

Analytic Hierarchy Process and SWOT Analysis of Agricultural Bank in Promoting Innovation and Entrepreneurship in Agriculture Sector

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ABSTRACT

The role of public financial institutions in agricultural education and extension has received less attention. In this study, quantitative SWOT analysis was used to determine the strategy of the Agricultural Bank of Iran in education and extension of entrepreneurship and innovation in agriculture sector. Based on the literature review and global experiences, the Public-Private Partnership (PPP) framework was considered. For this purpose, the multi-criteria decision making models were used along with the combination of SWOT and Analytic Hierarchy Process (AHP) methodologies. The analysis of AHP-SWOT results in two-dimensional graphic space emphasizes the need for the bank to adopt aggressive strategies, which means following different combinations of the mentioned strengths and opportunities. According to the findings of this research, the most important strengths of the bank and the coefficient of importance of each (in parentheses) include branches across the country (0.6), trust in the bank as a governmental institution (0.25), and the developmental nature of the bank (0.15). The most important opportunities include the possibility of increasing productivity in the agricultural sector (0.35), innovation in financial area (0.28), international cooperation (0.24), and Internet impact and cyberspace (0.13). This study provides new insights into the role of a financial institution from the perspective of education and extension in agricultural sector. The important novelty of this study is that it develops a framework in which the preferred strategy of public institution can be identified in PPP programs.

Keywords: Internet impact, Public institution, Public Private Partnership, Rural development.

INTRODUCTION

Entrepreneurship and innovation are a viable necessity to establish sustainable development in rural areas. However, developing entrepreneurship is facing some obstacles, one of which pertains to educational issues. Education can still be delivered by government and governmental sectors, but this is loaded with considerable inefficiencies. On the other hand, non-governmental sector per se, does not have the required motivation and interest for

educating entrepreneurship among rural peoples either. The models used around the world to combine the governing roles of administrations simultaneously with the use of private sector competency are generally called Public Private Partnership (PPP) (FAO, 2016). It should be noted that PPP is not a specific method; rather, it is a statement to describe any partnership between government and non-government sectors to offer public and corporate governing services that encompass a vast array of different models (World Bank,

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2012). Agricultural Bank of Iran is a development bank and, as a public institution, has to play the role of developing agri-sector. Therefore, by focusing on the importance of education and extension, this paper tries to determine the preferred strategy approach for partnership of Agricultural Bank as a specialized and financial institution in the field of agriculture. In the methodology and data section, we will provide some examples of the role of the bank and its allocation of loans to entrepreneurial activities.

Due to the successful experience in the world and the requirements and issues that need to be considered in designing models, the purpose of this paper is to determine the preferred strategy approach for partnership of development banks, especially those in agriculture sector, in terms of education of rural entrepreneurship and innovation.

Innovation in agriculture is necessary to achieve food security and sustainable development (Zwane, 2020). Various studies have been conducted in connection with educating development of agriculture and innovation, for instance Dabson *et al.* (2003) designed entrepreneurial activities and amass information about organizations, plans, and supportive activities for entrepreneurship in rural areas. Researches reveal that, in economic theories, special attention is paid to the self-motivated economic activities in a form of entrepreneurship in rural areas, and that economic development and entrepreneurship have a tight interrelation (Bradley *et al.*, 2012). Farmers may be the source of innovation in agricultural communities and a potential source for entrepreneurship (Boland, 2012). McElwee (2005) assumes entrepreneurship as a process of running a business plus its management, continuation, and growth. Robert and Sternberg (2004) define rural entrepreneurship as a set of three predicates as follows: first, a power mobilizing other resources to respond to an unanswered request in the market; second, the ability to create something from nothing; and third, the process of creating value by

means of marrying a unified set of resources in line with utilizing an opportunity. After all, what could be defined for the definition of rural entrepreneurship is the innovative application of resources and amenities in rural areas in line with hunting business opportunities. Karimi and Niknami (2020) found that it was necessary to emphasize on topics such as cost reduction methods, marketing methods for products, and economic management of farms to help producers improve their annual income.

PPP models, for which there are various definitions by international authorities, are a set of models used for investment in infrastructures that have been prominent for the last two decades throughout the world. The definition used by the World Bank (2012) states that “public private partnership is partnership of non-governmental sector to offer services and infrastructures that have been traditionally offered by the government. This model of partnership guarantees taking risks by each and every party in a long term framework”. Food and Agriculture Organization (FAO) defines PPP in compliance with the World Bank (FAO, 2016). Studying PPP in innovation in the agri-sector of Latin American countries during 2007, Hartwich *et al.* (2007) pointed out the social and economic benefits of this kind of partnership.

One of the problems in terms of education and extension of innovation relates to operational costs, literally transaction costs including financing cost (Spielman *et al.*, 2010; Hall *et al.*, 2002). Innovation should be supported by financial system and it should consider the probability of failure (Hsu *et al.*, 2014). The concept of financing agriculture has been studied by some researchers. Onyiriuba *et al.* (2020) investigated strategic policies of governments for financing the sector in emerging markets. Liu *et al.* (2021) studied the impacts of rural financial development on agricultural innovation in China. There are also other types of banks in agriculture sector that should be noticed in the literature. Middleton *et al.* (2018) study the

experiences of food banks in high-income countries. They define food banks as “a centralized warehouse or clearinghouse registered as a non-profit organization for collecting, storing, and distributing food (donated/shared), free of charge, to front line agencies, which provide supplemental food and meals to the hungry.” Although food banks are not financial institutions, their performance can be noticed as a new subject. Li *et al.* (2021) investigate the role of grain banks in China. These banks are organizational innovation in China and their role is to reduce food security costs. They expressed that low efficiency of public banks is one of the main challenges, and they suggest privatization as a solution. The role of financial technology (Fin-Tech) in innovation at agriculture in recent years has been highlighted and concepts such as mobile money and block chain technology are the driver of innovation in the sector. (McIntosh and Mansini, 2018).

In addition, the role of financial institution for education in agriculture is discussed in different research including financial literacy through financial education programs (Meier and Sprenger; 2013, Xu and Zia 2012), risks and returns in rural area (Samphantharak and Townsend, 2018). European Investment Bank (2019) focuses on 5 types of financial institutions including public banks, commercial banks, private equity, corporate venture capital, and cooperative and foundations. They describe that public banks can use blended finance and add public grant for financing innovation in agriculture.

MATERIALS AND METHODS

Research Methodology and Data

The Agricultural Bank has had some roles in extension and educating entrepreneurship and innovation in the agricultural sector. These include specialized training courses for fish farming in cages and greenhouse cultivation for agricultural experts in order

to use the environment effectively and compatibly, as well as developing the agricultural sector, supporting the exhibition for the role of women entrepreneurs in sustainable development, and supporting exhibition of the capabilities of Iranian villagers (Agricultural Bank, 2021). Also, this bank, like other financial institutions, has allocated loans to entrepreneurial activities in two scales of micro and macro projects, the results of which can be seen in Table 1.

This research is based on expert judgment. The research method is quantitative and descriptive-survey type and is applied in terms of purpose. The SWOT analysis and Analytic Hierarchical Process (AHP) are used in combination for determining the strategy. Although SWOT methodology is a good basis for formulating effective strategies, it has weaknesses in terms of measurement and evaluation of models (Hill and Westbrook, 1997). In fact, in traditional SWOT model, the importance of factors to determine the impact would not be any quantitative factor. As such, it was not a suitable tool to determine the relative importance (Kajanus *et al.*, 2004). In most cases, the results obtained from SWOT are merely a deficient list of internal and external quality factors (Kangas *et al.*, 2003). To remove the weak points of the measurement and evaluation in SWOT analysis, Kurttila *et al.* (2000) used an integrated method. This method has been used in the research conducted by Stewart *et al.* (2002) and Masozera *et al.* (2006). The application of AHP model is appropriate because the integration of qualitative and quantitative factors and their analysis are provided in one model. The edge is resulted from the fact that pair comparisons are possible between items and evaluation criteria at the same time. This method allows a complicated problem to be broken down into smaller components and the elements could be compared individually and bit by bit. The process of hierarchical analysis reflects the natural behavior and human thinking. This technique studies complicated

**Table 1.** Entrepreneurship loans of Agricultural Bank between 2019 and 2021 (Billion Rials).

| Year | Micro projects | | Macro projects | |
|------|----------------|--------|----------------|--------|
| | Number | Amount | Number | Amount |
| 2019 | 81321 | 35969 | 219 | 91677 |
| 2020 | 79486 | 31876 | 311 | 157703 |
| 2021 | 20800 | 10428 | 392 | 329404 |

(Agricultural Bank, 2021).

problems according to their reciprocal impact while changing them into a simple form to solve (Saaty, 1980).

The advantage of the AHP method over other decision models is that it does not require large statistical samples to achieve statistically accurate results (Dias and Ioannou 1996; Doloi, 2008). Some researchers argue that since the AHP method is based on expert judgment and on a specialized subject, it does not require the use of large samples (Lam and Zhao, 1998). Other researchers argue that since this method is based on expert judgment, even judging by a qualified expert is acceptable. (Golden *et al.*, 1989; Abudayyeh *et al.*, 2007; Tavares *et al.*, 2008). In addition, the use of large samples in the AHP method may be useless and significantly affect the level of consistency of judgments. (Cheng and Li, 2002).

This process works in several steps are as follows:

- Setting target: Our target is determining the strategy for partnership of Agricultural Bank for the purpose of training and elevation of innovation and entrepreneurship in agri-sector, upon which the name of this study is based.
- Determining criteria or indices of comparison: To determine a decent model we need some criteria. To this end, the criteria related to the value for money are selected. What is meant by value for money is that the costs and resources that are used for a subject are worth spending, so that it leads to the best results. Value for money is comprised of three components: economical or minimum cost; effectiveness, which means doing

something right; efficacy, which refers to doing something in a correct manner.

- Preferred judgment (pair comparisons): At this stage, the pair comparisons of various alternatives of decision-making based on indices were conducted and, as for the importance of decision making index through pair comparison, some calculations were done. This stage could be done by means of consensus and brainstorming of experts over any of the comparisons or through distribution of questionnaire among experts and collection of their comments.
- Calculation of relative weights of criteria: Comparison of weights and importance of decision making criteria with one another is achieved via numerical calculations (via software)
- Merging relative weights and calculation of final weights: This step is done for the purpose of ranking alternatives of decision making.
- Determining consistency of responses and system: The consistency ratio is a mechanism that determines the consistency of responses. This mechanism demonstrates to what extent one can trust the priorities of tables. A true Consistency Ratio (CR) is calculated by dividing the Consistency Index (CI) for the set of judgments by the Index for the corresponding random matrix. Saaty (1980) suggests that if that ratio exceeds 0.1, the set of judgments may be too inconsistent to be reliable. In practice, CRs of more than 0.1 sometimes have to be accepted.

We took three conditions for selection of experts. First, specialized knowledge and experience in the field of Agricultural Bank affairs, especially the ones related to education and agriculture. Secondly, university degree at Master's level or higher. Thirdly, work experience of a minimum ten years. It should be noted that the second and third conditions are vital to gain the ranking of an expert in public offices. Tsyganok *et al.* (2012) state that there is no specific criteria for the minimum acceptable numbers of experts to do the analysis of AHP, there is no specific criteria. The point here is that the level of knowledge and expertise of experts is the same, so that the opinions of those people who are more knowledgeable and have greater expertise should be weighed more. However, the qualifications and meritocracy and weight of experts will decline when the number of team members decrease. Under the maximum 20% for estimation error and the minimum 30 people for team members, the difference among experts could be ignored. As for the validity and reliability of the questionnaires, in the AHP method, the criterion of consistency ratio is computed by the software.

Thus, due to the limited statistical population - according to the definition provided - all members of the statistical population were considered as a sample.

Therefore, the statistical sample of 30 people includes 23 men and 7 women. Six people had a doctorate and 24 people had a Master's degree. The tool used in this research was graphical questionnaire based on AHP, in which pair comparison was done for the component of SWOT. The software used was Expert Choice. The analysis sessions were held with experts in 2021 spring

The organization of the later stages of the model are as follows:

In stage one, the idea of the AHP-SWOT format of model is formulated at four levels (Figure 1). Stage one: Selection of the best strategy;

Stage two: Principal factors for analysis;

Stage three: Sub-factors of model, that as indicated in the figure are, respectively, 5, 4, 5, and 4 subordinate factors for each of the points of strength, weakness, opportunities and threats;

Stage four: Representing the desired strategy in this research.

Then, the matrices of pair comparisons of main factors are analyzed by means of peer reviews and through the following table via the software (Expert Choice) so that the vector of weight is achieved. During the pair comparisons the consistency should be less than 0.1 to have acceptable results.

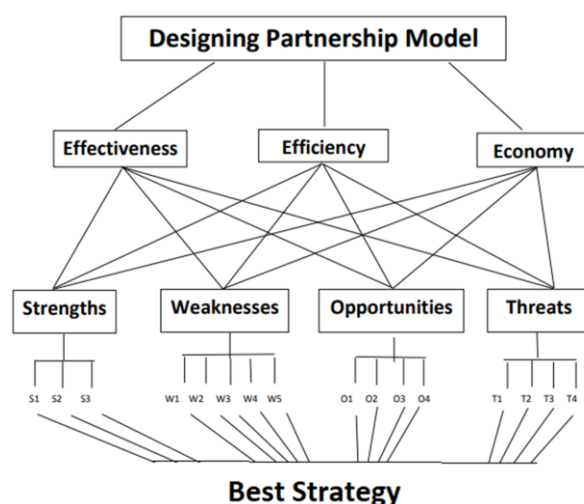


Figure 1. Integration of AHP and SWOT in a hierarchical tree.



RESULTS

By focusing on the major goals of agriculture sector that were referred to in the second section, and in order to recognize the fields and areas required for education and extension, the analysis sessions were held with experts and the following points were identified. Accordingly, the SWOT matrix with subjects regarding strengths, weaknesses, opportunities, and threats of Agricultural Bank's presence in the field of promotion and education of innovation and entrepreneurship in agri sector was composed (Table 2).

At this stage, using the AHP questionnaire, first, a comparison is made between the three criteria. Then, in pairwise comparisons in the framework of AHP, the importance of each of the strengths, weaknesses, opportunities and threats is determined, the results of which are presented in Table 3. The results of this table will be used to determine the absolute and relative weights in the following steps

Selection of Optimum Point in Terms of Strength points is done through the following matrix:

$$OPT(S) = \begin{bmatrix} S1/S1 & S1/S2 & S1/S3 \\ S2/S1 & S2/S2 & S2/S3 \\ S3/S1 & S3/S2 & S3/S3 \end{bmatrix}$$

After calculation of the weights related to each of the strength points, the sum of

partial weights is calculated, as shown in Table 4.

To calculate the partial Weights, the following matrix was used:

$$OPT(W) = \begin{bmatrix} W1/W1 & W1/W2 & W1/W3 & W1/W4 & W1/W5 \\ W2/W1 & W2/W2 & W2/W3 & W2/W4 & W2/W5 \\ W3/W1 & W3/W2 & W3/W3 & W3/W4 & W3/W5 \\ W4/W1 & W4/W2 & W3/W3 & W4/W1 & W4/W5 \\ W5/W1 & W5/W2 & W5/W3 & W5/W4 & W5/W5 \end{bmatrix}$$

By calculating each of the weakness points, the partial weights were calculated as Table 5.

The next step was calculation of Opportunities through the following matrix:

$$OPT(O) = \begin{bmatrix} O1/O1 & O1/O2 & O1/O3 & O1/O4 \\ O2/O1 & O2/O2 & O2/O3 & O2/O4 \\ O3/O1 & O3/O2 & O3/O3 & O3/O4 \\ O4/O1 & O4/O2 & O4/O3 & O4/O4 \end{bmatrix}$$

The obtained results for partial weights of every identified opportunity are shown in Table 6.

And finally, to calculate partial weights in terms of Threats, the following matrix was formed:

$$OPT(T) = \begin{bmatrix} T1/T1 & T1/T2 & T1/T3 & T1/T4 \\ T2/T1 & T2/T2 & T2/T3 & T2/T4 \\ T3/T1 & T3/T2 & T3/T3 & T3/T4 \\ T4/T1 & T4/T2 & T4/T3 & T4/T4 \end{bmatrix}$$

The weights calculated for identified threats are shown in Table 7.

As a result, the matrix of strategic assessment of the AHP-SWOT analysis is represented in Table 8.

Table 2. Summary of SWOT results of meeting with experts.

| | |
|---|--|
| <p>Strength</p> <p>S1- Having branches all across the country</p> <p>S2- Developmental nature of Agricultural Bank</p> <p>S3- Trusting the bank as a public organization</p> | <p>Opportunities</p> <p>O1- Innovation in financial area</p> <p>O2- International cooperation</p> <p>O3- Possible increase of productivity in agriculture sector</p> <p>O4- Internet impact and cyberspace</p> |
| <p>Weakness</p> <p>W1- Bureaucratic procedures in the bank</p> <p>W2- Restrictions in financial resources</p> <p>W3- Weakness in negotiation knowledge</p> <p>W4- Weakness in technical know-how associated with agri sector</p> <p>W5- Lack of required data from former experience</p> | <p>Threats</p> <p>T1- Low investment rate in agriculture</p> <p>T2- Low education and old age in farmers</p> <p>T3- Complicated issues in intellectual property</p> <p>T4- Expanse of small-scale farmlands</p> |

Table 3. “Relative pair value” of SWOT analysis over the criteria.

| | Effectiveness | Efficiency | Economy | Overall Number |
|----|---------------|------------|---------|----------------|
| | 0.384 | 0.301 | 0.315 | |
| S | 0.265 | 0.289 | 0.512 | 0.35 |
| W | 0.225 | 0.208 | 0.162 | 0.20 |
| O | 0.324 | 0.196 | 0.275 | 0.27 |
| T | 0.186 | 0.307 | 0.051 | 0.18 |
| CR | 0.04 | 0.07 | 0.08 | |

Table 4. “Relative weight” of strength factors based on the criteria.

| | Effectiveness | Efficiency | Economy | Overall number |
|----|---------------|------------|---------|----------------|
| | 0.384 | 0.301 | 0.315 | |
| S1 | 0.654 | 0.587 | 0.547 | 0.60 |
| S2 | 0.184 | 0.195 | 0.066 | 0.15 |
| S3 | 0.162 | 0.218 | 0.388 | 0.25 |
| CR | 0.06 | 0.03 | 0.07 | |

Table 5. “Relative weight” of weakness factors based on the criteria.

| | Effectiveness | Efficiency | Economy | Overall number |
|----|---------------|------------|---------|----------------|
| | 0.384 | 0.301 | 0.315 | |
| W1 | 0.025 | 0.074 | 0.058 | 0.05 |
| W2 | 0.204 | 0.362 | 0.040 | 0.20 |
| W3 | 0.314 | 0.235 | 0.472 | 0.34 |
| W4 | 0.273 | 0.254 | 0.155 | 0.23 |
| W5 | 0.184 | 0.075 | 0.275 | 0.18 |
| CR | 0.08 | 0.01 | 0.03 | |

Table 6. “Relative weight” of opportunity factors based on the criteria.

| | effectiveness | efficiency | economy | Overall Number |
|----|---------------|------------|---------|----------------|
| | 0.384 | 0.301 | 0.315 | |
| O1 | 0.251 | 0.268 | 0.327 | 0.28 |
| O2 | 0.231 | 0.229 | 0.261 | 0.24 |
| O3 | 0.315 | 0.435 | 0.311 | 0.35 |
| O4 | 0.203 | 0.068 | 0.100 | 0.13 |
| CR | 0.05 | 0.09 | 0.02 | |

Table 7. “Relative weight” of threat factors based on the criteria.

| | Effectiveness | Efficiency | Economy | Overall number |
|----|---------------|------------|---------|----------------|
| | 0.384 | 0.301 | 0.315 | |
| T1 | 0.075 | 0.098 | 0.037 | 0.07 |
| T2 | 0.521 | 0.483 | 0.649 | 0.55 |
| T3 | 0.231 | 0.113 | 0.087 | 0.15 |
| T4 | 0.173 | 0.306 | 0.227 | 0.23 |
| CR | 0.04 | 0.02 | 0.08 | |

Table 8. Calculated weights in AHP-SWOT Analysis.

| | Weight | Factor | Partial weight | Total weight |
|---------------|--------|--------|----------------|--------------|
| Strengths | 0.35 | S1 | 0.6 | 0.21 |
| | | S2 | 0.15 | 0.0525 |
| | | S3 | 0.25 | 0.0875 |
| Weaknesses | 0.2 | W1 | 0.05 | 0.01 |
| | | W2 | 0.2 | 0.04 |
| | | W3 | 0.34 | 0.068 |
| | | W4 | 0.23 | 0.046 |
| | | W5 | 0.18 | 0.036 |
| Opportunities | 0.27 | O1 | 0.28 | 0.0756 |
| | | O2 | 0.24 | 0.0648 |
| | | O3 | 0.35 | 0.0945 |
| | | O4 | 0.13 | 0.0351 |
| Threats | 0.18 | T1 | 0.07 | 0.0126 |
| | | T2 | 0.55 | 0.099 |
| | | T3 | 0.15 | 0.027 |
| | | T4 | 0.23 | 0.0414 |

DISCUSSION

Based on the analysis of SWOT results, four strategy models can be categorized (Wehrich, 1982; Gurel, 2017): SO strategy (aggressive), WO strategy (competitive), ST strategy (conservative), and WT Strategy (defensive). At this stage, in a two-dimensional space consisting of TO and WS axes, the optimal point is first found using the following equations:

$$x = \sum (S)_i/4 - (W)_i/4 = 0.0375$$

$$y = \sum (O)_i/4 - (T)_i/4 = 0.0225$$

The optimal point represents the choice of SO strategy, which means focusing on Strengths and Opportunities. Analysis of AHP-SWOT results indicates the need for the bank to emphasize its SO strategy. Therefore, the Agricultural Bank must adopt aggressive strategies (Figure 2). According

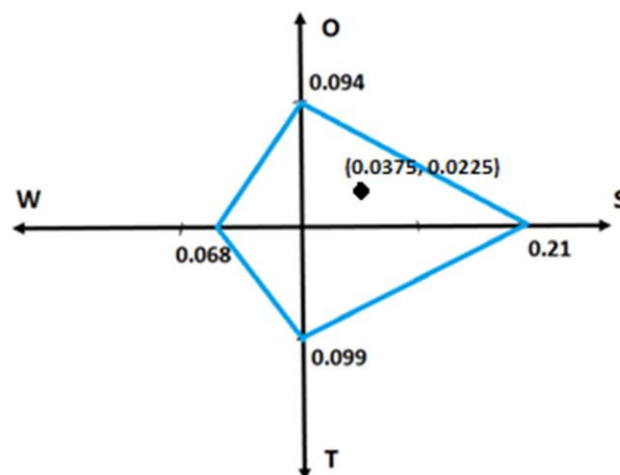


Figure 2. The location of Optimal Strategy in SW- OT space in SWOT analysis

to the findings of this research, the most important strengths of the bank and the coefficient of importance of each (in parentheses) include having branches all across the country (0.6), trusting the bank as a public institution (0.25), and the developmental nature of the bank (0.15). In addition, the most important opportunities include the possibility of increasing productivity in the agricultural sector (0.35), innovation in financial area (0.28), international cooperation (0.24), and Internet impact and cyberspace (0.13).

Since SO strategies have been identified as the bank's priority strategies, solutions based on each of the opportunities and strengths can achieve the highest value for money for the bank. Among these, strategies that use the bank branches (highest strength) to promote ways to increase entrepreneurship and innovation (highest opportunity) will have the highest priority. In addition, strengthening international cooperation and focusing on financial innovation can be part of the bank's aggressive strategies.

Our research makes several contributions to the current literature. First, it discusses how to design a strategy for a development bank to play a role in innovation and entrepreneurship in agriculture. Most existing studies concentrate on the relationship between resources of financial institution and the degree of innovation in the sector. However, few scholars have directly explored the role of financial institution in promotion of innovation and entrepreneurship in agriculture sector.

Second, this study Reviews the existing literature on education and extension in agriculture. According to current literature, entrepreneurship is necessary for rural development. This study's analytical results further show that a development financial institution like Agricultural Bank can play a critical role in enhancing innovation of the sector by using appropriate strategy based on its strength and through identifying current opportunities.

Third, it highlights that the components of SWOT (strengths, weaknesses, opportunities

and threats) for a development bank (as a public partner) can be quantified based on value for money criteria including effectiveness, efficiency, and economy. These criteria are the necessary conditions to reach a successful Public Private Partnership (PPP) to promote innovation and entrepreneurship in agricultural sector.

The conclusion of this article provides the preferred strategy of the bank to enhance education of innovation and entrepreneurship in agricultural sector. Policymakers should select the appropriate strategy based on strengths and available opportunities to promote education of innovation in the sector.

Researchers agree that there is no "one-size fits all" model for agricultural development (Birner, *et al.*, 2006). It is also the case for extension and education. Each country and each public institution has its exclusive strengths, weaknesses, opportunities, and threats. This combination of SWOT can lead to different strategy for different institution. Even the SWOT matrix is not constant for Agricultural Bank, and it certainly will vary during time and in different circumstances. The important novelty of this research is that we developed a framework in which preferred strategy of public institution can be identified. While we avoid "one-size fits all" solution to promote education in agriculture sector, the framework we introduced can be used elsewhere. Our finding is in line with Hsu *et al.* (2014) that innovation needs to be supported by a high-quality financial system. The findings about strategic role of Agricultural Bank as a governmental bank is also in line with the findings of Onyiriuba *et al.* (2020) and Liu *et al.* (2021).

CONCLUSIONS

In this study, we identified the preferred strategy for partnership of Agricultural Bank of Iran (as a public financial institution) to promote education of entrepreneurship and innovation in agriculture sector. We used



expert judgment method to identify the strengths, the weaknesses, the opportunities, and the threats that Agricultural Bank is facing to promote innovation in agriculture sector. Then, we used AHP method to quantify the SWOT matrix, based on partial weights and total weights. Accordingly, for the selection of the best partnership strategy a questionnaire based on pair comparisons was designed. Finally, in a two-dimensional space consisting of TO and WS axes, the optimal point was identified. Analysis of AHP-SWOT results indicates the need for the bank to emphasize its SO strategy, which means combining the strengths and opportunities of the bank. The main strengths of the bank with the highest priority are having branches across the country, trust in the bank as a public organization, and developmental nature of Agricultural Bank, respectively. The highest ranked opportunities of the bank include possible increase of productivity in agriculture sector, innovation in financial area, international cooperation, and Internet impact and cyberspace. This conclusion has also an important implication for the selection of the partner for the bank. In this regard, fin-tech companies and international development institution are the two main types of potential partner for the bank in its PPP programs.

This study extends the existing literature on public-private partnership. As the other study such as FAO (2016) and Spielman *et al.* (2010) stated earlier, public institution can play a vital role in agriculture development. This study shows how this role can be played.

This study has important implications for both theory and practice. While Onyiriuba *et al.* (2020) discussed about strategic policies of governments for financing the sector in emerging markets, in this research, we designed a theoretical and practical framework based on multi decision criteria method. This framework is especially fruitful when high quality data is insufficient in the country.

This study's conclusion has important implications for both enterprises and government policymakers at the practical level. Liu *et al.* (2021) studied the impacts of rural financial development on agricultural innovation in China. We in this study determined how to select the best strategy for a rural financial institution.

One of the main limitations of this research was the lack of comprehensive and operational methods and this limitation was the motivation and cornerstone of this research. Another important limitation was the access to specialists with interdisciplinary knowledge in the fields of agriculture, finance, and education. To overcome this limitation, a wider range of experts in this field was used.

International sources such as the World Bank (2012) have divided agricultural education into four levels, including high school /vocational education, university, technician, and in-service training. There has been extensive discussion in articles and reports about which level of intervention is more effective. Since the Agricultural Bank is inherently a development financial institution and not an educational institution, the above issues were not addressed in this study, but could be a practical issue for policy makers in the field of agricultural education. After implementing the strategy identified in this research, the evaluation and effectiveness of this strategy can be one of the research and practical issues required by the country through cost-effectiveness and cost-benefit analysis.

REFERENCES

1. ADB. 2008. *Public-Private Partnership (PPP) Handbook*. Asian Development Bank, Manila.
2. Abudayyeh, O., Zidan, S. J., Yehia, S., and Randolph, D. 2007. Hybrid Prequalification Based, Innovative Contracting Model Using AHP. *J. Manag. Engin.*, **23**(2): 88-96.
- 3.

4. Agricultural Bank. 2021. Annual Report. <https://www.bki.ir/gettingtoknow/about-us/financialtransparency> (in Persian).
5. Birner R., K. Davis, J. Pender, E. Nkonya, P. Anandajayasekeram, J. Ekboir, A. Mbabu, D. Spielman, D. Horna, S. Benin, and M. Cohen. 2006. From Best Practice to Best Fit. A Framework for Analyzing Pluralistic Agricultural Advisory Services Worldwide. ISNAR Discussion Paper No.5. Washington, DC: International Food Policy Research Institute.
6. Boland, W. P. 2012. An Analysis of the Hidden Variables Influencing the Challenges and Opportunities of Implementing R&D and Value-Chain Agricultural Public-Private Partnerships in the Developing World. Prepared for Syngenta Foundation of Sustainable Agriculture.
7. Bradley, S., McMullen, J., Artz, K. and Simiyu, E. 2012. Capital Is Not Enough: Innovation in Developing Economies. *J. Manag. Stud.*, **49(4)**: 684-717.
8. Cheng, E. W. L., and Li, H. 2002. Construction Partnering Process and Associated Critical Success Factors: Quantitative Investigation. *J. Manag. Engin.*, **18(4)**:194-202.
9. Dabson, B., Malkin, J., Matthews, A., Pate, K. and Stickle, S. 2003. *Mapping Rural Entrepreneurship*. Crop for Enterprise Development, Washington, DC. Available at: https://www.energizingentrepreneurs.org/file_download/inline/b6dba3f4-689a-4fc1-8c66-0ba4e2e54e
10. Dias Jr, A., and Ioannou, P. G. 1996. Company and Project Evaluation Model for Privately Promoted Infrastructure Projects. *J. Construct. Engin. Manag.*, **122(1)**: 71-82.
11. Doloi, H. 2008. Application of AHP in Improving Construction Productivity from a Management Perspective. *Construct. Manag. Econ.*, **26(8)**: 841-854.
12. FAO. 2016. *Public-Private Partnerships for Agribusiness Development: A Review of International Experiences*. (Eds): Rankin, M., Gálvez Nogales, E., Santacoloma, P., Mhlanga, N. and Rizzo, C. Rome, Italy. Available at: <http://www.fao.org/3/a-i5699e.pdf>.
13. Gurel, E. 2017. SWOT Analysis: A Theoretical Review. *J. Int. Soc. Res.*, **10(51)**: 994-1006.
14. Golden, B., Wasil, E., and Harker, P. 1989. *The Analytical Hierarchy Process: Applications and Studies*. Springer Verlag, New York. Berlin, pp. 68-81
15. Hall, A. J., Sulaiman, R., Clark, N., Sivamohan, M. V. K. and Yoganand, B. 2002. Public-Private Sector Interaction in the Indian Agricultural Research System: An Innovation Systems Perspective on Institutional Reform. In: *"Agricultural Research Policy in an Era of Privatization"*, (Eds.): D. Byerlee, D. and R. Echeverría, R. CABI Oxon, UK.
16. Hartwich, F., Gottret, M., Babu, S. and Tola, J. 2007. *Building Public-Private Partnerships for Agricultural Innovation in Latin America: Lessons from Capacity Strengthening*. IFPRI Discussion Paper 00699, International Service for National Agricultural Research Division. International Food Policy Research Institute, Washington, DC, 56 PP.
17. Hill, T. and Westbrook, R. 1997. SWOT Analysis: It's Time for a Product Recall. *Long Range Plann.*, **30**: 46-52.
18. Hsu, P. H., Tian, X. and Xu, Y. 2014. Financial Development and Innovation: Cross-Country Evidence. *J. Finance Econ.*, **112**: 116-135.
19. Kajanus, M., Kangas, J. and Kurttila, M. 2004. The Use of Value Focused Thinking and the A'WOT Hybrid Method in Tourism Management. *Tour. Manage.*, **25**: 499-506.
20. Kangas, J., Kurttila, M., Kajanus, M. and Kangas, A. 2003. Evaluating the Management Strategies of a Forestland Estate: The S-O-S Approach. *J. Environ. Manage.*, **69**: 349-358.
21. Karimi, E. and Niknami, M. 2020. Analyzing Impacts of Farmer Field School on the Economic, Social, Production, and Knowledge Status of Greenhouse Owners: Evidence from Tehran Province and Its Surrounding Counties. *J. Agr. Sci. Tech.*, **22(1)**: 27-41
22. Kurttila, M., Pesonen, M., Kangas, J., Kajanus, M. 2000. Utilizing the Analytic Hierarchy Process (AHP) in SWOT Analysis: A Hybrid Method and Its



- Application to a Forest-Certification Case. *For. Policy Econ.*, **1**: 41–52.
23. Lam, K., and Zhao, X. 1998. An Application of Quality Function Deployment to Improve the Quality of Teaching. *Int. J. Quality Reliability Manag.*, **15(4)**: 389-413.
24. Li, T., Zhou, D., Razzaq, A. and Wang, Q. 2021. Rethinking the Role of Grain Banks in China's Agriculture. *Agriculture*, **11**: 49.
25. Liu, Y., Ji, D., Zhang, L., An, J. and Sun, W. 2021. Rural Financial Development Impacts on Agricultural Technology Innovation: Evidence from China. *Int. J. Environ. Res. Public Health*, **18**: 1110.
26. Masozera, M. K., Alavalapati, J. R. R., Jacobson, S. K. and Shresta, R. K. 2006. Assessing the Suitability of Community-Based Management for the Nyungwe Forest Reserve. *For. Policy Econ.*, **8**: 206–216
27. McElwee, G. 2005. *Developing Entrepreneurial Skills of Farmers*. EU-EsoF, University of Lincoln, 77PP.
28. <http://www.esofarmers.org/fileadmin/esofarmers/documents/ESoFliteraturereview_000.pdf>.
29. McIntosh, C. and C. S. Mansini, 2018. The Use of Financial Technology in the Agriculture Sector. ADBI Working Paper 872, Asian Development Bank Institute, Tokyo. Available at: <https://www.adb.org/publications/use-financial-technology-agriculture-secto>
30. Meier, S. and C. D. Sprenger. 2013. Discounting Financial Literacy: Time Preferences and Participation in Financial Education Programs. *J. Econ. Behav. Org.*, **95**: 159–74.
31. Middleton, G., Mehta, K., Mcnaughton, D. and Booth, S. 2018. The Experiences and Perceptions of Food Banks amongst Users in High-Income Countries: An international Scoping Review. *Appetite*, **120**: 698–708.
32. OECD. 2014. Strategic Public/Private Partnerships. In: “*OECD Science, Technology an Industry Outlook 2014*”. OECD Publishing, Paris. http://dx.doi.org/10.1787/sti_outlook-2014-8-en.
33. Onyiriuba, L., Okoro, E. U. O. and Ibe, G. I. 2020. Strategic Government Policies on Agricultural Financing in African Emerging Markets. *Agric. Finance Rev.*, **80(4)**: 563-588.
34. Robert, J. and Sternberg, B. 2004. Successful Intelligence as a Basis for Entrepreneurship. *J. Bus. Ventur.*, **19(4)**: 189-201.
35. Samphantharak, K. and Townsend, R. M. 2018. Risk and Return in Village Economies. *Am. Econ. J. Microecon.*, **10(1)**: 1–40.
36. Saaty, T.L. 1980. *The Analytical Hierarchy Process*. McGraw-Hill, New York.
37. Spielman, D., Hartwich, F. and Grebmer, K. 2010. Public–Private Partnerships and Developing-Country Agriculture: Evidence from the International Agricultural Research System. *Public Adm. Dev.*, **30**: 261-276.
38. Stewart, R., Moamed, S. and Daet, R. 2002. Strategic Implementation of IT/IS Projects in Construction: A Case Study. *Autom. Constr.*, **11**: 681–694.
39. Tavares, R. M., Tavares, J. L., and Parry-Jones, S. L. 2008. The Use of A Mathematical Multicriteria Decision-Making Model for Selecting the Fire Origin Room. *Building Environ.*, **43(12)**: 2090-2100.
40. Tsyganok, V., Kadenko, S. and Andriichuk, O. 2012. Significance of Expert Competence Consideration in Group Decision Making using AHP. *Int. J. Prod. Res.*, **50(17)**: 4785-4792
41. Verbeek, A., Fackelmann, S. and McDonagh, B. 2019. Feeding Future Generations: How Finance Can Boost Innovation in Agri-Food. *European Investment Bank*, 1 PP.
42. Wehrich, H. 1982. “The TOWS Matrix a Tool for Situational Analysis. *Long Range Planning*, **15(2)**: 1982.
43. World Bank. 2012. Foundations for Public-Private Partnerships. Thematic Note 1. In: “*Agricultural Innovation Systems: An Investment Sourcebook*”, Ed: Ernstberger, J. Available at: https://olc.worldbank.org/system/files/AIS_%20Sourcebook.pdf>.
44. Xu, L. and B. Zia. 2012. Financial Literacy around the World: An Overview of the Evidence with Practical Suggestions for the Way Forward. Policy Research Working Paper; No. 6107. World Bank, Washington, DC.
45. Zwane, E. 2020. The Role of Agricultural Innovation System in Sustainable Food Security. *S. Afr. J. Agric. Ext.*, **48**: 122–134.

تحلیل AHP-SWOT نقش بانک کشاورزی برای ارتقای نوآوری و کارآفرینی در بخش کشاورزی ایران

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چکیده

نقش نهادهای مالی دولت در آموزش و ترویج کشاورزی کمتر مورد توجه قرار گرفته است. در این مقاله از تحلیل SWOT کمی برای تعیین استراتژی مشارکت بانک کشاورزی در آموزش و ترویج نوآوری و کارآفرینی در بخش کشاورزی استفاده شد. بر پایه ادبیات موضوع و تجربیات جهانی، چارچوب مشارکت عمومی-خصوصی مورد توجه قرار گرفت. برای این منظور از مدل‌های تصمیم‌گیری چند متغیره استفاده شد که در این راستا ترکیب روش SWOT با AHP به کار گرفته شد. طبق یافته‌های این تحقیق مهمترین نقاط قوت بانک و ضریب اهمیت هر یک (داخل پراتز) عبارتند از: برخورداری از شعب در سراسر کشور (۰.۰۶)، اعتماد به بانک به عنوان نهاد دولتی (۰.۲۵) و ماهیت توسعه‌ای بانک (۰.۱۵). مهمترین نقاط ضعف بانک عبارتند از: ضعف در دانش مذاکرات (۰.۳۴). فرآیندهای بروکراتیک (۰.۲۳) و محدودیتهای مالی (۰.۰۲). مهمترین فرصتها شامل امکان افزایش بهره‌وری در بخش کشاورزی (۰.۳۵)، نوآوری در حوزه مالی (۰.۲۸)، همکاری-های بین‌المللی (۰.۲۴) و تاثیرات اینترنت و فضای مجازی (۰.۱۳) می باشد. مهمترین تهدیدها عبارتند از: تحصیلات کم و سن بالای کشاورزان (۰.۵۵)، هزینه های بالای مزارع کوچک (۰.۲۳)، مسائل پیچیده مالکیت معنوی (۰.۱۵) و نرخ پایین سرمایه‌گذاری در بخش کشاورزی (۰.۰۷). نهایتاً تحلیل نتایج AHP-SWOT در فضای گرافیکی دو بعدی، بر ضرورت اتخاذ استراتژی‌های تهاجمی توسط بانک تاکید دارد.