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Identification of the Leading Knowledge of the Agricultural Sector Using Key Technology Techniques and AHP in Kermanshah Province, Iran

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Abstract

The pattern of knowledge-based production has recently changed economic and social relations. If one wants to use the benefits of this pattern, they have to pay serious attention to the production, distribution, and dissemination of knowledge; in this regard, Leading Knowledge (LK) plays a vital role in developing areas. However, since government budgets have to be spent for public, especially for science and technology which are too expensive, it is impossible to experience the simultaneous advancement in all branches of knowledge. This qualitative and descriptive analysis adopts an applied approach, and tries to identify the LK of the agricultural sector in Kermanshah province, Iran. First, the initial list of LK and Analytic Hierarchy Process (AHP) method based on key technology techniques were prepared through reviewing documents and surveys, i.e. interviews and a panel of experts. In-depth and purposeful interviews were also adopted to extract experts' opinions. Finally, data were analyzed by a panel of experts using the Analytic Hierarchy Process in Expert Choice (EC) software. The results showed that water engineering (0.223), horticultural Science (0.196), and biotechnology (0.138) were listed in order of priority in Kermanshah province. The results can be helpful in revising the educational policies of universities and research centers at the province level, allocating limited resources to the relevant government organziations, Agriculture Jihad and related research centers, and determining the policy of science and technology park and agricultural research centers at the national level.

Keywords: Agricultural sector, Kermanshah province, Key technology, Knowledge-based economy, Leading knowledge

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Introduction

Over the past few decades, a new economic revolution as the knowledge-based economy, has emerged in the world. According to the reports released by the World Bank and the Organization for Economic Co-operation and Development (OECD), knowledge has taken a leading role in economic growth and improvement of people's quality of life (World Bank, 1998; OECD, 1999). OECD defined a knowledge-based economy as an economy that is directly based on the production, distribution, and use of knowledge and information (OECD, 1996). Accordingly, knowledge innovation is strongly focused in the 21st century (Kao, 2004).

One of the basic prerequisites for the development of societies is the correct choice of Leading Knowledge (LK) (Rahmani *et al.*, 2019). Friedrich List emphasized the need for a leading industry in his book entitled “National System of Political Economy” (List, 1904). It is also highlighted in the US National Security Strategy (NSS) in the 21st Century (The United States Commission on National Security, 2001). As it is acceptable, investment in all sciences is not possible while a limited number of them in developed and leading countries, including the United States, Britain, Germany, Ireland, Chile, and Finland (Rahmani, 2015) are acknowledged.

LK refers to the knowledge that every country or region should follow based on its current conditions and capacities to achieve growth and development (Rahmani *et al.*, 2019). According to the definition, every country must inevitably obtain this knowledge at any stage of development for achieving goals. Targeing all sciences and branches simultaneously could not be possible

Knowledge on the importance of LK is based on the differences in LK by region. This difference can result from different spatial and temporal variations, for instance, climatic and geographical conditions and historical and institutional backgrounds. While traditional planning approaches cannot meet this requirement of society, nowadays, applying regional planning knowledge to identify the LK is necessary (Pourmohammadi *et al.*, 2011; Zali, 2012; Zali, 2013). Therefore, the present study has tried to identify the LK for Kermanshah province using the foresight approach and key technology techniques.

A new concept called "foresight" has emerged in the world over the past few decades. Nowadays, two factors of the awareness of human knowledge and the considerable concern about the acceleration in the rate of unknown events have emphasized the importance of thinking about the future of societies (Amin Nayeri *et al.*, 2017). The term has been widely used to differentiate the concepts in question from other future planning approaches since the 1980s (Amanatidou, 2012). The European Union developed a Practical Guide called Foresight for Regional Development Network (FOREN) concerning foresight and regional development in 2001 to encourage EU’s members to use regional foresight. The FOREN project is a practical guide making a better understanding of the nature of foresight. According to the FOREN project, foresight is a systematic and participatory process of understanding the future which builds a medium- and long-term vision to achieving today's decisions mobilizes joint actions, and provides approaches to improve decision-making (Gavigan, 2001). It can also be defined as one’s ability and capacity to think systematically about the future properly to inform present-day decision-makers (Conway, 2015). It explains how foresight can provide valuable inputs for strategic planning, regional development policymaking, and the stimulation of strategic collective action. FOREN project has specifically focused on the regional level, especially in the following areas: 1) why and how regional foresight can be used; 2) What different foresight approaches are; 3) when and where regional foresight can be used properly; 4) how regional or local conditions can be addressed in the foresight design process. However, the most appropriate definition for the present study is as follows: foresight is an integrated systematic and multidisciplinary approach that is used to identify technological, economic, and social areas to prioritize investments and research and consequently determine medium- and long-term future strategies using all levels of resources ranging from organizational to international resources (Yuksel, 2017). For example, the United States attempted to use science and technology foresight studies to identify key technologies in the 1990s (Porter, 2010).

In addition, the close relationship between foresight and science and knowledge was revealed due to the main applications of science and technology foresight. Technology foresight was introduced to achieve several main objectives as follows: 1) providing an approach to select and prioritize science and technology; 2) providing a mechanism for linking research opportunities with economic and social needs; 3) developing a strong relationship between science and technology and innovation and wealth creation resulting in improved quality of life; and 4) developing communication and collaboration between researchers, users, and suppliers for research projects (Martin and Johnston, 1999).

Despite the great potential of the agricultural sector in Kermanshah province for growth and development, there is a consensus about the inefficiency of the current production model in the province, and this model can be improved by transferring from source-based production systems to knowledge-based production systems (Naghavi, 2019). Knowledge-based agriculture has been centered around knowledge and technology. Similar to other economic sectors, the agricultural sector has also highlighted the vital role of knowledge in maintaining and increasing effectiveness (Floriańczyk *et al.*, 2012).

Based on the mentioned issues, the present study tries to find which areas of knowledge should be focused to achieve the knowledge-based production model in the agricultural sector in Kermanshah province.

Theoretical approach

Developed countries have focused on the expansion of high value-added clean industry and transfer of low value-added industries to developing countries. Therefore, their researchers have shown no interest in explaining the logic of science and leading industries nor in publishing scientific documents. List (List, 1904) addressed the necessity and criteria of the leading industry. Although this book is not directly about the LK and cannot be mentioned in the section of the review of literature, its logic of discussions and arguments is often related to the LK. The US National Security Strategy for the 21st Century announced that information and communication technology, biotechnology, and microelectronics are the most significant areas of knowledge (The United States Commission on National Security, 2001). In addition, researchers affiliated with US institutions are more focused on several specific areas, including biotechnology, health, nanotechnology, information, and communication technology, and the environment (OECD, 2013). Rennie introduced biotechnology as a key knowledge of human societies (Rennie, 2000). Paija emphasized information and communication technology and indicated that its role in the third wave of the industrial revolution is the same as the role of water vapor and electricity in the previous waves (Paija, 2001). Also, Karlsson & Rouchy believed that digital technologies are the main knowledge that creates changes in human societies (Karlsson and Rouchy, 2015) and has a high potential for the production, distribution, and application of information.

South Korea and Singapore have prioritized information and communication technology in investing in knowledge. Singapore has mainly worked on the new aspects of semiconductors, aerospace engineering, and medical sciences; however, Finland has mainly worked on digital information and communication technologies (Asian Development Bank, 2014). There are eight great technologies in the UK, including big data and energy-efficient computing, satellites and commercial applications of space, robotics and autonomous systems, biological sciences, genetics, and synthetic biology, regenerative medicine, agri-sciences on industries that reduce carbon dioxide emissions, advanced materials (nanotechnology), energy storage (Department for Business, Innovation & Skills, 2014). China, Japan, and South Korea play a relatively large role in producing nanotechnology and environmental sciences. Germany has focused more on environmental technologies (OECD, 2013). Chile follows some specific areas of knowledge, including biotechnology, environment, information, and financial engineering, forest genetics, and vaccines for aquaculture (World Bank, 2007). Ireland emphasized health and biotechnology greatly (OECD, 2004).

China will have advanced industry through knowledge of digital technology by 2025. In this regard, as its first step, it has launched forty-six smart projects. They also followed ten key areas, including Information and Communications Technology (ICT), robotic, agriculture, aerospace, marine technologies, railway equipment, clean energy, new materials, biological drugs, and medical devices to support the objectives. Canada has significant relative expertise in biotechnology and information and communication technology. It also made a huge investment in clean energy in 2015. Belgium has international competitive power in different areas of knowledge, including chemicals, biological sciences, and information and communication technology. Australia has retained clear international expertise in biotechnology (OECD, 2016).

According to the reports released by OECD on the perspective of Science, Technology and Innovation in 2016, aging societies, climate change, health challenges and the growth of digitalization may be able to shape research and development program (R&D program) and the scope and scale of innovation demand in the future. The following top ten sciences are identified in this report: The Internet of Things, big data analytics, Artificial intelligence (AI), neurotechnologies, nano/microsatellites, nanomaterials, additive manufacturing (or 3D printing), Advanced energy storage technologies, synthetic biology, and blockchain (OECD, 2016). This organization also accentuated three areas in another report in 2018: 1) Artificial intelligence and machine learning can boost the productivity of science, improve new types of discovery, and increase reproducibility, 2) genetic modification can revolutionize the present-day medical treatment, and 3) nanomaterials and bio-batteries can provide new clean energy solutions (OECD, 2018). With the advent of the coronavirus, synthetic biology or bioengineering has been introduced as basic and fundamental knowledge in a wide range of major economic sectors (OECD, 2021).

Only one article was found on LK and the introduction to its selection criteria in Iran (Rahmani *et al.*, 2019). On the other hand, the most relevant studies are about policymaking in science and technology (Khosravaninezhad *et al.*, 2020; Fatemi and Arasti, 2019; Peivasteh, 2019; Kalantari and Montazer, 2018; Nourmohammadi, 2017), which is beyond the scope of this study. At the national level, some efforts, such as the comprehensive scientific map of the country and document of strategic transformation of science and technology development of Iran have been made to identify the priorities of science and technology. The above-mentioned documents were compiled in 2009 and 2010, respectively. It should be mentioned that these studies and the present study are different in nature. For example, firstly, the present study tries to find LK in one or a few areas of knowledge in the early stages of knowledge development while the comprehensive scientific map of the country and document of strategic transformation of science and technology development of Iran cover a wide range of science and technology priorities in all possible areas. Secondly, the documents have addressed all aspects of the priorities of science and technology; however, this study merely tries to find general areas of knowledge based on the criteria. Thirdly, these documents and the present study are also different in the scope of introduction of priorities. The documents are implemented at the national level; however, the present study determines the LK at the provincial and regional levels.

It may seem that knowledge is ever-shifting in nature and cannot be limited to geographical boundaries, so the regional LK will not be an acceptable issue. Of course, it is true in this respect; however, the LK selection has two other aspects: first, it is necessary to meet the needs of regions with specific climatic, geographical, and institutional conditions. Second, there are some capacities of hardware and software and knowledge development and exploitation in the region, which are tied to the specific conditions, namely geographical and institutional conditions of the region. For example, desert dwellers have higher capabilities in leading the knowledge related to water scarcity control than the residents of waterlogged areas due to their local and indigenous knowledge and previous experiences. In this regard, it seems necessary to focus on regional LK. To put it differently, it is essential to have a scientific definition of the region in various studies of urban and regional development (Zali, 2010; Zali, 2011; Zali, 2013).

The present study is the first innovative study 8which has tried to provide a model for identifying and implementing the LK in the agricultural sector based on the foresight approaches of science and technology in Kermanshah province.

Methods and Materials

This qualitative and descriptive study adopted the key technology which is one of the methods of science and technology foresight and a component of the prioritization-based approaches (Unido, 2005). Key technology which is confirmed by UNIDO as a valuable approach in the evaluation of different research areas, is mainly applied to identify science and technology priorities, especially the LK in the agricultural sector in several countries, such as the Czech Republic, France, and the United States. It has four main stages, including a selection of experts, the preparation of the preliminary list of technologies, the prioritization of technologies, and the extraction of the final list (Unido, 2005).

In this research, data collection was carried out through library and documentary methods and a survey of experts' opinions. In this regard, articles, books, the document of strategic transformation of science and technology development of Iran, and document of strategic spatial planning in Kermanshah province as the most relevant upstream documents were examined to extract the preliminary list of science and knowledge priorities in agriculture and general criteria of evaluation.

Semi-structured in-depth interviews based on chain sampling, which is one of the types of purposive sampling, were used to seek out expert opinions. At this stage, data analysis and identification of the criteria of evaluation were carried out based on Strauss & Corbin's grounded theory (Strauss and Corbin, 1990). The statistical population included experts in the agricultural sector of Kermanshah province, including faculty members of Razi University and Islamic Azad University, owners of agricultural knowledge-based companies, employees of the department of department of agriculture-jihad, and the Agricultural and natural resources research and education in Kermanshah. Theoretical saturation was obtained in the fourteenth interview; however, the fifteenth to twentieth interviews were also conducted to confirm the findings. In qualitative research, data collection will be completed if no more new information is obtained (Strauss and Corbin, 1990).

There are several methods to validate the findings of qualitative research. Contrary to the reliability and validity in quantitative research, trustworthiness is common in the validation of qualitative research which Guba and Lincoln believe should contain four criteria, including credibility, transferability, dependability, and confirmability (Sharifzadeh *et al*., 2013). In this regard, in this research, all interviews were recorded while notes were being taken to ensure that all details were recorded. The transcript of the interviews was then provided and a copy was given to the interviewees to verify the accuracy of the contents. The researcher maintained contact with all interviewees until the end of the research and provided them with a hierarchical model of the criteria of evaluation and a list of identified knowledge to review and modify at each stage. Some interviews were coded several times at regular intervals to confirm the similarity of the codes. Moreover, each interviewee had enough time to talk in detail about their experiences and knowledge. In the end, other experts' opinions who did not participate in the study were sought out to verify the findings. Three experts who were specialized in both agriculture and knowledge-based activities and the research team reviewed and confirmed the final findings.

Finally, the key technology was formed based on group brainstorming sessions or a panel of experts. It means that fifteen experts participated in the study to analyze the obtained data and to prioritize the LK through multiple criteria decision making (MCDM). These models are used when it is important to make a decision with multiple criteria and in this respect, the Analytic Hierarchy Process (AHP) which is one of the most efficient and comprehensive techniques is really helpful (Ghodsipour, 2005). Many outstanding studies such as planning and choice of the best option have used the analytic hierarchy process (Vaidya and Kumar, 2006). This technique has also been used in urban planning studies (Zali *et al*., 2014).

There are four main steps to make decision in the Analytic Hierarchy Process (AHP), including, problem statement, decision mapping, pairwise comparison matrices, and determination of the Weights of criteria and general prioritization framework (Saaty, 2008). Saaty's 9-point scale was used for pairwise comparisons (Ghodsipour, 2005). the complex Analytic Hierarchy Process (AHP) was performed in the software package Expert Choice. Figure 1 illustrates the steps of the research.

We applied employed approach in this study for the Kermanshah province of Iran. Due to the climate and ecology of Kermanshah province, it usually has average annual precipitation and annual relative humidity which has generally covered the mountain slopes, valleys, and plains with forests and pastures. Climate diversity, large agricultural lands, and agricultural research centers, in general, have unleashed Kermanshah province's considerable potential in the agricultural sector.

A large number of people living in Kermanshah province have been working in the agricultural sector (Management and Planning Organization of Kermanshah, 2018). Although productive sectors (i.e. agriculture and industry) have held the same rank in terms of share of total employment at the provincial and national levels; however, they reflect a significant difference in the absolute values of shares. The mean ratio of agricultural to industrial employees in Kermanshah province has been about three to one during the last two decades. However, it is worth mentioning that the numbers of employees are almost equal in both sectors of the country. In other words, a significant part of the province's labor force has been involved in agricultural activities (Statistical Center of Iran, 2019). Since Kermanshah province has been struggling with widespread unemployment for a long time and its rate of unemployment was twice as high as the mean national rate in 2016 (Statistical Center of Iran, 2019), it can be claimed that the institutions, climate, and tacit knowledge in Kermanshah province are more adaptable to the agricultural sector.

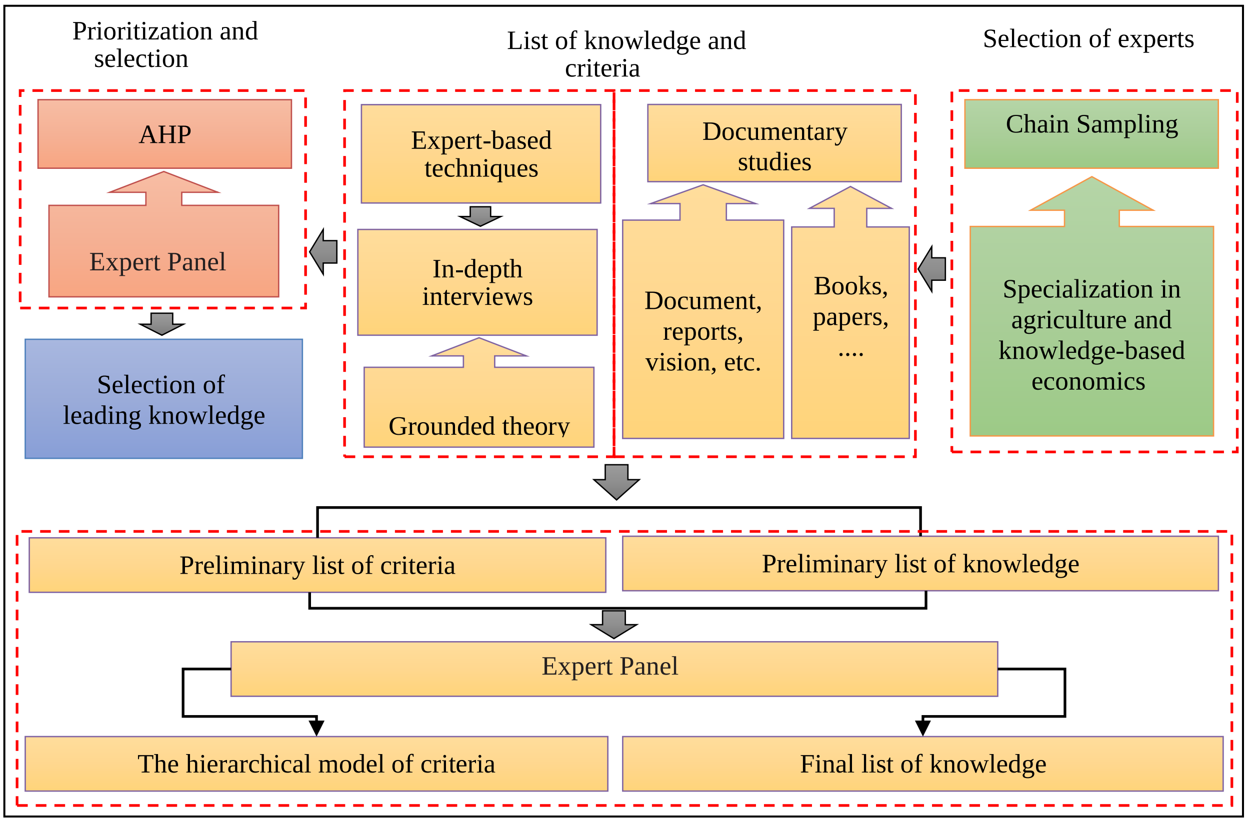

Figure 1- Steps of the research

Discussion and Results

Criteria for selecting Leading Knowledge

Similar to any other selections, it is necessary to find some criteria to identify LK that helps to make the right decision. Figure 2 illustrates the general criteria for selecting LK. These are level 1 criteria which are prepared based on the document of strategic transformation of science and technology development of Iran. The innovation of this research can be indicated by the fact that level 2 and 3 criteria were designed for the agricultural sector of Kermanshah province based on the document of strategic spatial planning in Kermanshah province and the survey of experts' opinions. at the end, all the criteria of the panel of experts were discussed and refined (see Figure 3).

Adaptation to existing capacities (current situation)

In the early stages of development, the existing capacities and capabilities of a region should be regarded as the most important and first criterion for selecting LK. List examines the actions of different countries in the first wave of the industrial revolution and realized that the winners of the Industrial Revolution, such as the factory owners, the nation states, colonial owners, and the people who were rich already have focused on one or more specific industries, concerning their current capacities and potentials and their historical and natural features (List, 1904). List's study is a historical study of the first industrial revolution which does not deal with knowledge as it is presented in the knowledge-based revolution. However, their logic and basis of arguments are similar, and their rules are still valid.

The selection of LK is tied to the path taken. To select LK in the early stages of development, the first and most important criterion, one must refer to natural capacities and capabilities. The integration of geography and historical and institutional backgrounds in a region has given vital importance to this criterion because economic activities have been mainly formed based on the historical and geographical features of a region, resulting in a kind of individuals' tacit knowledge. Stiglitz believed that organizations and individuals' tacit knowledge of years of experience is the source of existence and continuity of competitive advantage (Stiglitz, 1999).

Infrastructure is one of the criteria for evaluating existing capacities to determine LK (Rahmani *et al*., 2019). These infrastructures, such as trained workforce, laboratory and equipment, and organizations and institutions are needed to enhance knowledge-based development (Management and Planning Organization of Kermanshah, 2018). Natural capacities are also used to examine the adaptation to the current situations. Other relevant sub-criteria were derived from a survey of experts' opinions.

Global trends (future)

Demand and the knowledge supply are both important for future developments and global trends in science and technology. However, all specialized sub-branches of knowledge are beyond the scope of the present study; therefore, only general areas of market growth (two general criteria) are enough for the supply to examine the general trend and demand for knowledge.

Regional needs (strategic issues)

Document of strategic spatial planning in Kermanshah province is the most relevant upstream documents which are used to extract the strategic issues. It referred to the knowledge-based economy and diverse and productive employment as one of its main objectives (Management and Planning Organization of Kermanshah, 2018). Furthermore, level 3 criteria also include the ability to create added value, sustainable employment, and the power of clustering (Rahmani *et al*., 2019). Sustainable development is one of the strategic issues in the province. Other important issues which are also mentioned in the document of strategic spatial planning in Kermanshah province are Protection from the environment and Sustainability of basic resources (Management and Planning Organization of Kermanshah, 2018). A survey of agricultural experts' and stakeholders' opinions showed that the production of healthy products is regarded as one of the important criteria for sustainable development. Kermanshah province also faced other challenges, such as flood control, drought adaptation, and destruction of pastures which are provided in the section of regional hazards (Management and Planning Organization of Kermanshah, 2018).

Preliminary list of Leading knowledge

Based on key technology, a preliminary list of science and technology was prepared through group brainstorming sessions, the panel of experts, reference research, expert studies, interviews with industry experts, and environmental scanning (Unido, 2005). This study prepared the preliminary list of LK according to upstream documents (i.e. the comprehensive scientific map of the country and document of strategic transformation of science and technology development of Iran) and a survey of experts' opinions.

First, the agricultural science and technology priorities were extracted from the above-mentioned documents. Then, agricultural experts and stakeholders of the province were asked to complete the preliminary list based on the general criteria in selecting the LK (i.e., existing capacities of the province, strategic issues, and regional needs, and global trends). Finally, the priorities were adapted to the academic fields of studies and therefore a wide range of different specialized sciences was adapted. Since the present study tries not to identify all specialized sub-branches of knowledge and only considers general areas of knowledge, the extracted sciences were categorized into the eight main groups including biotechnology, water engineering, plant pathology, mechanical engineering of biosystems, horticultural sciences, natural resources, soil sciences, and modification of legal relations. The sub-groups are listed as follows:

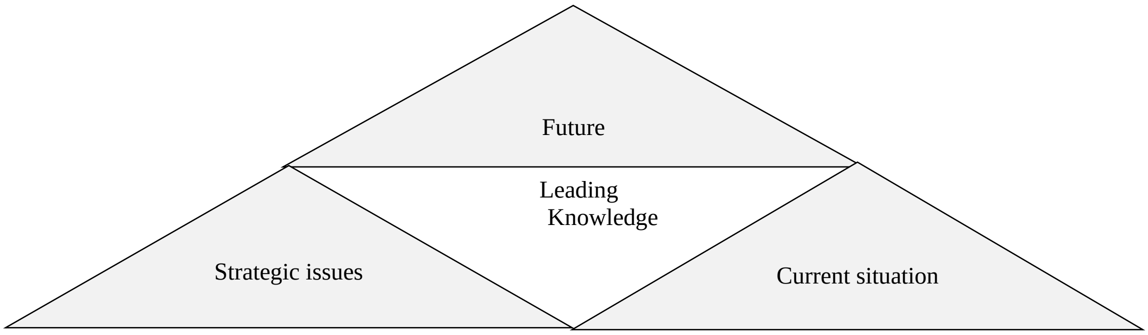

Figure 2- The general pattern of identifying Leading knowledge

1. Biotechnology: precision agriculture, agroecology, agrotechnology (i.e., seed technology, weed science, crop ecology), plant breeding (i.e., molecular genetics and genetic engineering), Animal Husbandry Engineering (i.e., pastoral farming and animal physiology), genetic resources conservation and management, biosafety, genetics, biological and non-Biological stresses, biological products, food security, identification, registration, preservation and restoration of genetic resources, the positive use of biodiversity in production of suitable cultivars and species and Reduction of Air Pollution, Optimization of Regional cropping Pattern
2. Water Engineering: irrigation and drainage water, structures of water, use of modern technologies and management practices in optimizing water distribution and consumption, exploitation of unconventional water resources for sustainable development, development of new irrigation and drainage methods
3. Plant pathology: agricultural entomology
4. Mechanical engineering of biosystem: design and construction, post-harvest technology, new energy, and renewable energies
5. Horticultural sciences: greenhouse products, medicinal plants, fruit farming (Growing fruit plants and trees)
6. Natural resources sciences: Rangeland and Watershed Management, restoration and exploitation of forests and rangelands
7. Soil Science: improving soil fertility
8. Modification of legal relations: modifying and improving operating systems

Selection of leading knowledge

Prioritization of knowledge through the Analytic Hierarchy Process (AHP) requires drawing a hierarchical decision tree consisting of the initial goal and different levels of criteria and options (see Table 1). Therefore, the pairwise comparison matrices of the main criteria and sub-criteria were designed to determine the final weights. Then, pairwise comparison matrices of 8 main groups of knowledge were formed. Paired comparisons were performed at the last level of the criteria resulting in the completion of 17 matrices. The panel of experts performed the completion and scoring of matrices in both stages. Finally, 8 knowledge groups were prioritized through pairwise comparison matrices in the software package Expert Choice (see Figure 4). The results showed that water engineering, horticultural sciences, and biotechnology were ranked first to third, respectively. In other words, the province's macro-policies should be adjusted to develop water engineering, horticultural sciences, and biotechnology sciences to realize the knowledge-based economy in Kermanshah province and benefit from its unique benefits.

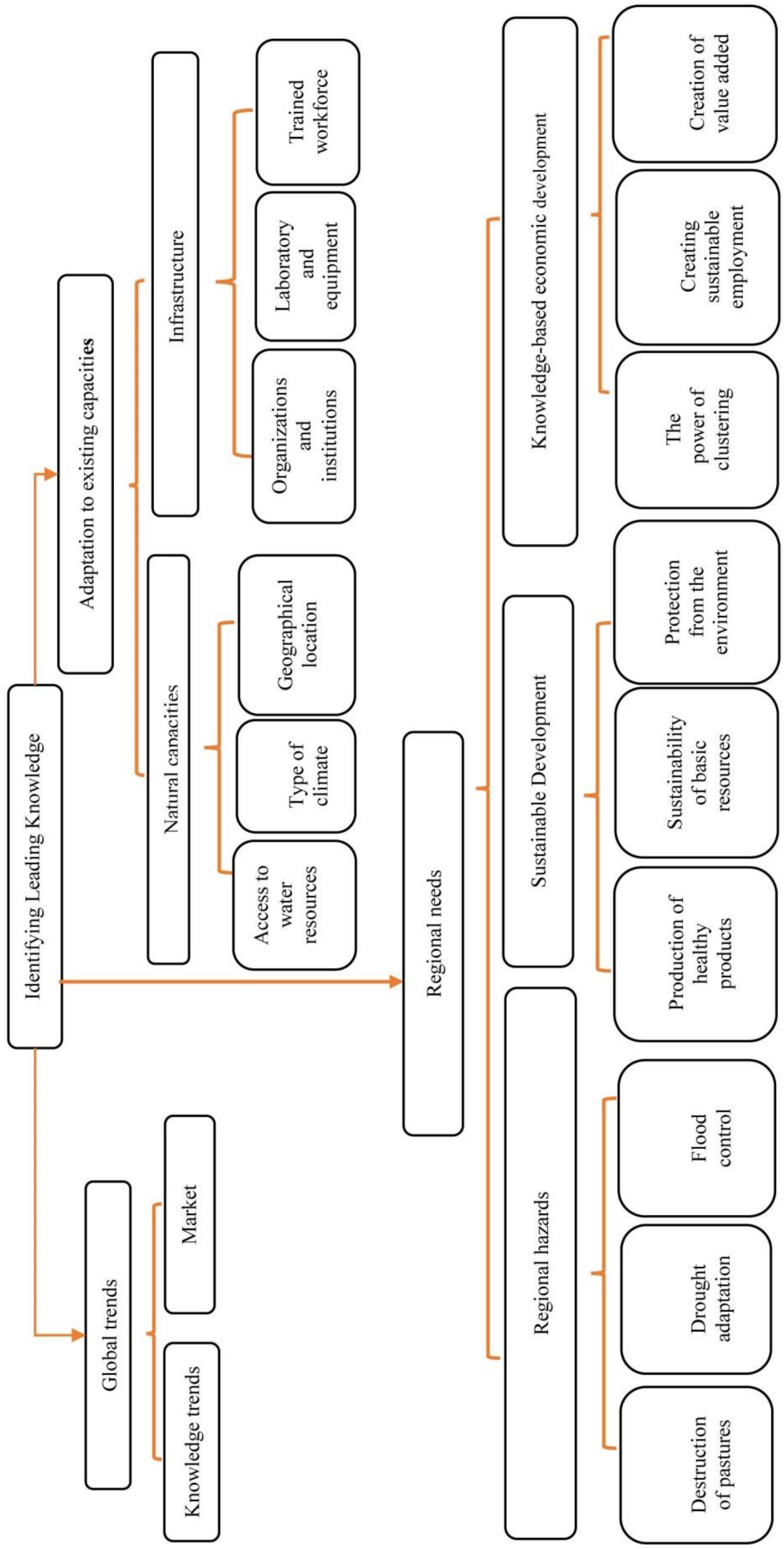

Figure 3- The hierarchical model of criteria for selecting Leading knowledge

Table 1- The final weight of criteria and sub-criteria in the decision-making hierarchy

Level 1 criteria	Weight	Level 2 criteria	Weight	Level 3 criteria	Weight
Adaptation to existing capacities	0.49	Infrastructure	0.125	Trained workforce	0.178
				Laboratory and equipment	0.07
				Organizations and institutions	0.751
		Natural capacities	0.875	geographical location	0.091
				Type of climate	0.455
				Access to water resources	0.455
Regional needs	0.451	Knowledge-based economic development	0.077	Creation of added value	0.156
				Creating sustainable employment	0.659
				The power of clustering	0.185
		Sustainable Development	0.692	Protection from the environment	0.455
				Sustainability of basic resources	0.455
				Production of healthy products	0.091
		Regional hazards	0.231	Flood control	0.057
				Drought adaptation	0.597
				Destruction of pastures	0.346
Global trends	0.059	Market		0.25	
		Knowledge trends		0.75	

Source: Research findings

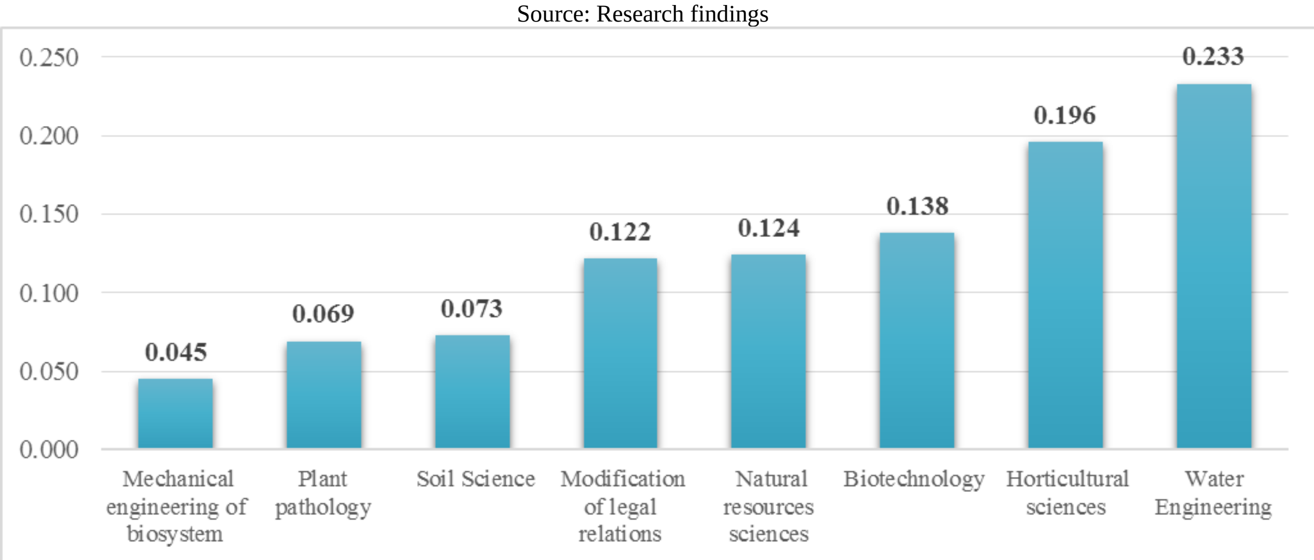

Figure 4- Prioritization of agricultural Leading Knowledge in Kermanshah province

The inconsistency rate was used to evaluate the validity of the research findings. All pairwise comparisons of decision criteria and knowledge groups had an inconsistency rate of less than 0.1. In addition, biotechnology is highly emphasized in US national documents. The U.S. Commission on National Security considers the most significant innovations in the first quarter of the 21st century stems from three categories, including information technology, biotechnology, and Micro-electromechanical systems (MEMS). It also believes that fundamental developments in biotechnology will be even more surprising than innovations in information technology, and there will be more investments in biotechnology than IT leading to more innovation and economic growth (The United States Commission on National Security, 2001).

Since Iran is located in the arid and semi-arid region and there has been a severe water crisis in Kermanshah province in recent years, the first rank of knowledge of water engineering is meaningful. On the one hand, it will not be possible to achieve the survival of agricultural activities in the province and sustainable development without investing in agricultural activities adaptable to drought. On the other hand, horticultural science, as a second priority, has unparalleled potential in dealing with drought, conserving water resources, and creating sustainable employment.

Biotechnology is the second-largest science and technology priority in the United States, Russia, and China (Kalantari and Montazer, 2018). The U.S. Commission on National Security has also emphasized the importance of this area (The United States Commission on National Security, 2001).

It should be noted that the present study emphasizes the agricultural sector; however, it never neglects industrial activities. It is necessary to invest in knowledge-based industries related to selected sciences and the LK of the province's industrial sector should be discussed in a separate study. However, it should be noted that Kermanshah province has favorable conditions for the development of agricultural activities due to its special climatic characteristics. About 30% of the province's workforce is active in agriculture. In other words, most of the tacit knowledge formed in this province is related to agricultural activities and also the institutions in the province have been the basis for the development of such activities. All mentioned conditions confirm that the LK at the early stage in Kermanshah province should be selected from the agricultural sector. On the other hand, the document of strategic spatial planning in Kermanshah province introduced advanced and sustainable agriculture as one of the leading developments of Eslamabad-e-Gharb, Qasr-e-Shirin, Sonqor, Sahneh, and Oramanat (Management and Planning Organization of Kermanshah, 2018).

According to the above-mentioned issues, the following points should be emphasized in development plans:

- Identifying and achieving consensus on the LK in each region and province of the country
- Optimal reallocation of resources to support the LK of the province, especially concerning knowledge and technology-based enterprises under the auspices of Kermanshah science and technology park
- Avoiding the concentration of the research budgets of universities and government agencies in charge on unnecessary and non-practical cases in the province
- The objectives of universities and research centers of the province should be the development of disciplines related to the three sciences of water engineering, horticultural sciences, and biotechnology.

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مقاله پژوهشی

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شناسایی دانش‌های پیشران با کمک تکنیک فناوری کلیدی و تحلیل سلسله‌مراتبی در استان کرمانشاه

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چکیده

الگوی تولید دانش‌بنیان طی چند دهۀ اخیر تمام مناسبات اقتصادی و اجتماعی را دگرگون نموده است. دستیابی به مزایای این الگو، در گرو توجه جدی به تولید، توزیع و انتشار دانش است. یکی از اساسی‌ترین و مهم‌ترین پیشنیازهای تحقق الگوی تولید دانش‌بنیان به ویژه در مناطق در حال توسعه، انتخاب دانش پیشران است. ضرورت این انتخاب به محدودیت‌های پیش روی جوامع برمی‌گردد. از سویی بودجه‌های دولتی با فشار فزایندۀ مخارج عمومی روبرو هستند و علم و فناوری هم به این بودجه‌ها وابسته است و از سوی دیگر، هزینه‌های سرمایه‌گذاری در حوزه‌های مختلف دانش به طرز سرسام‌آوری در حال افزایش است. بنابراین، پیشبرد همزمان تمام شاخه‌های دانش برای هیچ کشوری حتی جوامع پیشگام و توسعه‌یافته نیز، امکان‌پذیر نیست. مقاله حاضر با هدف شناسایی دانش پیشران بخش کشاورزی استان کرمانشاه انجام شده است. این پژوهش، از منظر روش پاسخ به سوال محوری تحقیق، کیفی و از منظر هدف، کاربردی است. در گام نخست، احصاء فهرست اولیۀ دانش‌های پیشران و مدل سلسله‌مراتبی معیارهای ارزیابی مبتنی بر تکنیک فناوری کلیدی با کمک دو روش اسنادی و نظرسنجی از خبرگان انجام شد. برای استخراج نظر خبرگان، از مصاحبه‌های عمیق و هدفمند، استفاده شد. در نهایت، تجزیه و تحلیل اطلاعات از طریق تکنیک تحلیل سلسله‌مراتبی با کمک نرم‌افزار اکسپرت چویس، انجام شد. این مرحله به وسیلۀ پنل خبرگان اجرا شد. یافته‌های پژوهش نشان می‌دهد رشته مهندسی آب با ضریب ۰/۲۳۳ اولویت نخست دانش پیشران استان کرمانشاه است. علوم باغبانی (۰/۱۹۶) و علوم مربوط به بیوتکنولوژی (۰/۱۳۸) نیز، در اولویت دوم و سوم، جای گرفتند. نتایج تحقیق برای بازنگری در سیاست‌گذاری‌های آموزشی دانشگاه‌ها و مراکز تحقیقاتی استان، تخصیص بهینه منابع محدود موجود در دستگاه‌های دولتی ذیربط (جهادکشاورزی و مراکز تحقیقاتی مربوطه) و همچنین تعیین خط‌مشی پارک علم و فناوری و مراکز رشد کشاورزی استان، می‌تواند مفید واقع شود.

واژه‌های کلیدی: استان کرمانشاه، اقتصاد دانش‌بنیان، بخش کشاورزی، دانش پیشران، فناوری کلیدی

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