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Abstract: The present research aimed to qualitatively design a paradigm for the development of agricultural knowledge-intensive enterprises in the west of Iran using grounded theory. The research population was composed of chief executive officers (CEOs) of agricultural knowledge-intensive enterprises. Based on the results; the causal conditions are composed of the components of aspirations, scientific mission, policy-legal factors, cultural factors, and self-esteem. The contextual conditions are composed of the components of governmental support, team making, and economic factors. The core category includes gaining competitive advantage and adaptability, and the intervening conditions include personal factors, wisdom-orientation, the existence of R&D culture, and corporate features. The components constituting strategies are managerial and policymaking factors, educational and research activities, platforms and infrastructure, scientific communications and networks, knowledge dissemination, and entrepreneurship. Finally, the development of knowledge-intensive enterprises will have positive consequences from the perspective of science, economy, and the realisation of Iran's 20-Year Vision Document, human, production, and marketing.

Keywords: agriculture; development; enterprise; infrastructure; economy; knowledge-based; personal factors; cultural factors; policy-legal factors.

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1 Introduction

In modern paradigms of agricultural development, knowledge and technology play a key role in the growth and development of sustainable agriculture. These paradigms are referred to as scientific agriculture, knowledge and technology-based agriculture, and knowledge-intensive agriculture (Fallah Haghighi and Mirtorabi, 2018).

Knowledge-intensive agriculture enhances the efficiency of agricultural production vs. traditional agriculture. Knowledge-intensive enterprises are a key option for wealth generation in developing countries (Mardanshahi, 2017). Currently, the economies of developed countries are most dependent on knowledge production, sharing, and use. In other words, in today's world, unlike traditional resources of the economy, including land, labour, and capital, scientific knowledge has emerged as the driving force of economic growth (Fontana et al., 2006). In Iran, the upstream documents, e.g., the

Policies of Article 44 of the Constitution, the Fourth and Fifth Development Plans, and the 20-Year Vision Document, have all recognised knowledge economy as an influential field and have prioritised its development in all development plans of the country. The precondition to achieve the goals enumerated in these documents is to establish and develop knowledge-intensive enterprises (Khayatian Yazdi et al., 2016). Knowledge-intensive enterprises are known as an economic development tool (Jafari Pastaki et al., 2018) and play an essential role in economic growth and development by commercialising scientific and technological achievements.

The involvement of these enterprises in the economy will result in increasing employment, sales, exportation, and capital formation and their involvement in the field of technology will result in the transfer of technology from the research sectors to production and industrial sectors (Mansuri et al., 2017). However, research shows that agricultural research is poorly commercialised in Iran so that this needs urgent attention (Fallah Haghighi and Mirtorabi, 2018). Given the crucial role of knowledge-intensive organisations in the development and in the 20-Year Vision Document of Iran, the documents related to these organisations show that 61.4% of the 95 projects implemented in high-tech organisations have failed to achieve their goals from 2003 to 2015 (Khalil Zadeh et al., 2016). An overview of the performance of Iran in the last two decades indicates that in spite of constructing the infrastructure required for the development of knowledge-intensive enterprises, such as specialised and educated human resource, the enhancement of laboratories, and considerable scientific progress, we have failed to succeed in the production of knowledge-intensive businesses (Narimani, 2017). Similarly, in the agricultural setting, knowledge-intensive enterprises are limitedly available despite the urgent need of the agricultural industry to them, and even these limited enterprises are faced with numerous problems (Yousefi et al., 2017) and are highly prone to fail (Fakhari et al., 2013). The output expected from the mission of knowledge-intensive enterprises in science and technology parks in Iran, i.e., the reinforcement of entrepreneurship morale at universities and scientific communities, has not been realised and these enterprises have not been perfectly successful and are struggling with structural challenges (Gholami and Ramezani, 2019).

Relevant statistics show that most knowledge-intensive enterprises have been eliminated or remained small over time, and only a few have been able to prosper into larger firms (Khayatian Yazdi et al., 2016). These enterprises have failed to sell their products and services and this has hindered their sustainability and development (Gholami and Ramezani, 2019). Previous research also shows that policymakers have mostly focused on science generation, technology development, and their commercialisation in knowledge-intensive enterprises and re-investment in science and technology generation (Souzanchi Kashani et al., 2014), and less attention has been paid to the issues of knowledge-intensive enterprises, especially agricultural enterprises, and tackling them to allow their development. For instance, Khayatian Yazdi et al. (2016) report that the sustainability of knowledge-intensive enterprises has been composed of four components, i.e., financial outputs, market outputs, innovation outputs, and entrepreneurship outputs. According to them, the factors influencing the sustainability of knowledge-intensive enterprises have two main components of intra-organisational factors (composed of two categories of personal factors of founders and corporate factors) and extra-organisational factors (composed of two categories of business features and innovation system components). In their study on the factors responsible for the viability of knowledge-intensive enterprises, Mahdavi et al. (2008) enumerate marketing

and sale, financial issues, production, distribution, research and development (R&D), legal issues, and human resource as the main ones. Mirghafoori et al. (2018) focused on designing an integrated model of innovation development and commercialisation in Iranian knowledge-intensive enterprises. They conclude that reaching the market is the key to the development and commercialisation of these enterprises. In an attempt to design a model for the establishment and development of knowledge-intensive enterprises in the context of human sciences, Roumezi et al. (2020) identified four steps of the initial idea, R&D, the transfer of results, and research and exploitation of research findings and six strategies of management and policymaking, educational and research activities, platforms and infrastructure, scientific communications and networks, and knowledge and innovation sharing and dissemination for the development of agricultural knowledge-intensive enterprises. Tari et al. (2016) addressed the factors underpinning the growth and viability of knowledge-intensive enterprises and categorised them at three levels – personal factors, organisational factors, and environmental factors. According to the results, the government and environmental conditions tend to play a more important role in laying the ground for the growth and success of these enterprises so that this factor has a key role in the sustainability of spin-off and knowledge-intensive enterprises. Dehdashti Shahrokh et al. (2019) reports that the paradigm of service commercialisation in knowledge-intensive enterprises in the information and communication technology industry include market research (need assessment), idea generation, analysis and financing, recruitment and training, development and implementation of marketing and advertisement strategies, comprehensive feasibility study of production, production, testing, improvement and enhancement, quality control, issuing permits and standards, and development and implementation of pricing, sale, and distribution strategies. Fallah Haghighi and Mirtorabi (2018) explored the problems of agricultural knowledge-intensive enterprises deployed in the Iranian Research Organization for Science and Technology and classified them into four concepts and 22 codes. The most important ones were distrust of the market of agricultural knowledge-intensive products, lack of facilities and financial support of agricultural knowledge-intensive enterprises, poor administrative and legal structure for the establishment of agricultural knowledge-intensive enterprises, and insufficiency of supportive and commercialisation policies and regulations in the context of agricultural research. Amini and Fatahi (2018) categorised the primary factors of the viability of knowledge-intensive enterprises into three groups of causal, environmental, and intervening factors. Causal factors included organisational and personal components, environmental factors included environmental and enterprise features, and intervening factors included managerial and organisational conditions. In a study on modern attitude towards third-generation universities aimed at developing knowledge-intensive enterprises, Zeynali (2016) concluded that the most important need of the modern world is the proper response of the higher education system to social, cultural, political, and economic changes. Response to new expectations from higher education institutions has led them towards internal changes, a change in their interaction of socioeconomic environment, and a change in their approach from education-based (first-generation) and research-based (second-generation) universities to entrepreneurial universities (third-generation). Mirzaei et al. (2016) identified the barriers to the success of applied research activities in universities and listed the main ones as management and policymaking barriers, organisation, regulations and research, researchers, cultural motives, research support and facilities, educational system and structure, policy and structure, and financing and administrative barriers. Kalantari et al. (2015) report nine

factors as the barriers of research commercialisation, including academic platforms and infrastructure, knowledge management, university strategy, faculty quality, research nature and its commercial orientation, academic networks, university management, university human resources, and financial structure and resources. Naghizadeh et al. (2018) identified the factors affecting the sustainable growth of knowledge-intensive startups in Iran and showed that the characteristics of the founders were a major factor in the growth and sustainability of these enterprises.

Grimsdottir et al. (2019) studied knowledge development in small and medium-sized enterprises and reported that brainstorming, the cooperation of the organisation's members, motivation, teamwork, and formal and informal collection of data were the main factors for the establishment and development of knowledge in these enterprises. Tuli et al. (2019) focused on planning for the establishment of knowledge-intensive enterprises in Melbourne, Australia and found that some factors hindered the development of these enterprises, the most important ones being the lack of national policies, poor coordination between different public sectors for strategy development, inattention to human capital, and inattention to the skills of students and home-grown talents. Wennberg et al. (2011) explored the performance difference between individuals who only focused on the transfer of knowledge from academic research and founded enterprises with no practical and industrial experience and those who engaged in the creation of a new job with academic training. They concluded that knowledge gained by experience for entrepreneurial activities was more valuable than academic knowledge acquired by research experiences at a university.

The review of the literature shows that various studies have dealt with knowledge-intensive enterprises, but no research has comprehensively attempted to design a paradigm for the development of agricultural knowledge-intensive enterprises whereas the agricultural sector has high importance in the added value of Iran and any contribution to the growth and development of startups in this sector can help Iran's economic development. The western province of Iran, including Kermanshah, Ilam, Hamedan, Kurdistan, and Lorestan, are agricultural hubs, and every year, many students graduate in agriculture disciplines from the universities of these provinces, but most of them are left unemployed. So, the development of knowledge-intensive enterprises is of much higher significance in the agricultural sector and in these provinces. However, the literature review shows that policymakers have mainly focused on the cycles of science production and technology development and commercialisation in knowledge-intensive enterprises and their re-investment in the production of science and technology, and they have given less attention to the issues and problems of these enterprises, especially agricultural knowledge-intensive enterprises, and solving these problems to help their development. Furthermore, although various paradigms have been proposed for the development of these enterprises, no paradigm has ever been presented for the development of agricultural knowledge-intensive enterprises, especially those in the west of Iran due to their few number vs. the whole country (the share of western provinces of Iran in agricultural knowledge-intensive enterprises is less than 8% whereas these provinces account for about 33% of the cultivated area of the Iran's agricultural products). So, this research is the first study in this field, which is its contribution, too. Given the lack of any similar research in the west of Iran and the share of these provinces in Iran's agriculture, the present research can contribute to not only the growth of the knowledge-intensive enterprises but also the development of the agricultural sector in these provinces by presenting the factors influencing the

development of these enterprises. Additionally, previous studies have less considered the development of agricultural knowledge-intensive enterprises from the perspective of their managers. This gap is filled with the present research. Therefore, the main question that the present research aims to answer is, ‘What is the optimal paradigm for the development of agricultural knowledge-intensive enterprises in western Iran?’ The research employs a field study of knowledge-intensive enterprises in western provinces and interviews with the successful managers of these enterprises to design a development paradigm for knowledge-intensive enterprises in the agricultural sector in these provinces.

2 Methodology

The research was conducted with a qualitative perspective by grounded theory as the research methodology. Out of the two approaches including objectivism (Strauss and Corbin, 2011) and constructivism (Chawla, 2007), the research adopted Strauss and Corbin’s (1998) objectivism because this approach uses a systematic set of procedures to develop a theory for a phenomenon inductively. In the present qualitative work, the researchers first selected several axes based on the review of the literature and theoretical framework to initiate interviews with them and collect interviewees’ experiences. These axes were arranged as the main categories to be dealt with by the interviewees. They were then asked to express their own experiences. The research population was composed of the CEOs of successful academic and knowledge-intensive enterprises in western provinces of Iran (Kurdistan, Hamedan, Kermanshah, Ilam, and Lorestan), amounting to 21 people who were selected by the purposive method for data collection. Data were collected by semi-structured in-depth interviews.

The interviews were started with asking questions as to the motives and main goals of establishing knowledge-intensive enterprises. Then, factors of the success of these enterprises in a competitive market, factors of their development, platforms and infrastructures for their development, barriers, strategies, and the main characteristics of managers who are influential in their development were discussed. Finally, the interviews were concluded with the consequences and strategies of the development of knowledge-intensive enterprises (Appendix 1).

After the collection and analysis of the answers, the items that did not fit the goals of agricultural knowledge-intensive enterprises were discarded with the consultation of the research team. To confirm the validity and reliability of the qualitative phase, data validity was subject to monitoring by the members (for which the results of data analysis were presented to the respondents to be informed of their responses) and the researcher’s self-monitoring during data collection and analysis. To ensure the transferability of the research, the research data were tried to be developed and described deeply during data collection. The credibility of the research was assured by precisely recording the interviewing process and all the details (Anderson, 2003). All recorded interviews were reviewed several times to extract the key points. Eventually, the items approved by the research team were presented to the respondents for final confirmation during which the items that they found inappropriate or unfit to the factors of the development of knowledge-intensive enterprises and the key categories were discarded. To analyse the data, the interviews were transcribed. Then, the collected data were mined by coding and categorised in three steps of open, axial, and selective coding. They were then analysed by the conventional MAXqda12 content analysis software package.

3 Results

3.1 Respondents' demographic and professional characteristics

A total of 21 interviews was conducted with the CEOs including eight interviews with the CEOs of agricultural knowledge-intensive enterprises in Kermanshah province, one interview with the CEO of Pardish Shahr-azin Company in Ilam province, five interviews with the CEOs of agricultural knowledge-intensive enterprises in Hamedan province, four interviews with the CEOs of agricultural knowledge-intensive enterprises in Kurdistan province, and finally, three interviews with the CEOs of agricultural knowledge-intensive enterprises in Lorestan province. The CEOs of the knowledge-intensive enterprises were, on average, 39.33 years old ($SD = 3.55$), showing that most enterprises have been founded by young people. Five respondent CEOs were female (23.80%) and 16 CEOs were male (76.19%). The youngest respondent was 35 years and the oldest was 62 years old. The distribution of the respondents based on the educational level shows that most of them (47.6%) had a Ph.D. degree. Four respondents (19%) had an M.Sc. degree. In terms of the educational field, 13 respondents of the 21 participants (61.9%) had their academic degrees in agriculture, while 7 respondents (33.3%) were graduates of non-agricultural fields. One respondent did not answer this item. The work experience of 7 individuals (33.3%) was less than five years. The lowest frequency was 3 people for the work experience of 15 years or over. Among the 21 participants, 3 managers (14.3%) stated that they had no experience in entrepreneurship. But, 18 individuals (85.7%) gave an affirmative answer to the question as to they had been an entrepreneur during their activity in the enterprise (Table 1).

In the present study, to design a paradigm for the development of knowledge-intensive enterprises in the west of Iran, interviews were first conducted with the CEOs of agricultural knowledge-intensive enterprises in western Iran. Then, the recorded interviews were analysed and the responses were investigated by grounded theory through three steps of open, axial, and selective coding. At the open coding stage, after the interviews were transcribed, they were explored line by line and each sentence was assigned with a unique code. As such, 156 key concepts were identified about the factors responsible for the development of agricultural knowledge-intensive enterprises. The concepts were coded by A, P, R, D, M, and Z. At the end of this stage, it seemed that these key concepts covered all dimensions of the indicators of agricultural knowledge-intensive enterprise development, so it was not necessary to refer back to the studied sample. In other words, the internal validity of the data was confirmed at this stage.

In axial coding, a set of concepts are grouped around a category and are covered like domes and form different categories (Table 2). These conceptual clusters are a departure point that leads the researcher towards a theory. After the concepts and categories are determined, the axial coding stage starts. At this stage, the researcher arranges the categories in a logical order to produce a theory. But beforehand it is necessary to purify the categories in the context of the real data and specify their linkages. These are performed at the axial coding stage. At this stage, comprehensive categories are formed and conceptualised according to the conceptual load of the sentences in each category. The categories formed for the development of agricultural knowledge-intensive enterprises include aspirations, scientific mission, political-legal factors, cultural factors, self-esteem morale, administrative, cooperative, and economic factors, achievement to competitive advantage, adaptability, personal factors, wisdom-orientation, corporate

features, the presence of research and development (R&D) culture, managerial and policymaking factors, platforms and infrastructure, educational and research activities, scientific communications and networks, knowledge dissemination, entrepreneurship, scientific, economic, and human development, the accomplishment to Iran's 20-Year Vision Document, production increase, social development, and marketing. The concepts related to each category are presented in Table 2.

Table 1 The demographic and professional characteristics of the respondents

<i>Demographic and professional characteristics</i>	<i>Stratum</i>	<i>Frequency</i>	<i>Percentage</i>	<i>Valid percentage</i>
Age	<30 years	–	–	–
	30–40 years	12	57.14	60.31
	40–50 years	5	23.80	26.96
	>50 years	2	9.52	12.68
	No response	2	9.52	100
Gender	Female	5	23.80	–
	Male	16	76.19	–
Educational level	Bachelor's degree or lower	7	33.4	–
	Master's degree	4	19	–
	PhD	10	47.6	–
Field of study	Agriculture	13	61.9	65
	Non-agriculture	7	33.3	35
	No response	1	4.8	100
Years of activities	<5 years	7	33.3	35
	5–10 years	6	28.6	30
	10–15 years	4	19	20
	>15 years	3	14.3	15
	No response	1	4.8	100
Experience in entrepreneurship	Affirmative	18	85.7	–
	Negative	3	14.3	–

3.2 Selective coding and paradigm development

In the selective coding stage, the concepts and categories analysed in open coding are connected to one another in new ways to build the linkages between category and subcategories. This is performed by using a paradigm composed of causal conditions, contextual conditions, intervening conditions, a core category, strategies, and consequences (Strauss and Corbin, 2008). The core category is the key idea of the research – here, the development of agricultural knowledge-intensive enterprises. The selective coding stage deals with discovering a key category for the research and relating it to the other categories within a paradigm. In the next paragraphs, we present the indicators and components related to each part of the model and a paradigm for the development of agricultural knowledge-intensive enterprises in the west of Iran.

Table 2 The results of axial coding

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>	
Causal conditions	Aspirations	Gaining the trust of the market in the efficiency and quality of knowledge-based products	4	A1	
		Commercialising research findings		A2	
		Empowering graduates to enter the labour market		A3	
		Realistically studying the market and its demand by managers and members of agricultural knowledge-intensive enterprises		A4	
	Scientific mission	Efforts to improve the quality of knowledge-intensive products in the agricultural sector	4	A5	
		Engaging in applied research in agricultural knowledge-intensive enterprises		A6	
		Planning to convert science to wealth in agricultural knowledge-intensive enterprises		A7	
		Attention to the perpetual need for vocational training and discipline among enterprise personnel.		A8	
	Political-legal factor	Improving the agility of the administrative system in the Ministry of Agriculture Jihad in the field of the related inspection system and licensing;	Facilitating governmental laws for the registry of knowledge-intensive products and facilitating the process of the presence of knowledge-intensive enterprises in science and technology parks	13	A9
			Appropriately making policies and planning by the officials of the agricultural sector to develop and support agricultural knowledge-intensive enterprises in order to modernise the agricultural sector with the aim of achieving high productivity and income in the agricultural sector		A10
			Providing political and legal tools to increase the competitiveness of agricultural knowledge-intensive goods with similar products of foreign competitors in the market		A11
			Shrinking bureaucracy related to the registry and approval of knowledge-intensive enterprises and eliminating brokerage in enterprise registration		A12
			Adopting appropriate policies to prevent smuggling and import of similar products for the development of organisations		A13
			Adopting a law to protect knowledge-intensive enterprises and allow them to enjoy the benefits of free zones		A14
					A15

Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>
Causal conditions	Political-legal factor	Developing a law to protect intellectual property in agricultural knowledge-intensive enterprises		A16
		Marketing of knowledge-intensive products by the government		A17
		Reforming competitive policies such as eliminating various monopolies and rents		A18
		Eliminating quasi-rent monopoly in the agricultural sector		A19
		Mobility and effectiveness of the Agricultural Engineering System		A20
		Organisation as the only trade union organisation of agricultural graduates in this field		A21
	Cultural factors	Not allowing the copy of agricultural knowledge-intensive products		A21
		Transforming the culture of risky investment into an institutional culture in enterprises by parks through gaining the trust of venture investors and guaranteeing the return on capital and profit	4	A22
		Strengthening the culture of entrepreneurship, participation, and teamwork in knowledge-intensive enterprises		A23
		Emphasising the use of the youth in knowledge-intensive enterprises		A24
		Improving the culture of not buying foreign products by managers		A25
		Self-esteem	Obliging state-run agencies to purchase knowledge-intensive products	2
	Creating a successful brand for knowledge-intensive products		A27	
Contextual conditions	Government factor	Government's technical and financial support of agricultural knowledge-intensive enterprises	15	Z1
		Adopting measures to facilitate the access of knowledge-intensive enterprises to technology and technical consulting		Z2
		Reducing government ownership and clarifying the workflow in the agricultural sector		Z3
		Providing the necessary training for the founders of knowledge-intensive enterprises		Z4

Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>
Contextual conditions	Government factor	Providing tax, protection, and customs incentives for knowledge-intensive enterprises and their products		Z5
		Eliminating rents in the agricultural sector market by those in charge of the agricultural sector		Z6
		Appropriate insurance coverage of technological and innovative activities of agricultural knowledge-intensive enterprises		Z7
		Specifying how to price agricultural knowledge-intensive products		Z8
		Appropriate and realistic pricing of products that are similar to knowledge-intensive products in the market		Z9
		Determining the process of registration of intellectual property of agricultural knowledge-intensive enterprises		Z10
		Developing a support package for agricultural knowledge-intensive enterprises		Z11
		Supporting the promotion of agricultural knowledge-intensive enterprises in the media		Z12
		Allocating location and equipment to spin-off knowledge-intensive enterprises with the approval of the boards of trustees		Z13
		Implementing incentive policies by the government, such as loan granting or tax exemptions to industry owners or forcing them to allocate a portion of their profits to purchase products from knowledge-intensive enterprises		Z14
		Facilitating the process of patenting for knowledge-intensive enterprises		Z15
		Team formation and social networking among the members of agricultural knowledge-intensive enterprises	5	Z16
		Development of critical resources as a management team		Z17
		Human resources recruitment		Z18
Existence of experienced consulting teams to communicate with members of knowledge-intensive enterprises		Z19		
		Customer attraction		Z20

Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>
Contextual conditions	Economic factor	Ability to provide and manage the required money and credit and proper record of accounts by members of knowledge-intensive enterprises	7	Z21
		The amount of capital and initial resources of the enterprise		Z22
		Appropriate allocation of budget between units and departments active in the field of agricultural knowledge-intensive enterprises		Z23
		Attracting foreign investors to invest in agricultural knowledge-intensive enterprises		Z24
		Increasing the share of the government-allocated budget in idea-based agricultural activities;		Z25
		Adoption of measures to facilitate access of knowledge-intensive enterprises to technology and technical consulting		Z26
		Having a robust financing model by the enterprise		Z27
Core category	Gaining competitive advantage	Constantly monitoring the market and analysing competitors	14	M1
		Identifying the hidden needs of customers to provide value beyond competitors		M2
		Close verbal, linguistic, and cultural communication of enterprises with target farmers and having a local marketer or consultant in each region		M3
		Being aware of the psychology of the farmers and understanding their concerns		M4
		Ongoing activities in the R&D department to increase productivity in the enterprise's products to reduce costs and make the cost of the product competitive		M5
	Gaining competitive advantage	Providing after-sales service and product warranty	M6	
		Being a pioneer in the market	M7	
		Introducing new business models	M8	
		Producing a new product	M9	
		Attracting investors and partners	M10	
		Attracting new customers	M11	
		Mass production and presentation into the market	M12	
		Exporting the enterprise's products to other countries	M3	
		Having morale of risk-taking in the enterprise	M14	

Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>
Core category	Adaptability	Ability to adapt to heterogeneous needs of customers	2	M15
		The ability of fast adaption, acclimation, and re-organisation of the enterprise in the face of environmental changes		M16
Intervening conditions	Personal factor	Enterprise members' skills, expertise, and experience	13	D1
		Enterprise members' homogeneity in the experiences		D2
		Enterprise members' education, attitudes, and values		D3
		Enterprise members' knowledge of the market		D4
		Enterprise members' gender		D5
		Enterprise members' joint work experience		D6
		Enterprise members' experience in the industry		D7
Intervening conditions	Personal factor	Enterprise members' spirit of self-confidence in relation to the extraction of knowledge and strengthening it		D8
		Enterprise members' spirit of cooperation and knowledge sharing		D9
Intervening conditions	Personal factor	The use of knowledgeable people with international experience as consultants and partners		D10
		Sufficient motivation and interest in employees		D11
		Enterprise members' abroad academic degrees		D12
		Diversity of expertise among enterprise members		D13
	Wisdom-orientation	Protection of intellectual property in agricultural knowledge-intensive enterprises	3	D14
		Paying attention to the intellectual property rights and intellectual property of the enterprise		D15
		Development of e-government, e-commerce, and information and communication technologies		D16
	Existence of R&D culture	Quality of scientific papers published in the field of agricultural knowledge-intensive enterprises	3	D17
		Transforming scientific and research ideas into products and services and guiding knowledge-intensive enterprises		D18
		Existence of a strong R&D department in the enterprise		D19

Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>			
Intervening conditions	Corporate features	Enterprise's experience	5	D20			
		The small size of knowledge-intensive enterprises		D21			
		Location and proximity of agricultural knowledge-based companies to the industrial sector		D22			
		Perspective and growth-oriented mission of the enterprise		D23			
Strategies	Management and policymaking factor	Deployment in free zones	7	D24			
		Strategic planning		R1			
		Resource management		R2			
		Recruitment management		R3			
		Talent management		R4			
		Scientific responsibility		R5			
		Accountability		R6			
Strategies	Educational and research activities	Talent-oriented management	8	R7			
		Scientific transformation		R8			
		The ability of persistence in innovation and production of new products/services and responding to the mobility of competitors and changes in market requirements as needed		R9			
		Development of knowledge boundaries		R10			
		Applied research		R11			
		Providing marketing training to CEOs		R12			
		Investment in training and empowerment of human resources in the field of entrepreneurship		R13			
		Development of scientific hubs		R14			
		Having a scientific holistic view		R15			
		Platforms and infrastructure			Being supportive	5	R16
					Scientific authenticity		R17
					Pragmatism		R18
					Being culture-oriented		R19
		Scientific communications and networks			Scientific credibility	5	R20
					Scientific diplomacy		R21
Scientific dialogue	R22						
The synergy of scientific centres	R23						
Development of international research	R24						
Development of connections among knowledge-intensive enterprises	R25						

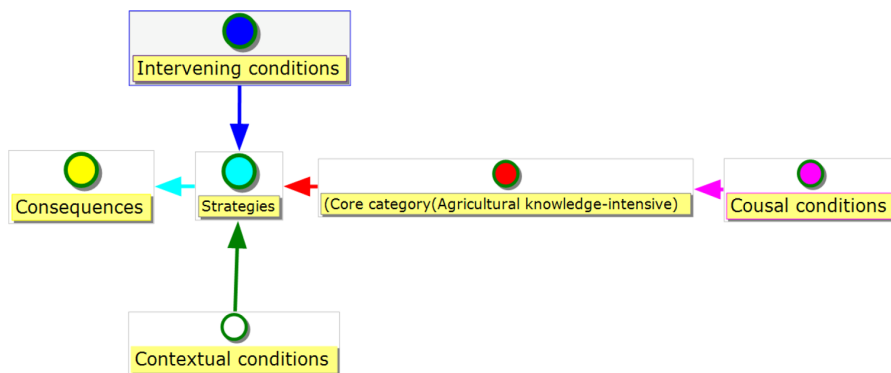
Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>		
Strategies	Knowledge dissemination	Social responsibility	3	R26		
		Cultural responsibility		R27		
		Development of scientific meetings and conferences		R28		
	Entrepreneurs hip	Risk-taking	4	R29		
		Opportunity creation		R30		
		Creativity		R31		
		Innovation-orientation		R32		
Consequences	Scientific development	The ability of timely supply of products/services to the market as per the enterprise's conditions	3	P1		
		Service providing to the community		P2		
		Development of innovations and inventions		P3		
	Accomplishment to Iran's 20-Year Vision Document	Drawing a comprehensive scientific map for the country	6	P4		
		Creating employment		P5		
		Globalising		P6		
		Accomplishing the goals of resistance economy		P7		
		Reducing governmental takeover in the agricultural sector and increasing its monitoring role		P8		
		Enhancing the conservation of water and soil resources for sustainable development		P9		
		Economic development		Increasing sale and exportation	5	P10
				Increasing capital and capital return		P11
				Increasing productivity and profitability		P12
	Food security sustainability		P13			
	Self-sufficiency		P14			
	Human development	Development of humanism and wisdom-orientation	5	P15		
		Enhancement of problem-solving capability among the members		P16		
		Increasing the number of employees		P17		
		Increasing customers		P18		
		Empowering the members		P19		
	Production	Product diversification	3	P20		
		Production of up-to-date products		P21		
		Increasing product quality		P22		

Table 2 The results of axial coding (continued)

<i>Core category</i>	<i>Sub-category</i>	<i>Concepts</i>	<i>Frequency</i>	<i>Code</i>
Consequences	Social development	Gaining social, cultural, and political reputation by the enterprise and its members	3	P23
		Increasing customer responsiveness		P24
		Creating welfare for rural communities		P25
	Marketing	Increasing the number of contracts	5	P26
		Gaining the support of ministries, organisations, and other countries for the products		P27
		Gaining the required standard certificates from authentic national and international organisations		P28
		Increasing customer satisfaction		P29
		Increasing popularisation		P30

Figure 1 A paradigm for the development of agricultural knowledge-intensive enterprises (see online version for colours)



As is evident in Figures 1 and 2, the causal conditions directly influence the core category, i.e., the development of knowledge-intensive enterprises. The core category influences the strategies. In addition, the intervening conditions and contextual conditions directly impact the strategies. Finally, the strategies influence the consequences of developing agricultural knowledge-intensive enterprises and entail several implications for these enterprises in different aspects. Figure 3 depicts the components of each factor. It is evident that the causal conditions are composed of five components of aspirations, scientific mission, political-legal factors, cultural factors, and self-esteem morale. Three components are related to the contextual conditions. They are governmental support, cooperative factors, and economic factors. The intervening conditions are composed of four components: personal, wisdom-orientation, the existence of an R&D culture, and corporate features. Two categories are related to the core category. They include achievement to competitive advantage and adaptability. The strategies of developing knowledge-intensive enterprises have three components including managerial and policy-making component, educational and research activities, platforms and infrastructure, scientific communications and networks, knowledge dissemination, and entrepreneurship.

The consequences of developing agriculture knowledge-intensive enterprises are also specified by scientific aspects, the accomplishment to Iran's 20-Year Vision Document, economic aspect, human aspect, production aspect, social aspect, and marketing.

Figure 2 A paradigm for the development of agricultural knowledge-intensive enterprises

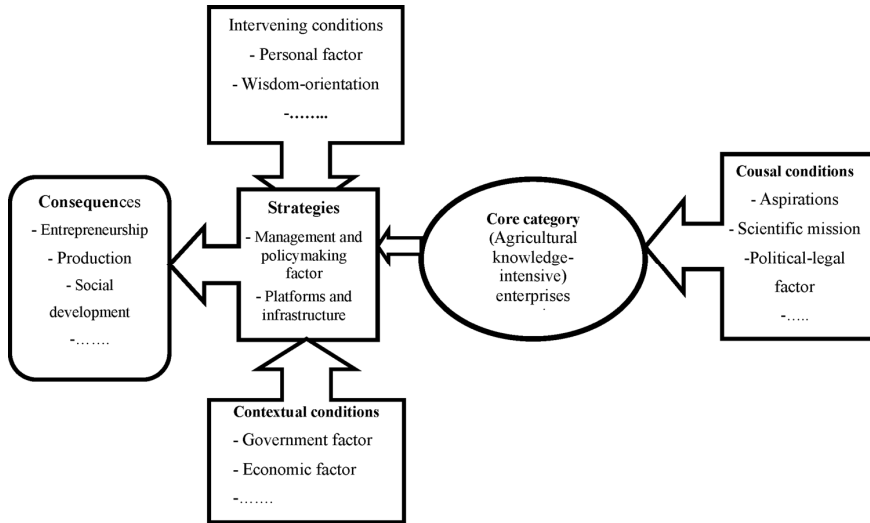
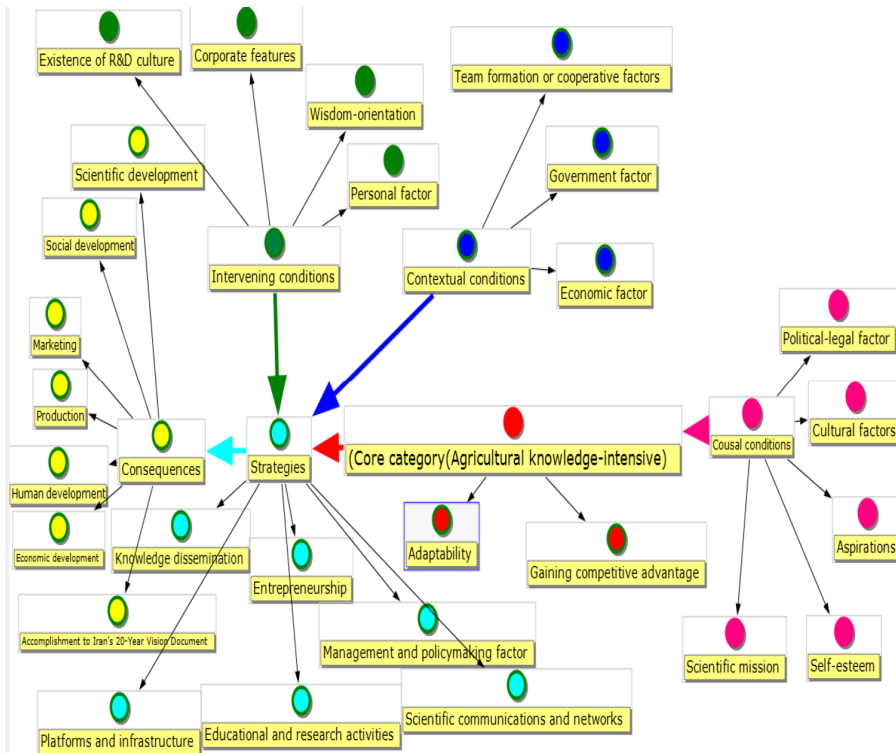


Figure 3 The relationship between the factors and indicators of a paradigm for the development of agricultural knowledge-intensive enterprises (see online version for colours)



4 Conclusions

Agricultural knowledge-intensive enterprises in Iran have not grown significantly and still they have lagged in the western province of Iran vs. the other regions. Accordingly, the present research aimed to design a paradigm for the development of agricultural knowledge-intensive enterprises in western Iran. Based on the results, the development of agricultural knowledge-intensive enterprises is directly affected by causal conditions (aspirations, scientific mission, political-legal factors, cultural factors, and self-esteem morale). A component related to this part is the aspiration, which should be considered by agricultural knowledge-intensive enterprises. For instance, they should consider the quantity and quality of their products to ensure customer satisfaction, surpass competitors, and accomplish commercialisation and profitability. Another component related to this category is to empower the graduates of this sector. Since a major drawback of the higher education system in Iran, especially the agricultural higher education system, is that it does not prepare the graduates to enter the labour market, agricultural knowledge-intensive enterprises can engage their members in practical and scientific activities, thereby enhancing their technical skills, which will contribute to the entrepreneurship. Amini and Fatahi (2018) also state that intervening factors and the supply of technical skills by knowledge-intensive enterprises are important for their success.

Knowledge-intensive enterprises have important scientific missions, including improving the quality of their products to achieve a market share and succeed in the market and conducting applied research that would result in the production of high-quality products that fit customer needs. Dehdashti Shahrokh et al. (2019) also show that producing high-quality products that are suited to market needs is a success factor of agricultural knowledge-intensive enterprises. Political-legal factors constitute a category related to causal conditions for the development of agricultural knowledge-intensive enterprises. According to most participants, this component is an essential problem and barrier that engages CEOs at the beginning of their activity and discourages them, so officials should pay serious attention to this problem. Dehdashti Shahrokh et al. (2019) and Fallah Haghighi and Mirtorabi (2018) have mentioned strict administrative regulations and paperwork as a barrier against company registration. The participants also suggest that actions to prevent the import of agricultural knowledge-intensive products and their copying and the measures by the Engineering System Organization – as an institution working with agricultural graduates – to support knowledge-intensive enterprises are effective in developing a part of the activity of these enterprises. This is supported by Fallah Haghighi and Mirtorabi (2018). Another category related to the causal conditions of the development of agricultural knowledge-intensive enterprises is cultural factors one of whose key components is to build up the trust of risk-averse investors to invest in the western provinces of Iran. Since some of these provinces are located in the borderline area, investors, especially foreign investors, perceive investment in these regions as a risk. So, proper conditions should be provided for them, e.g., gain trust in capital return. As such, investment in these regions will be an opportunity for marketing, sale, and export, not a threat. Furthermore, the respondents emphasised trust in the youth in agricultural knowledge-intensive enterprises, like other sectors so that they should not be discouraged with the pretext of their lack of experience. Another issue pertaining to cultural factors is to make a change in the attitude of the people towards the quality of knowledge-intensive enterprises' products and to encourage them to use domestic

products, thereby contributing to the prosperity and growth of domestic production. The issues of purchasing domestic products and reinforcing the culture of their purchase are emphasised in Fallah Haghighi and Mirtorabi (2018), too.

Strategies are mechanisms and actions taken to cope with a phenomenon. The development of agricultural knowledge-intensive enterprises needs management and policymaking, educational and research strategies, platforms and infrastructure, knowledge dissemination, scientific communications and networks, and entrepreneurship. Indeed, a current challenge in Iran is the multiplicity of policymaking centres, which is a reason for many present malfunctions in Iran. So, the first challenge related to the research findings is to recognise the role of policymaking. As well, many educational and research centres and institutions within state-run organisations and governmental ministries further complicate the situation so that they engage in issues with no awareness of the others, and this results in duplications. In these conditions, negotiation and synergy hardly happen. This finding is consistent with the reports of Zeynali (2016) and Mirzaei et al. (2016). There are also basic issues about educational and research activities. Furthermore, there are broader factors that influence the development, establishment, and halting of education and research. These supportive or inhibitory factors include, but not limited to, the capability of persistence in innovation and production of new products and services, the potential to respond to the movements of competitors and changes in market needs as required, the development of knowledge, conducting applied research, and providing training, especially on marketing, to the managers of agricultural knowledge-intensive enterprises. This is in agreement with Zeynali (2016) and Mirzaei et al. (2016).

Platforms and infrastructure refer to the part of the model infrastructure that facilitates the development of agricultural knowledge-intensive enterprises, such as giving facilities to knowledge-intensive enterprises and periodically providing their members and CEOs with diverse training as required, providing platforms and infrastructure for applied activities, and reinforcing platforms and infrastructure to create trust in different fields. The lack of scientific authenticity, a local model of development, scientific trustworthiness, and supports are gaps in research commercialisation, which requires basic actions. These results agree with the report of Roumezi et al. (2020).

A component for the approaches to developing agricultural knowledge-intensive enterprises identified within the interviews was scientific communication and interactions. It should be noted that there is a belief in the significance of interaction, mutual relationships, and the role of scientific circles and collective and cooperative activities among members. In the present study, the strategies identified for scientific communications and networks include scientific diplomacy, scientific dialogue, the synergy of scientific centres, the development of international research, the development of communications among knowledge-intensive enterprises such as the link between universities and industries, the development of activities related to the link between investors and new ideas, cooperation and network of universities with authentic domestic and international universities, the implementation of shared programs, and the establishment of an office to register and guide new ideas and technology. Mirghafoori et al. (2018) and Kalantari et al. (2015) also noted the importance of scientific communications and networks.

Knowledge publication and dissemination is also a strategy for the development of agricultural knowledge-intensive companies. Knowledge is a perpetual source at the disposal of economic enterprises, which contributes to gaining a competitive advantage, increasing added value, and ensuring sustainable development by frequent participation

in different production and service processes. Knowledge-intensive businesses play a significant role in developing and modelling production, research, and development processes, commercialising knowledge, enriching science and techniques, training, fostering, and developing human resources, and sharing knowledge, which is supported by Wennberg et al. (2011).

Another strategy for the development of agricultural knowledge-intensive enterprises is the entrepreneurial potential of people, which should be considered. The major components of fostering entrepreneurial human resources are to train risk-taking, how to grasp opportunities, and creativity, which need to be considered. This is supported by Dehdashti Shahrokh et al. (2019), Fallah Haghighi and Mirtorabi (2018), and Roumezi et al. (2020). However, strategies are directly influenced by contextual conditions (governmental, cooperative, and economic factors) and intervening conditions (personal factors, wisdom orientation, the existence of an R&D culture, and corporate features), too. According to the respondents, since knowledge-intensive enterprises are still novices in most fields, they need serious support from the government, which can take the form of technical and financial support, tax exemptions, insurance coverage, and tax incentives, which is consistent with Khayatian Yazdi et al. (2016) and Mahdavi et al. (2008).

Cooperation and collaboration among the members of a knowledge-intensive enterprise are important because human resources and their cooperation can create a synergy in different settings and can help resolve issues and problems. Grimsdottir et al. (2019) corroborate this finding. The issue of the economy as a field related to contextual conditions can be effective in the development of agricultural knowledge-intensive enterprises via the absorption of investors, the allocation of budget to these enterprises, and the enhancement of the enterprise's capital. Dehdashti Shahrokh et al. (2019) report a similar finding. Corporate characteristics, its members, and the culture of R&D among the members are other key factors for the development and success of the enterprise, which are among the intervening conditions. In this respect, it can be said that human resource is the foundation of the viability of any organisation and corporation, especially knowledge-intensive enterprises. The people in these enterprises need to be experienced, skilful, and expert in their fields. This factor is an important element for the development and success of knowledge-intensive enterprises, too. Furthermore, these enterprises need to employ motivated and diligent people. The morale of self-esteem and collaboration is also a character that is essential for the human resource to contribute to the success of a knowledge-intensive enterprise. The same result is reported by Tuli et al. (2019). The respondents also suggest that an R&D department that can transform scientific and research ideas into products and services, and publish scientific papers about the issues and problems of the knowledge-intensive enterprise will be very effective in the development and success of the enterprise as confirmed by Mahdavi et al. (2008), too. Another contextual factor that is effective in the development of agricultural knowledge-intensive enterprises is corporate features, e.g., the history of activity, the relationship with the industry, and the growth perspective and mission. Obviously, a corporate with a longer history of activity is more experienced and this experience is a major factor for its success. The relationship of an enterprise with the industry, their mutual cooperation and collaboration to solve the problems of both sectors, and the awareness of the industry's requirements and the development of corporate plans as per those requirements can greatly help the enterprise to accomplish its goals.

Finally, the development of agricultural knowledge-intensive enterprises indirectly has positive consequences including economic, scientific, human, production, and social development and the accomplishment to the goals of Iran's 10-Year Vision Document.

The interviewed CEOs, indeed, suggest that if all components are paid attention, the main consequences of these enterprises can be the scientific development from the perspective of innovations and inventions, the accomplishment to Iran's 20-Year Vision Document about employment, globalisation, the accomplishment to economic goals, the conservation of water and soil resources by scientific farming practices, and the production of climatically-compatible crops. It will also contribute to economic growth and development by increasing sales, exportation, capital return, productivity, and self-sufficiency. From the human aspect, they strengthen problem-solving capability in the human resource and produce high-quality, diverse, and up-to-date products, thereby raising customer satisfaction and creating welfare for the target and rural communities. The final results of these actions are prosperity, more production, and realisation of the resistance economy goals.

Recommendations

Given the research findings regarding the strong effect of causal conditions (main factors) and their indicators on the development of agricultural knowledge-intensive enterprises, the planners and officials need to pay serious attention to these indicators and components, including

- Seriously considering the applied research on agricultural knowledge-intensive enterprises and providing support for the enterprises to commercialise their research findings.
- Since the input of these enterprises is research, this sector should be considered and enterprises should have a strong R&D department. Also, adequate attention should be paid to applied studies. The development of international research and keeping the science and knowledge up-to-date can be effective in creating and developing applied research in agricultural knowledge-intensive enterprises.
- Triggering a transition in academic curricula from theoretical courses to practical training to empower graduates and allow them to gain practical experience, which will finally foster specialised graduates with practical experience that are ready to work in agricultural knowledge-intensive enterprises.

According to the results, the strategies are affected by three categories of intervening conditions (factors facilitating or limiting the execution of the strategies), contextual conditions (platforms and infrastructure), and core category (the main and axial phenomenon). The following recommendations can be made about the different components of these factors to strengthen them:

- The factor of international communications and the identification of the international market has been included in the intervening conditions of the model. In this regard, it is recommended to the managers of this field to expand international links with key prospects and partners at the global level through participation in scientific

conferences and specialised exhibition in order to lay the ground for the viable presence in the international arena.

- The presentation of the products of agricultural knowledge-intensive enterprises by organisations that are in direct contact with farmers and rural people, e.g., agriculture jahad organisations, in rural districts can help the marketing and sale of these products.
- Providing the conditions for the insurance of the products of these enterprises and the enterprises themselves, as well as their members, can contribute to ensuring investors about the security of their investment and activity in these enterprises.
- Training and empowering the staff of these enterprises to mentally and professionally prepare them for entering the global markets is another recommendation to empower the employees in order to use their potential in the process of globalisation.

The research findings regarding the indicators of the contextual factor (platforms and infrastructure) point to the support of the government. In this respect, governmental measures on preparing the ground in terms of management and policymaking, educational and research activities, infrastructure, scientific communications and networks, innovation, and knowledge dissemination for launching and developing knowledge-intensive enterprises can be listed:

- Based on the results, a problem mentioned by the CEOs is the high taxes that the enterprises should pay. Given that heavy taxes can discourage the CEOs and board members from continuing the activity and can finally result in their failure, plans for tax payment based on revenue, tax exemptions in the first five years of the enterprise activity, and providing tax, support, and customs incentives can be effective in the success of these enterprises.

According to the results regarding the effectiveness of the axial category on strategies, it is recommended to

- pay serious attention to identifying the explicit and implicit needs of the market, the target population of the enterprises, especially rural people and farmers, and the target countries for the export of the products of these enterprises in order to research and produce need-based products
- increase the interaction of the farmers and CEOs of the emerging agricultural enterprises through regular meetings for information sharing as it can be effective in presenting and describing the idea-based products by CEOs.

Recommendations for future research

- Factors affecting the viability and development of agricultural knowledge-intensive enterprises.
- A paradigm for the development of agricultural knowledge-intensive enterprises in other provinces and from the perspective of the CEOs of other enterprises and its comparison with the paradigm presented here.

- Testing the present research on some enterprises as a survey.
- Conducting similar research by other software packages and validating their results.

Research limitations

Some limitations of the research are listed below:

- The lack of accurate data on the number of agricultural knowledge-intensive enterprises in different provinces and the reluctance of the relevant organisations to provide data on the pretext that these enterprises are monitored by the presidential office and their information cannot be disclosed. The researcher finally succeeded in collecting the data after several months of correspondence with different organisations.
- Due to the COVID-19 pandemic and the dispersion of the enterprises across different provinces, it was impossible to visit the CEOs face-to-face due to limitations on trips between the provinces. In this regard, the researcher had to conduct long telephone interviews with the CEOs for data collection. Also, the researcher formed groups of CEOs in the virtual world to use their discussion on the topic for data collection.
- It was difficult to persuade the respondents for data collection since they claimed that enterprise information was confidential. In this regard, the researcher could earn their trust after presenting letters from the university and science and technology park and ensuring them that the information will only be used in the research anonymously.

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Appendix 1: Interview questions

- What was your main motivation and goal in establishing an agricultural knowledge-intensive enterprise?
- What are the most important goals of agricultural knowledge-intensive enterprises?
- What factors contribute to the success of agricultural knowledge-intensive enterprises and their achievement of goals?
- What factors are effective in the development of agricultural knowledge-intensive enterprises?

- What factors contribute to the success of agricultural knowledge-intensive enterprises in the competitive market?
- What are the most important characteristics of a manager that are effective in the development of agricultural knowledge-intensive enterprises?
- What are the development beds and infrastructures of agricultural knowledge-intensive enterprises?
- What are the barriers to the development of agricultural knowledge-intensive enterprises?
- What is the development strategy of agricultural knowledge-intensive enterprises?
- What are the consequences of the development of agricultural knowledge-intensive enterprises?