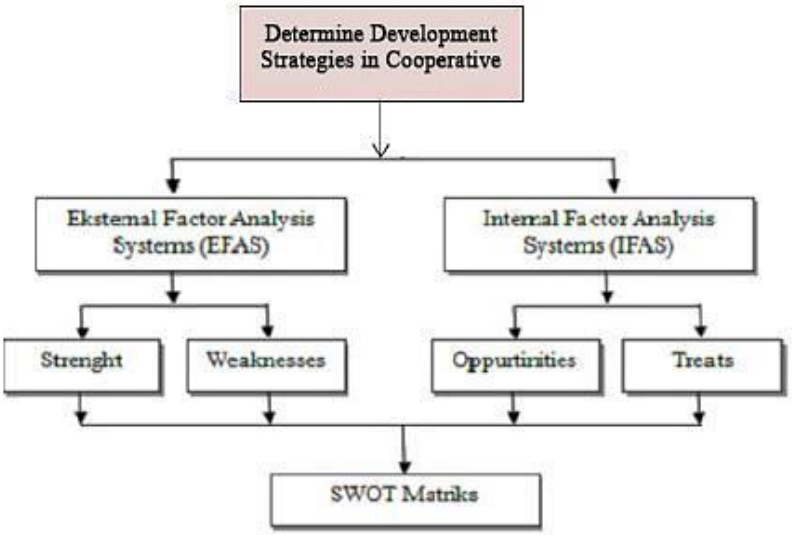

Figure 2. SWOT analysis framework

Figure 2 shows how SWOT analysis fits into a determine development strategies in cooperative. The final goal of a strategic planning process, of which SWOT is an early stage, is to develop and adopt a strategy resulting in a good fit between internal and external factors [16].

4.4. Experimentation and analysis of results

In order to assess the effectiveness of the research initiative in achieving real-world results, existing information is used by consumer cooperatives. The dimensions of the problem under study are as follows

Table 1. Dimensions of the issue

Number of cooperatives	10
Number of indexes	3
Number of criteria	20
Number of sub-criteria	78

All information provided is a component of the cost of implementing each sub-criterion in cooperatives, and the data required to resolve the issue has been approved by experts. Table 3 shows the values of the problem parameters.

Table 2. The minimum and maximum cost of implementing each criterion in cooperatives

parameter C_i	**Cost amount** $(toman)$ Uniform(l_i, U_i)	parameter C_i	Cost amount $(toman)$ Uniform(l_i, U_i)
C_1	Uniform(1000000, 3000000)	C_{11}	Uniform(2000000, 15000000)
C_2	Uniform(5000000, 20000000)	C_{12}	Uniform(5000000, 50000000)
C_3	Uniform(150000, 1000000)	C_{13}	Uniform(1000000, 4000000)
C_4	Uniform(500000, 5000000)	C_{14}	Uniform(1000000, 5000000)
C_5	Uniform(5000000, 15000000)	C_{15}	Uniform(1000000, 5000000)
C_6	Uniform(2000000, 10000000)	C_{16}	Uniform(1000000, 3000000)
C_7	Uniform(1000000, 4000000)	C_{17}	Uniform(1000000, 5000000)
C_8	Uniform(1000000, 10000000)	C_{18}	Uniform(2000000, 20000000)
C_9	Uniform(2000000, 10000000)	C_{19}	Uniform(1000000, 5000000)
C_{10}	Uniform(1000000, 50000000)	C_{20}	Uniform(1000000, 10000000)

The following table sets out the amount of each cooperative's budget for the implementation of the programs approved at the annual meeting of the Board of Directors, with the participation of members and the allocation of a portion of the cooperative's annual profits.

Table 3. Cooperatives' annual budget for improvement

$\mathbf{B_j}$	Amount of budget (toman)	Co-operative Code
B_1	50.000.000	1
B_2	20.000.000	2
B_3	25.000.000	3
B_4	12.000.000	4
B_5	4.000.000	5

B_6	22.000.000	6
B_7	40.000.000	7
B_8	10.000.000	8
B_9	13.000.000	9
B_{10}	15.000.000	10

The following is a summary of each of the criteria used to evaluate each cooperative.

Table 4. Abbreviation

Row	Abbreviation	Criteria	Row	Abbreviation	Criteria
1	CS	Customer satisfaction	11	CO	Customer Orientation
2	SC	Safety and cleanliness	12	IP	Internal processes
3	PW	Process and work flow	13	GL	Grow and learn
4	SG	Strategies and goals	14	VM	Voluntary and Free Membership
5	S	System	15	MO	Monitoring members
6	EP	Efficiency and problem solving	16	MI	Member Investment
7	Q	Qualitative	17	IN	Independence and independence
8	M	Management	18	TI	Training and information
9	HR	Human resources	19	CS	Cooperation and solidarity
10	OS	Organizational Structure	20	EV	Environmental Protection

The current status of each cooperative has been evaluated based on field indicators and observation of the required documentation and requirements according to the criteria and criteria set. Its numerical value is based on the 10-point Likert spectrum, the best of which is 100 and the worst of 10.

Table 5. Scoring of evaluation items in Likert spectrum

Selected option	Very weak	Poor	A little weak	intermediate	medium	Medium upward	A little good	Good	very good	Excellent
point	10	20	30	40	50	60	70	80	90	100

Other criteria and sub-criteria were evaluated and extracted as in the table below.

Table 6. The amount of evaluation of each sub-criterion in cooperatives

Criteria	Customer satisfaction				Safety and cleanliness				Process and workflow			
sub-criteria / Row	**CS1**	**CS2**	**CS3**	**CS4**	**SC1**	**SC2**	**SC3**	**SC4**	**PW1**	**PW2**	**PW3**	**PW4**
1	60	60	70	80	80	70	80	70	60	60	50	80
2	60	80	90	80	70	90	90	80	6	50	70	60
3	80	90	90	80	90	70	80	90	70	80	90	80
4	50	50	10	10	60	70	60	60	60	60	60	50
5	60	70	60	70	80	50	70	60	80	70	60	90
6	50	100	10	100	100	80	70	70	80	50	60	50

7	70	80	70	70	70	80	80	90	90	80	80	80
8	70	80	10	90	50	70	70	40	30	10	10	10
9	60	70	60	70	60	50	50	60	50	40	50	40
10	70	70	80	90	80	90	90	80	70	60	90	70

The weight of each criterion was calculated by using the FAHP method and by using expert opinions. Listed below are each of them.

Table 7. The desirability (Weight) of the criteria

w_i	Weight	w_i	Weight
w_1	0.055	w_{11}	0.067
w_2	0.059	w_{12}	0.056
w_3	0.038	w_{13}	0.045
w_4	0.046	w_{14}	0.049
w_5	0.069	w_{15}	0.024
w_6	0.067	w_{16}	0.077
w_7	0.038	w_{17}	0.038
w_8	0.045	w_{18}	0.069
w_9	0.046	w_{19}	0.047
w_{10}	0.037	w_{20}	0.028

After solving the problem with the proposed algorithm, cooperative number 1 was considered in the algorithm and its results are presented in Table 8, which includes the cost of implementing each criterion, and selecting each criterion to implement in the cooperative. It was found that the cooperative at its best with its limited budget can implement 14 of the 20 criteria that would generate the highest utility of 0.797.

Table 8 . Report on Selection Criteria Results and Cost of Implementation in Co-operative No. 1

C_{ij}	cost	X_{ij}	amount	C_{ij}	cost	X_{ij}	amount
C_{11}	2.000.000	X_{11}	1	C_{111}	2.000.000	X_{111}	1
C_{21}	5.000.000	X_{21}	1	C_{121}	5.000.000	X_{121}	1
C_{31}	2.250.000	X_{31}	0	C_{131}	2.500.000	X_{131}	1
C_{41}	500.000	X_{41}	1	C_{141}	3.000.000	X_{141}	1
C_{51}	10.000.000	X_{51}	1	C_{151}	5.000.000	X_{151}	0
C_{61}	2.000.000	X_{61}	1	C_{161}	1.000.000	X_{161}	1
C_{71}	2.500.000	X_{71}	0	C_{171}	1.000.000	X_{171}	0
C_{81}	1.000.000	X_{81}	1	C_{181}	2.000.000	X_{181}	1
C_{91}	2.000.000	X_{91}	1	C_{191}	1.000.000	X_{191}	1
C_{101}	1.000.000	X_{101}	0	C_{201}	1.000.000	X_{201}	0

Therefore, according to the evaluation carried out in each cooperative, it is determined at what cost each criterion is implemented. The rest of the cooperatives calculate and display in such a table as the above.

5. Analysis of the model solution results

The diagram below shows the weights of each criterion obtained from the fuzzy AHP method. The most weighted figure in this chart relates to the 16th criterion, namely the participation and initial investment that the cooperative's annual budget provides for changes in the organization from the same location. The second weight relates to criterion 5, which is about system building in co-operatives, which is extremely important and the foundation for co-operative development. And the third criterion relates to item 18 which discusses education and the need to increase productivity with continuing education.

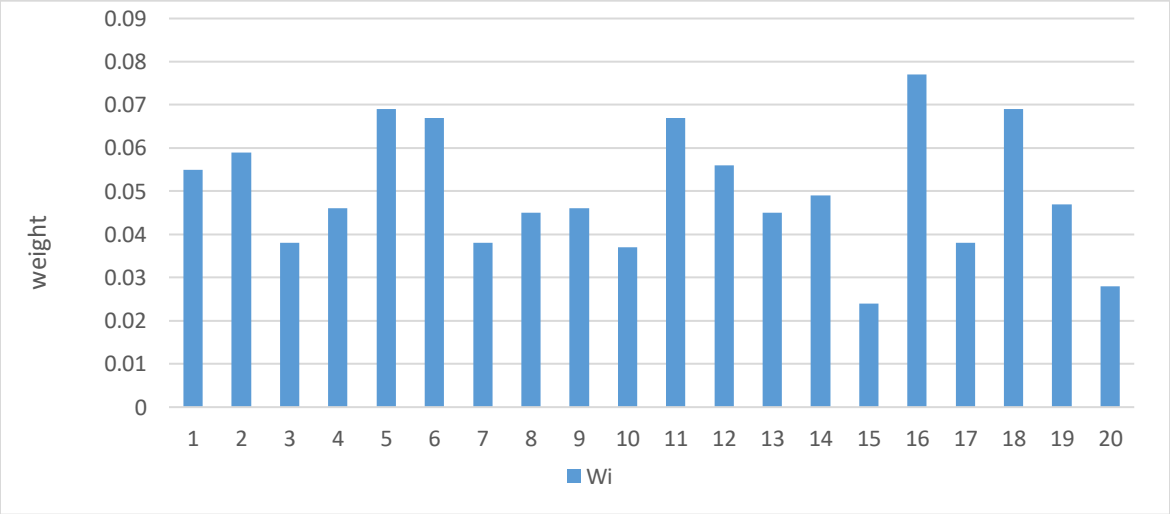

Figure 3. Weight chart of each criterion

With regard to co-operative budget No. 1 and the cost of implementing each of the criteria based on the evaluations of the problem-solving model, we identified the criteria that generate the most utility (productivity) in the objective function of the problem. Accordingly, in cooperative number 1, as you can see in Figure 5 that 8 criteria out of 20 criteria should be implemented. The criteria are (Customer Satisfaction - Strategy and Goals - System - Management - Customer - Internal Processes - Growth and Learning - Education and Information). The utility created in the objective function is 78%. Accordingly, the rest of the cooperatives will be calculated and the criteria for their implementation will be determined by the evaluation.

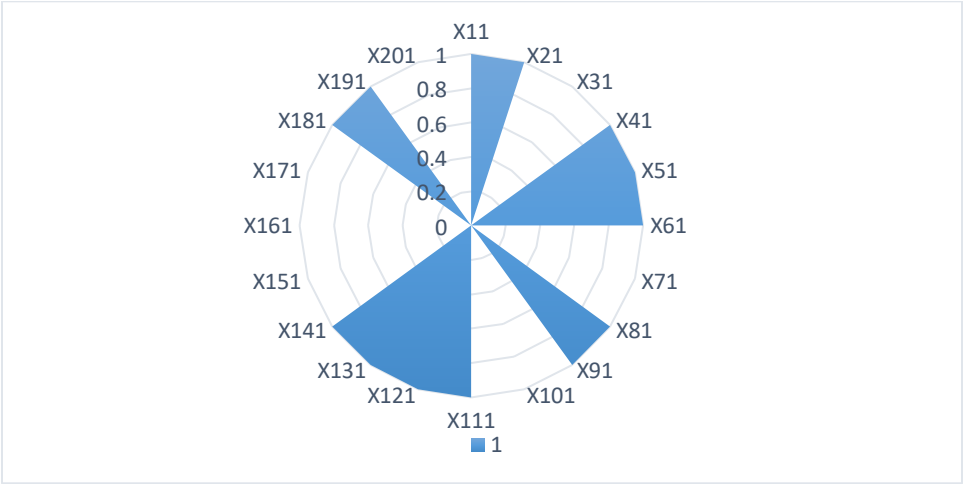

Figure 4. (X_{ij}) implementation criteria i in j cooperation is selected 1 otherwise 0

The diagram below shows the cost of implementing each criterion in Co-operative No. 1, which is based on this figure 5 benchmark, systematization, which indicates the organization's need based on the evaluation performed in this section. There needs to be more investment . It also needs to update internal processes. Thus, in this case, in this diagram, at any criterion, the closer the cost to zero, the better the status of the set, and the closer the cost to its limit value, indicating the weakness of the organization at that point and the need for investment to improve. It has an area there.

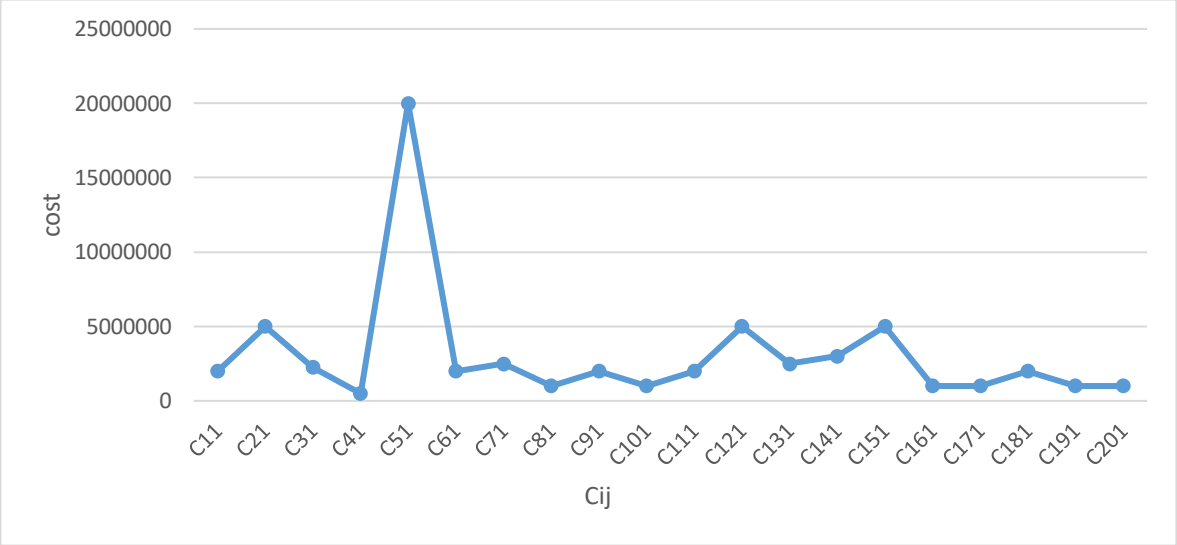

Figure 5. implementation cost criteria i in cooperation

In SWOT analysis, external and internal factors are examined to identify future opportunities, threats, strengths and weaknesses of the organization and to formulate appropriate strategies to better address them. A SWOT matrix is used to perform this analysis. This matrix is one of the important tools for managers to provide information on possible internal and external factors. A Comparison of key internal and external factors in the most difficult parts of matrix preparation is threats, opportunities, weaknesses, and strengths and needs good judgment.

Table 9. Matrix of Factors Checking (SWOT) Department of Cooperative Affairs

Internal factors Organization External Factors Environment	**S**	**W**
	S_1 : Possession of physical assets in cooperatives (buildings, land ...) **S_2 :** High liquidity of cooperatives in cash purchases **S_3:** Provide all goods up to 39 months **S_4:** Active board and regular meetings **S_5 :**Valuable human resources and management with important and special experience **S_6 :**Good unity and coordination of the cooperative members	**w_1 :**Defective mechanism for selecting cooperative managers **w_2 :**Lack of relevant training for cooperatives and managers **w_3:**Failure to purchase all members from covered cooperatives **w_4 :**Lack of capital and high liquidity in cooperatives **w_5 :**Lack of optimum use of information, advertising and media **w_6 :**Lack of backing banks to support cooperatives

O	**O_1:** People's trust in cultural consumption cooperatives **O_2 :** Have the necessary platform to work with other companies, shops and cooperatives **O_3 :**Use of other consumption groups such as municipal and taxation **O_4 :**Convenient location of cooperatives in the city **O_5:**Co-operative Banks and Facilities (Development and Co-operation) **O_6 :**Potential customers at city level	**SO** **S1O2:** Provide collaborative platforms with outbound businesses on a two-way contract **S2O5:** Focusing on the bank's liquidity and contracting to provide members with facilities **S_5O_3**: Attract other large government and quasi-government consumption groups **S_3O_1**: Get the most out of your free use groups and condition your products with the necessary warranties	**WO** **W1O6 :**Developing indicators and eligibility criteria for managers and employees of cooperatives **W2O6** :Developing a comprehensive training program to strengthen co-operative managers in financial matters, supplier evaluation and ... **W3O7 :**Developing the necessary training in the human resources management cycle **W5O4**:Using mass and mass media and new ways of advertising **W6O5** :Use of banking facilities
T	**T_1**: Paying Value Added Tax **T_2**: Government Tax Policies on Cooperatives **T_3 :**Lack of support for relevant organs **T_4**: Strong market fluctuations in price changes **T_5 :**City-wide chain stores (Janbo, Cyrus ...) **T_6**: Extensive advertising of stores throughout the city	**ST** **S6T1:** Raise the company's liquidity by members to offset the VAT **S_4T_2 :**Follow-up and coordination through legal authorities to properly define this law **S_4T_3 :**Solving problems between cooperative-related bodies by the board of directors **S_2T_4**: Use of warehouses and cash purchase of goods and evaluation and evaluation of suppliers	**WT** **W5T1**: Develop and extend oversight of consumer cooperatives and formulate strategic documents **W5T1: D**evelopment of information and technology infrastructures and design, implementation and development of new management tools in cooperative management

6. Conclusions

In this study, we aimed to present a mathematical model for the optimal allocation of costs related to implementing metrics in each cooperative.The results indicate that one of the primary causes of deficiencies and anomalies in consumer cooperatives is mismanagement and the absence of an accurate, optimal system. A unique feature of cooperative companies is the convergence of individuals who share common needs, attitudes, desires, and goals. One of the key pillars for maintaining, sustaining, and enhancing this cohesion is the effective management and leadership of staff, ensuring the optimal use of their capacities and resources to sustain and develop the cooperative, while fulfilling its members' capital, aspirations, desires, and goals. Furthermore, the importance and sensitivity of managing consumer cooperatives lie in the fact that all employees and staff members have the right to make decisions within their cooperative, in accordance with its principles . The key to the sustainability of cooperative institutions today lies in several valuable factors: the effective social and economic participation of members, the selection and engagement of knowledgeable, active, and motivated human resources, the promotion of cooperative culture, and the institutionalization of this culture among members—especially in the core leadership of the cooperatives. Additionally, special attention must be given to increasing member investment and pursuing efficient management practices.Therefore, considering the evaluation, the proposed mathematical model, and the SWOT matrix analysis, the following executive measures are recommended to enhance the performance of cooperatives.

6.1 Managerial insights

1 .Development of financial resources and improvement of liquidity (such as using new methods such as crowdsourcing, Facilitating access to loans and credits etc.)

2. Improving infrastructure
Renovation of equipment and infrastructure: using new technologies and updating infrastructure to improve performance.
Supply chain development: cooperation with local and foreign suppliers to increase product variet.
3 .Strengthen management and supervision
Professionalization of management: selection of managers with experience and familiar with the principles of cooperatives and financial management.
Use of technology: Using software systems to manage resources, inventory, and financial processes helps improve performance.
Close monitoring: establishing a coherent and periodic monitoring system that examines the performance and financial health of the cooperative.
4 .Attention to the needs of members and customers (Investigating the real needs of members and analyzing them, improving the quality and competitive price of the products offered)
5 .Implement and implement a quality management system in all cooperatives.
6. Developing marketing and development strategies (Advertising and information)
7. Take the demands of the cooperative customers seriously: if the customers are asking for goods and services that are not available in the cooperative store, get them quickly and as soon as possible so that they can have them.
8. Take the complaints and criticisms of customers and employees seriously, criticisms and suggestions actually show the sense of responsibility and honest and positive expectations of the customer from the cooperative. If you ignore it, they will lose hope in you and your cooperative.
9. From the point of view of customers, the component of "quality orientation, customer orientation" is known as the most important solution to improve the business performance of consumer cooperatives.
10. Evaluating existing suppliers using multi-criteria decision-making methods (MCDM, MODM, etc.) and preparing development plans to identify new suppliers with the aim of purchasing goods and products with higher quality along with special after-sales services With a competitive and affordable price (upgrading suppliers).

6.2 Future Research Directions

For future research, several areas could be explored to build on the findings of this study:
1 .Integration of Technology in Cooperative Management
Investigating how digital tools and platforms (such as ERP systems or blockchain) can improve transparency, decision-making, and efficiency in cooperative management
2 .Behavioral and Social Dynamics in Cooperatives
Future studies could examine the social and psychological factors affecting decision-making and participation within cooperatives .
3 .Impact of External Market Forces on Cooperatives
Research into how external economic and market forces, such as globalization, competition, or policy changes, impact the functioning and sustainability of cooperatives could offer strategic insights into how cooperatives can adapt to an evolving economic landscape.

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