Knowledge Management Research & Practice

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tkmr20

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KNOWLEDGE MANAGEMENT RESEARCH & PRACTICE
https://doi.org/10.1080/14778238.2020.1832871

The role of knowledge management in the development of drought crisis management programmes

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ABSTRACT
The purpose of this study was to investigate the role of knowledge management in the development of drought crisis management programmes from the viewpoint of agricultural beneficiaries in Iran by exploring the tacit knowledge of beneficiaries, using explicit knowledge, and integrating tacit and explicit knowledge. This survey study was conducted using a stratified random sampling method to select 384 people who were implementing drought crisis management programmes. Data were collected with a questionnaire. SPSS21 software was used to analyse the collected data. The results show a positive and significant relationship between knowledge management components and development of drought crisis management programmes. Among the six components of knowledge management, knowledge maintenance had the greatest impact on the development of drought crisis management programmes. The present study provides a deep understanding of the relationship between knowledge management and the development of drought crisis management programmes in drought-affected areas to improve agricultural activities.

ARTICLE HISTORY
Received 13 July 2019
Accepted 1 October 2020

KEYWORDS
Drought crisis; knowledge management; development; drought crisis management plans; agricultural beneficiaries in Iran; Kerman province

1. Introduction

1.1. Drought crisis management programmes in Iran

Iran is located in an arid and semi-arid zone (Kheiri et al., 2017). Intergovernmental Panel on Climate Change IPCC and Core Writing Team (2014) projects that Iran's temperature will rise by 0.5–1.5°C in 2020–2029. It is also estimated that there will occur a 9% decrease in precipitation of the country over the 2010–2039 period. In the coming decades, the temperature of almost all provinces of Iran will increase. Moreover, the central and eastern parts of the country have high climate variability due to their distance from the Mediterranean precipitation, and they are, thus, more exposed to drought. As a result, prolonged droughts have been a prime phenomenon contributing to severe water supply shortages in these areas (Choobin et al., 2016).

Drought is a climatic phenomenon caused by the lack of rainfall, and its repetition over time is unavoidable. Persistent droughts can inflict enormous losses upon human, economic, and physical capitals, especially, in the agro-rural sector. In addition, the rise in population and the increase in producing various agricultural products in the south-eastern part of Iran has resulted in excessive water usage in this region. This has been exacerbated in recent years in the province of Kerman, Southern Iran, with destructive impacts on water resources (Choobin et al., 2016).

To manage drought and improve agricultural activities in Southern Iran, a couple of approaches have been implemented called "drought crisis management programmes" composed of (a) watershed and groundwater management plans (e.g., the protection of groundwater supplies and the prevention of unregulated use of them, the creation of efficient methods of water use, and the improvement of irrigation efficiency by pressurised irrigation systems), and (b) water utility projects (e.g., shutting down engine pumps in winter and planting alternative crops with lower water requirements).

Yet, a few studies (Gerber & Mirzabaev, 2017; Zhao et al., 2017) suggest that management plans should be based on environmental risk management programmes such as drought prevention strategies. Drought risk assessment helps to identify drought-prone areas, thereby allowing policymakers to gather the required information and warn farmers based on the risk map of the regions. Drought risk assessment provides an opportunity to reduce the high cost of crisis management, which in turn increases the resilience of farmers and sustainable production. In Iran, the Islamic Republic of Iran Meteorological Organisation (IRIMO) is responsible for recording and reporting reduced levels of risk and vulnerability

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of different social sectors to climate change and drought (FRWO, 2014).

The Ministry of Agriculture (MoA) is responsible for providing a comprehensive database for the supervision and field confirmation of crops and existing livestock. The MoA established the National Agricultural Drought Committee (NCAD) in 2001 (Ameziane, 2006). In Iran, one of the most important measures is to establish effective communication between the public and the local governments with a view on responding to emergencies promptly. It is essential to establish technical crisis committees in the field of emergency food and water supply and damage control (Heydari, 2006; Khosravi et al., 2014). The development of the resilience of agricultural and pastoral societies and the resilience of landscapes is an essential element of drought management plans. As suggested by KM, indigenous and local communities play an important role in desertification prevention through active dryland resource management and, in particular, water management, often based on mechanisms for local decision-making and conflict resolution (Convention on biological Diversity, 2009). Therefore, most local communities have a well-developed awareness of plant and animal biodiversity and can support efforts to preserve and use them sustainably. Nonetheless, building on new and conventional expertise, technologies, and methods and in collaboration with scientists, local communities are in the best position to adopt desertification reduction and drought management practices (UN-Water Decade Programme on Capacity Development (UNW-DPC), 2015).

1.2. Contribution of knowledge management to the development of drought crisis programmes

Knowledge and information play a key role in both developed and developing countries. Relevant information enables operational decisions to be taken at individual and business levels. Competitive advantages usually depend on sound decision-making, which in turn depends on the availability of relevant information. Nonetheless, the functional organisation of information supply can create a variety of different barriers that limit access to the business information needed (Lendzion, 2015). In other words, an active organisation of information flows or knowledge management (KM) is an important strategic tool for today's productive businesses (Materia, 2012). Agricultural knowledge management is often confused with the agricultural extension. Both have similar objectives, but agricultural extension involves advising farmers and providing them with information. In contrast, KM is relevant to the supply of data within a company/society and it can include the extension as an external source of information (Reed et al., 2014).

In KM, the key elements of drought risk management programmes include a monitoring network, drought indicators, assessment of drought hazards, early warning of droughts, drought forecasting, and impact/risk assessments. In order to ensure efficiency, these elements should be configured into a functional framework with institutional, methodological, public, and operational components (UN-Water Decade Programme on Capacity Development (UNW-DPC), 2015). The implementation of KM is necessary to deal with drought crises, especially in the agricultural sector to develop drought crisis management programmes (Keshavarz et al., 2010). Drought crisis management programmes focus on increasing the capacity of individuals and communities to cope with drought incident. The programmes should also provide mitigation strategies for climate change impacts. In these programmes, geospatial information may be used to monitor, predict, and provide early warning about droughts (Heydari, 2006; Khosravi et al., 2014).

Indeed, if intellectual capital, human resource knowledge, and existing facilities are not included, it will be impossible to achieve the goals of drought crisis management programmes in Iran. Moreover, neglecting the tacit knowledge of farmers (i.e., a set of experiences, skills, and work perspectives of individual farmers that are not stored in any database) in drought crisis response programmes is a major issue in the process of drought management (Karami, 2009). Focusing on farmers, they play a key role in agricultural production and the implementation of drought crisis response programmes. Moreover, the knowledge gained by farmers from experience will lead to a better and more effective implementation of drought crisis management programmes (Khosravi et al., 2014).

In this regard, KM can play an important role by identifying the knowledge gained by farmers from the experience of implementing drought crisis response programmes, organising and sharing it as a source of knowledge among farmers, and complementing it with explicit knowledge, which helps to manage the crisis to cope with drought and ultimately leads to sustainable rural development in Iran. Therefore, the purpose of this study was to investigate the role of KM in the development of drought crisis management programmes, provide solutions for developing drought crisis management programmes, and improve agricultural activities in developing countries with special attention to Iran, which can be useful at national and international levels.

For this purpose, various models related to KM were examined (Ahmadyousefi et al., 2017). Finally, the Gilbert model, which shows intellectual capital management, was selected to form the basis of the research work (Probst, 1998) based on an in-depth literature review, field studies, and interviews with farmers in the area, and also given the limitations of other models (Annexe Table A1). According to this model, there are six KM-related processes, which are presented in the form of loops. These processes can be described as knowledge localisation (i.e., the discovery of knowledge and the creation of methods that can acquire knowledge through the structure of intellectual capital), knowledge acquisition (acquiring knowledge through interactions with individuals and the outside world), knowledge development (producing new products, improving processes or skills, and creating creativity), and knowledge sharing (which is very complex because, on the one hand, it examines the existing knowledge between individuals, and on the other hand, it shows that individuals need to know what information need, so they can achieve some of the goals of the community when combined with their skills, so it is worth noting who has access to this information and how information is disseminated), knowledge utilisation (knowledge should be used effectively, so obstacles such as fear of unknowns or loss of opportunity must be overcome), and knowledge maintenance (if knowledge is to be exploited, it should also be preserved). Access to this information contributes to the development of society because mistakes are not repeated and intellectual capital is used (Galbreath & Rogers, 1999; Stroinska & Trippner-Hrabi, 2018).

In the present study, based on the mentioned model, KM includes the components of knowledge identification, knowledge acquisition, knowledge development, knowledge sharing, knowledge utilisation, and knowledge maintenance. According to the preceding studies, knowledge identification aims to know information, knowledge, skills, and information requirement, have the necessary knowledge, and use it by the beneficiaries in the implementation of drought crisis management programmes (Alharithy, 2015; Newk-Fon Hey Tow et al., 2012). Knowledge acquisition here includes participation in educational training courses, access to knowledge positions and places, and the use of the Internet to acquire more information and be aware of the experiences and skills of other beneficiaries in relation to drought crisis management programmes. The purpose of the knowledge development, innovative suggestions, and the participation of the beneficiaries in the determination and implementation of drought crisis management programmes is to use information to solve problems and use new knowledge and experiences in the implementation of drought crisis management programmes. The KM also aims to share knowledge, support the relevant institutions in disseminating experiences and knowledge of individuals, participate in knowledge sharing sessions, encourage others to transfer their experiences and knowledge, and have enough time to share their knowledge and experiences about drought crisis management programmes. The use of knowledge means the development and utilisation of posters or booklets, the use of new knowledge and information, experiences of beneficiaries in the process of implementing drought crisis management programmes, and assessment of knowledge resources related to these programmes by the beneficiaries. Furthermore, the purpose of keeping knowledge in the present research is to maintain the past experience of the beneficiaries in implementing drought crisis management programmes and preserve records of failures and success of these programmes for the use in future decisions.

Moreover, the study attempts to examine the fact that previous information, experience, and knowledge are helpful in meeting today's needs and decisions about drought crisis management programmes and analyse the impact of Internet access on the rate of information storage. The goal in developing drought crisis management programmes in the present study is the growth and development of these programmes while addressing social, economic, and environmental issues, and their sustainability to meet the needs of society (Alharithy, 2015; Galbreath & Rogers, 1999; Gilbert, 1998; Stroinska & Trippner-Hrabi, 2018).

2. Research background and literature review

This section reviews the literature on a series of KM elements associated with the research objectives. Afrakhteh et al. (2015) concludes that by applying adaptation strategies in rural areas, such as planting drought-resistant crops and flood control and runoff systems in the watershed area, improving awareness, and using modern irrigation methods, local communities will be enabled to cope with drought impacts (Afrakhteh et al., 2015). Tandi Lwoga (2011) discusses that knowledge potential for agricultural development should be discussed within the context of the target community. Given that knowledge of farmers has usually been underestimated, it should be addressed more deeply in future studies. This study shows that farmers mainly share and preserve their native knowledge through face-to-face contacts during their individual and collective interactions. Therefore, knowledge mediators (i.e., researchers, input suppliers, information experts, media, etc.) must play an important role in facilitating knowledge creation activities in local communities (Tandi Lwoga, 2011).

Moreover, information, knowledge, technology, and skills in agricultural organisations should be organised properly. Organising information and knowledge in organisations, in particular knowledge that is consistent with the climatic conditions of each region, is considered to be one of the main tasks of agricultural management (Kazeminejad et al., 2011). Studies show that the vulnerability of rural communities is linked to crisis management programmes in Iran (Karami, 2009). Many researchers have clearly indicated that crisis management is significantly nonproductive, untimely, and economically unviable (Gerber & Mirzabaev, 2017; Knutson et al., 2001; Wilhite, 2014; Zhao et al., 2017). Letonja and Duh (2016) conclude that the transfer of tacit knowledge from one person to another is important, but it is not enough to promote innovation strategies. The tacit knowledge must be combined with explicit knowledge. Thus, the transfer of tacit knowledge and then putting it besides explicit knowledge can promote innovation in individuals (Letonja & Duh, 2016).

Wipawayangkool and Teng (2016) investigated tacit knowledge sharing methods and concluded that managers should be able to assess the level of efficiency of the tacit knowledge of individuals, identify the backgrounds for its improvement, and enhance this knowledge. In addition, their results indicated that knowledgeable and informed people preferred to use individual communication enabled by new technologies for knowledge sharing. Therefore, managers should create an appropriate environment among people, work, and technology factors. Barbero-Sierra et al. (2018) studied local and scholarly knowledge for evaluating the quality of plans in Central Spain. The results indicate that both local and scientific knowledge have certain strengths and weaknesses. On the one hand, local (tacit) knowledge is comprehensive and based on farmers' experiences that allow them to manage their farm. This knowledge is mainly used on a precise scale, on fields, and in a limited space or specific realm and is confronted with limitations when facing new scenarios (e.g., policies, new product quality, and climate change). On the other hand, scientific (explicit) knowledge is more appropriate for modelling and providing an alternative to scenario change. However, it is not consistent with some aspects of the everyday decisions of farmers such as access to knowledge and efficiency, which require knowing both kinds of knowledge and putting them together to solve the challenging future issues (Barbero-Sierra et al., 2018). Wang et al. (2017) investigated the construction of a motivational system for tacit knowledge sharing. In this study, implicit knowledge is considered a valuable and important element for investing and gaining competitive advantage, and tacit knowledge is seen as an essential part of KM and a tool to guide people to share and learn knowledge from one another.

In arid and semi-arid regions, drought mitigation activities require developing knowledge on comprehensive watershed management for effective operation management and coordination at national and provincial levels among relevant organisations at different levels. Proper methods for managing drought in agriculture will empower farmers and ranchers so that they can adopt the right technology to follow the principles of sustainable agriculture. Moreover, success or failure of strategies and plans to promote water and land-use systems (e.g., water distribution, floodwater management, and the construction of artificial water supply pools) should be applied in the agricultural lands at provincial and local levels (Khosravi et al., 2014).

Although the integration of tacit and explicit knowledge will improve the development of agricultural activities in drought conditions, participating farmers in identifying and solving drought problems is a missing link in Kerman province so that drought crisis management programmes are conducted with top-down approaches. This requires strengthening the relationship between tacit and explicit knowledge in rural communities. Drought crisis management, with an emphasis on knowledge acquisition, preservation, sharing, and use, has already shown its importance in the tacit and explicit management of knowledge in developing countries (Tandi Lwoga, 2011). However, the use of KM in most developing countries, including Iran, is still at an elementary level. Therefore, it is essential to assess KM in order to integrate tacit and explicit knowledge and protect the tacit knowledge of farmers for sustainable agricultural practices within the rural community.

By reviewing the literature, it became clear that no investigation has ever focused on different components of KM and their effect on the development of drought crisis management plans, which is one aspect of innovation in this research. Therefore, the present study mainly aims to investigate the role of KM in the development of drought crisis management programmes from the viewpoint of agricultural beneficiaries.

According to what has already been mentioned, the purpose of this research is to use KM to develop drought crisis management programmes. To this end, after examining different KM models with respect to the research objectives, Gilbert et al.'s model was selected as a more comprehensive and appropriate model. This model holds that KM is composed of the components of knowledge identification, knowledge acquisition, knowledge development, knowledge sharing, knowledge utilisation, and knowledge maintenance. In this research, the KM components were operationally defined and used based on the drought crisis management programmes implemented in Iran.

3. Methodology

The present quantitative and functional research is a descriptive-correlational survey in terms of objective. Kerman province was divided into three agricultural regions according to climate conditions, amount of water resources, geographical location, and land cultivation method. Due to the similarity of the crops in the studied areas, one county that was very active in terms of agricultural activity and where the majority of people were engaged in agricultural work and drought crisis management programmes was selected from each region. They included Baft from the temperate and mountainous regions of the mountainous area, Jiroft from the tropical farming areas, and Rafsanjan from the dry and desert areas. The statistical population of the study consisted of 258,633 agricultural beneficiaries in the three areas. Statistical sampling was performed by the Morgan table, and 384 people were selected among the agricultural beneficiaries of the province by the stratified random sampling technique (Table 1).

The main instrument for collecting information was a questionnaire, which was designed based on the programmes and policies adopted by the MoA in response to the drought crisis in Iran's agricultural sector. In addition to university funds, the MoA also played a significant role in this research. Hence, data were collected from the farmers by the extension staff of the province and the MoA staff. The content and face validity of the research tool were verified and corrected by a panel of experts at the Agricultural Extension and Education Department of Tarbiat Modarres University, and its reliability was estimated at 0.74 based on Cronbach's alpha for KM components and 0.81 for the components of drought crisis management programmes development, which is quite acceptable (Table 2).

Table 1. The statistical population and sample of agricultural beneficiaries in Kerman province.

Row	Regions	City	Agricultural beneficiaries	Number of samples
1	**Temperate and mountainous areas**	Baft	22,753	97
2	**Tropical farming areas**	Jiroft	24,175	102
3	**Dry and desert areas**	Rafsanjan	43,334	185
Total			258,633	384

Source: Research findings

Table 2. The reliability of the research instrument.

Variables	Items	Cronbach's alpha coefficients	Commentary
Knowledge management	24	0.74	Acceptable
Development of knowledge Management programmes	13	0.81	Good

Source: Research findings

In this study, the components to measure KM consist of knowledge identification, knowledge acquisition, knowledge development, knowledge sharing, knowledge utilisation, and knowledge maintenance. Each component consists of 4 items totalling 24 items (listed in Table 9) scored by the Likert scale (Galbreath & Rogers, 1999; Gilbert, 1998; Letonja & Duh, 2016; Stroinska & Trippner-Hrabi, 2018).

The components to measure the development of drought crisis management programmes consist of motor pump off hours (hours), area of farm/garden equipped with mechanised irrigation system (hectare), cultivation area of drought-resistant plants (hectare), the reduction of water use for agricultural activities before implementing drought crisis management programmes, the reduction of the number of illegal wells for field/garden irrigation after implementing drought crisis management programmes, the reduction of groundwater harvest after implementing drought crisis management programmes, the reduction of water waste at the farm/garden level after implementing drought crisis management programmes, the increase in dams after implementing drought crisis management programmes, the improvement of water supply to the farm/garden after implementing drought crisis management programmes, impacts of timely allocation of credits for the development of mechanised irrigation methods, fewer requests to get permission for the use of wells in irrigating farms/gardens after the implementation of drought crisis management programmes, and the effect of input subsidisation on increasing the cultivation of drought-resistant crops and using dams to control surface water, which were scored on a Likert scale ranging from 0 for very low, to 1 for low, 2 for moderate, 3 for high, and 4 for very high (Table 5, Table 6, Table 7, Table 8; Agricultural Jihad organisation of Iran, 2014). Data were analysed by SPSS21 software, Pearson correlation coefficient, and multivariate regression. To be clear, 13 items in Table 5–8 were used to measure the extent of the "development of drought crisis management programs" using Iran's MoA policies and plans in 2014. Since these items were measured by different scales, the Division by Average Value method was used to eliminate scale bias. Then, the free scale items were combined and the composite index was calculated. The aim of the research was to investigate the role of KM in the development of drought crisis management programmes, in which the dependent variable was a composite index consisted of a combination of 13 scale-free items. It should be mentioned that data were compared before and after the implementation of drought crisis management programmes by paired sample t-test, and different items and components of KM were compared and ranked by the Friedman test (Tables 9&10).

Table 3. The frequency distribution of agricultural beneficiaries based on age.

Variable	Variable levels	Frequency	Per cent	Cumulative frequency
Age (year)	< 30	24	6.3	6.3
	30–40	94	24.5	30.7
	40–50	100	26.0	56.8
	> 50	166	43.2	100
	Sum	384	100	

Mean: 48.33, Standard deviation: 11.75, Maximum: 83, Minimum: 25
Source: Research findings

4. Results and discussion

The descriptive statistics showed that the average age of the participants was about 48 years. As can be seen in Table 3, the age group of >50 years had the highest frequency of over 40% and the age group of <30 years had the lowest frequency of 6.3%. These results are consistent with the results obtained by Jafari et al. (2014) and Wang et al. (2017). So, more than 40% of beneficiaries are over 50 years old, and a large proportion of them have more than 10 years of agricultural experience. It is the result of years of effort on the part of these people and the experience they have gained over these years that will be lost by their withdrawal.

The average days of participation of the beneficiaries in training courses on drought crisis management programmes were 0.49 (about 1) with a standard deviation of 0.83, and the highest and lowest number of attendance at educational-extensional classes were 5 and 0, respectively. The majority of the participants (88.5%) had participated in training courses just once, whereas just a slight number (0.1%) had attended more than three training courses (Table 4).

The average motor pump off hours before the implementation of drought crisis management programmes was 1.39 with a standard deviation of 1.72 with the maximum and minimum being 6 and 0 hours, respectively. In addition, the group of less than 2 hours had the highest frequency of 73.4%, and the group of more than 4 hours had the lowest frequency of 4.7%. The results of the descriptive statistics showed that the average pump off hours after drought crisis management programmes was 1.88 with a standard deviation of 2.9. Moreover, the maximum and minimum were 7 and 0 hours, respectively. The group of less than 2 hours had the highest and the group of more than 4 hours had the lowest frequency (67.4 and 15.9 per cent, respectively). Also, the motor pump off hours was compared before and after the implementation of the programmes by paired sample t-test and the results revealed a significant difference at the 1% level between them (Table 5).

Table 4. The frequency distribution of participation in training courses.

Variable	Variable levels	Frequency	Per cent	Cumulative frequency
Participation in training courses	< 1	340	88.5	88.5
	1–3	40	10.4	99.0
	< 3	4	1.0	100
	Sum	384	100	

Mean: 0.49, Standard deviation: 0.83, Maximum: 5, Minimum: 0
Source: Research findings

Table 5. The distribution of motor pump off hours.

Variable		Variable levels	Frequency	Per cent	Cumulative frequency	Mean	t-value	Sig
Motor Pump off hours (hours)	Before the implementation of programmes	< 2	282	73.4	73.4	1.39	−12.96	0.00
		2–4	84	21.9	95.3			
		> 4	18	44.7	100			
		Sum	384	100				
	Standard deviation: 1.72, Maximum: 6, Minimum: 0							
	After the implementation of programmes	< 2	259	67.4	67.4	1.88		
		2–4	64	16.7	84.1			
		> 4	61	15.9	100			
		Sum	384	100				

Standard deviation: 2.09, Maximum: 7, Minimum: 0
Source: Research findings

Table 6. Area of farm/garden equipped with mechanised irrigation system.

Variable		Variable levels	Frequency	percent	Cumulative frequency	Mean	t-value	Sig
Area of farm/garden equipped with mechanised irrigation system	Before the implementation of programmes	< 2	381	99.2	99.2	0.29	−8.830	0.00
		2–4	2	0.5	99.7			
		4<	1	0.3	100			
		Sum	384	100				
	Standard deviation: 0.33, Maximum: 5, Minimum: 0							
	After the implementation of programmes	< 5	324	84.4	84.4	3.33		
		5–10	3	11.2	95.6			
		10<	17	4.4	100			
		Sum	384	100				

Standard deviation: 7.33, Maximum: 90, Minimum: 0
Source: Research findings

Table 7. The cultivation area of drought-resistant plants.

Variable	Variable levels	Frequency	Per cent	Cumulative frequency
Cultivation area of drought-resistant plants	< 0.5	364	94.8	94.8
	0.5–1	16	4.2	99.0
	1<	4	1.0	100
	Sum	384	100	

Mean: 0.11, Standard deviation: 0.32, Maximum: 3, Minimum: 0
Source: Research findings

Table 8. Ranking of items of development of drought crisis management programmes.

Item	Mean	Standard deviation	Coefficient of variation	Rank
Reducing water use for agricultural activities before implementing drought crisis management programmes	3.04	0.86	0.282	1
Reducing the number of illegal wells for field/garden irrigation after implementing drought crisis management programmes	2.75	0.99	0.36	2
Reducing groundwater harvest after implementing drought crisis management programmes	2.65	1.07	0.403	3
Reducing water waste at the farm/garden level after implementing drought crisis management programmes	2.42	1.21	0.500	4
Increasing number of dams after implementing drought crisis management programmes	2.33	1.21	0.519	5
Improving water supply to the farm/garden after implementing drought crisis management programmes	2.40	1.26	0.525	6
Effect of timely allocation of credits for the development of mechanised irrigation methods	2.20	1.25	0.568	7
Decreased application for authorisation of wells for irrigation of the farm/garden after implementation of drought crisis management programmes	1.76	1.14	0.647	8
The effect of allocated subsidies on inputs on increasing the cultivation of drought-resistant crops.	1.57	1.07	0.681	9
Using dams to control surface water	1.36	1.20	0.882	10

Source: Research findings

The average area of field/garden equipped with a mechanised irrigation system before the implementation of drought crisis management programmes was 0.29 hectares with a standard deviation of 0.33. The maximum and minimum were 5 and 0 hectares, respectively, and the group of less than 2 hectares with 99.2 per cent was the most frequent, while the group of more than 4 hectares with 0.3 per cent was the least frequent. Moreover, the results showed that the average area of field/garden equipped with a mechanised irrigation system after the implementation of drought crisis management programmes was 3.33 hectares with a standard deviation of 7.33. The highest and lowest areas were 90 and 0 hectares, and the group of less than 5 hectares with 84.4 per cent is the most frequent while the group of more than 10 hectares had the lowest frequency of 4.4 per cent. Also, paired sample t-test was applied to make a comparison in this variable before and after the implementation of drought crisis management programmes, which revealed a significant difference at the 1% level (Table 6).

The mean cultivation area of drought-resistant plants was 0.11 hectares with a standard deviation of 0.32. The highest and lowest cultivation areas of drought-resistant plants were 3 and 0 hectares, respectively. In addition, the group of less than 0.5 hectares with 94.8 Percent and the group of more than 1 hectare with 1.0 percent had the highest and lowest frequencies, respectively. Due to the inappropriate location of the market for alternative products (drought-resistant), the inputs allocated to drought-resistant crops had no effect on the expansion of the cultivation of drought-resistant plants. These results are consistent with the findings of Afrakhteh et al. (2015), as both studies highlight appropriate measures to improve the market for alternative crops in the context of agro-rural development.

4.1. Ranking of items of development of drought crisis management programmes

Among the ten items used to measure the development of drought crisis management programmes (Table 8), the items "reducing water use for agricultural activities before implementing drought crisis management programmes" and "reducing the permission of well digging for field/garden irrigation after implementing drought crisis management programmes" had the highest ranks, and the items "using dams to control surface water and feed the underground table" and "using allocated subsidies for the cultivation of drought-resistant products" had the lowest ranks.

However, a common strategy to manage drought is based on crisis management (ex-ante). The perspectives, strategies, and modalities adopted to handle drought in Iran have remain at the level of tacit knowledge among individuals. The lack of successful sharing of information and expertise and awareness on substance management strategies can, therefore, be described as one of the main reasons for the unsatisfactory performance of current drought management practices (Khosravi et al., 2014). Focusing

Table 9. Ranking of the knowledge management components.

Knowledge management components	Items	Mean	Standard deviation	coefficient of variation	Rank	Mean Rank	Sig
Knowledge identification	Having information, skills, and knowledge in relation to drought crisis management programmes	3.02	0.92	0.304	1	2.91	0.00
	Using our knowledge to implement drought crisis management programmes in the environment	2.88	0.98	0.340	2	2.77	
	Understanding our information needs in relation to drought crisis management programmes	2.86	1.02	0.356	3	2.70	
	Having knowledge about drought crisis and its management programmes	1.71	1.04	0.608	4	1.61	
Knowledge acquisition	Being aware of the experiences and skills of other beneficiaries	2.49	1.09	0.437	1	3.14	0.00
	Participating in training courses in relation to drought crisis management programmes	1.69	0.98	0.579	2	2.95	
	Using the Internet to acquire more information about drought crisis management programmes	1.52	1.01	0.664	3	2.04	
	Access to knowledge and drought crisis management programmes	1.22	0.91	0.745	4	1.88	
Knowledge development	New knowledge and experiences lead to effective implementation of drought crisis management programmes	2.47	1.16	0.469	1	3.27	0.00
	Innovative recommendations on drought crisis management programmes	1.95	1.10	0.564	2	2.91	
	Using information on drought crisis management programmes to resolve problems	1.16	0.95	0.818	3	2.11	
	Using beneficiaries ideas in planning drought crisis management programmes	0.79	0.79	1	4	1.71	
Knowledge sharing	Encouraging others to transfer their experiences and knowledge about drought crisis management programmes	3.05	0.97	0.318	1	2.73	0.00
	Participating in knowledge sharing sessions	2.30	1.26	0.547	2	2.61	
	Having enough time to share their knowledge and experiences about implementing drought crisis management programmes	1.06	0.88	0.830	3	2.60	
	Support of relevant institutions of publishing experiences and knowledge of individuals regarding implementation of drought crisis management programmes	1.08	1.04	0.962	4	2.05	
Utilisation of knowledge	Using the experience of beneficiaries in the implementation of drought crisis management programmes	3.09	0.89	0.288	1	3.53	0.00
	Using new knowledge and information on drought crisis management programmes to fix executive problems	2.29	1.02	0.445	2	2.88	
	Making posters or booklets about knowledge crisis management programmes available to the beneficiaries	1.62	1.12	0.691	3	2.22	
	Assessment of knowledge resources related to drought crisis management programmes by beneficiaries	0.70	0.73	1.042	4	1.37	
	Using past information, experience, and knowledge gained to meet today's needs and make decisions about drought crisis management programmes	3.06	0.88	0.287	1	3.54	0.00
Knowledge maintenance	Exploiting Internet access for the rapid storage of information solicited from the implementation of effective drought crisis management programmes	2.83	1.01	0.356	2	3.36	
	Preserving the experiences of failures and successes of drought crisis management programmes for use in future decisions	0.81	0.69	0.851	3	1.62	
	Preserving the experiences of the beneficiaries about implementing drought crisis management programmes	0.66	0.61	0.924	4	1.48	

Source: Research findings

Table 10. Status of the knowledge management components.

KM Components	Mean Rank	Mean	Rank	Sig
Knowledge identification	5.38	2.61	1	0.00
Knowledge utilisation	3.54	1.92	2	
Knowledge sharing	3.39	1.87	3	
Knowledge maintenance	3.23	1.84	4	
Knowledge acquisition	2.93	1.73	5	
Knowledge development	2.52	1.59	6	

Source: Research findings

on drought crisis management programmes in the agricultural sector, the present study is in line with the study of Shakeri et al. (2011). In their study, the KM process in Yazd's agricultural and natural resources research sector was assessed using a general assessment framework (leadership, policy and strategy, human resource management, processes, and resources). Their results show that only two dimensions of human resource management and resources and partnerships affect KM.

4.2. Ranking knowledge management components

Among the components of knowledge identification "having information, skills, and knowledge about drought crisis management programmes" and "using our knowledge to implement drought crisis management programmes in the environment" had the highest rank, and two items of "having knowledge about the drought crisis and its management programmes" and "understanding our information needs in relation to drought crisis management programmes" had the lowest rank.

In the of knowledge acquisition component the results showed that "being aware of the experiences and skills of other beneficiaries" and "participating in training courses on drought crisis management programmes" ranked the highest while "access to knowledge and drought crisis management programmes" and "use of the Internet to acquire more information about drought crisis management programmes" ranked the lowest, respectively.

In the knowledge development component, "New knowledge and experiences lead to effective implementation of drought crisis management programmes" and "innovative recommendations on drought crisis management programmes" had the highest rank, while the items of "using the ideas of beneficiaries in planning drought crisis management programmes" and "the use of information on drought crisis management programmes to resolve problems" had the lowest rank.

In the knowledge sharing component, As indicated in Table 9, the items "encouraging others to transfer their experiences and knowledge about drought crisis management programmes" and "participating in knowledge sharing sessions" had the highest rank, while the items "support of relevant institutions of publishing experiences and knowledge of individuals regarding the implementation of drought crisis management programmes" and "having enough time to share their knowledge and experiences about implementing drought crisis management programmes" had the lowest rank.

In the knowledge utilisation component, among the items mentioned, the two items of "using the experience of beneficiaries in the implementation of drought crisis management programmes" and "using new knowledge and information on drought crisis management programmes to fix executive problems" were ranked the highest and the two items of "assessment of knowledge resources related to drought crisis management programmes by beneficiaries" and "making posters or booklets related to knowledge crisis management programmes available to the beneficiaries" were ranked the lowest.

In the knowledge maintenance component, the items of "using past information, experiences, and knowledge gained to meet today's needs and make decisions about drought crisis management programmes" and "using the Internet access for the rapid storage of information solicited from the implementation of effective drought crisis management programmes" had the highest ranks, while the items of "preserving the experiences of the beneficiaries about implementing drought crisis management programmes" and "preserving the experiences of failures and successes of drought crisis management programs for the use in future decisions" were ranked the lowest (Table 9). Consistent with the research of Tandi Lwoga (2011), the ranking of the items related to the knowledge acquisition shows that farmers can benefit from the experience of other regional beneficiaries to gain more knowledge on drought crisis management programmes. The participants are interested in attending extension-educational courses, but due to ignorance as to the places where they are offered information on drought crisis management programmes and also due to their ageing, most of them could not use new technologies and take advantage of these classes. Therefore, educational-extensional courses should be organised to increase awareness and knowledge of beneficiaries in the development of drought crisis management programmes in accordance with the needs and age of beneficiaries.

At the end it should be mentioned that, the different items in each component were compared by the Friedman test whose results showed that there was a significant difference between different items of each component at the 1% level.

4.3. Status of knowledge management components

The status of the deployment of KM components from the point of view of the beneficiaries is shown in Figure 1 & Table10. Accordingly, the knowledge identification component with a mean of 2.61 had the best status, and the knowledge development with a mean of 1.59 had the worst status among the KM components. Also, the different scores of the KM components were compared by the Friedman test and the results showed a significant difference between different components of KM.

The multivariate regression by the stepwise method was used to predict the role of each KM component in developing drought crisis management programmes. In this case, the strongest variables were included in the equation, and this continued as long as the test error reached a significant value of 0.05. After examining the correlation between the independent variables and the dependent variable of the research (development of drought crisis management programmes), the variables correlated with the dependent variable (knowledge

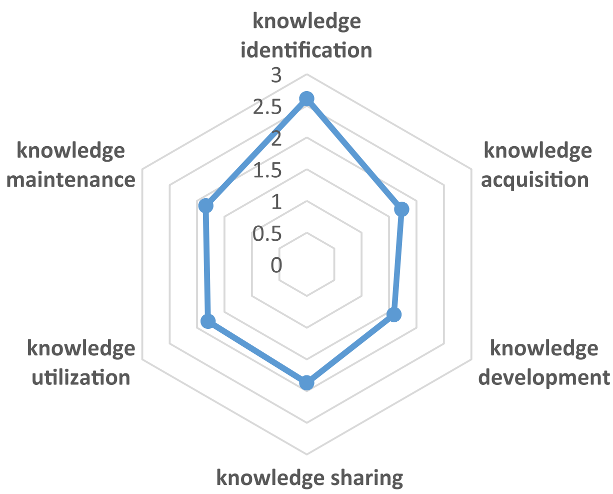

Figure 1. The status of deployment areas.

Table 11. Multivariate regression.

	Variable	R	R^2	R^2_{adj}	B	β	t	Sig	VIF	Durbin Watson
	Constant number				1285.51		2045.74	0.000		1.175
1	**Knowledge development (X_1)**	0.540	0.291	0.289	0.230	0.232	5.528	0.000	1.446	
2	**Knowledge maintenance (X_2)**	0.637	0.405	0.402	0.315	0.260	7.061	0.000	1.119	
3	**Knowledge utilisation (X_3)**	0.691	0.478	0.474	0.179	0.177	4.059	0.000	1.573	
4	**Knowledge sharing (X_4)**	0.714	0.509	0.504	0.193	0.173	4.332	0.000	1.310	
5	**Knowledge acquisition (X_5)**	0.728	0.531	0.524	0.138	0.140	3.351	0.001	1.437	
6	**Knowledge identification (X_6)**	0.736	0.542	0.535	0.122	0.124	3.034	0.003	1.376	

$Y = 1285.51 + 0.230(X_1)+0.315(X_2)+0.179(X_3)+0.193(X_4)+0.138(X_5)+0.122(X_6)$
Source: Research findings

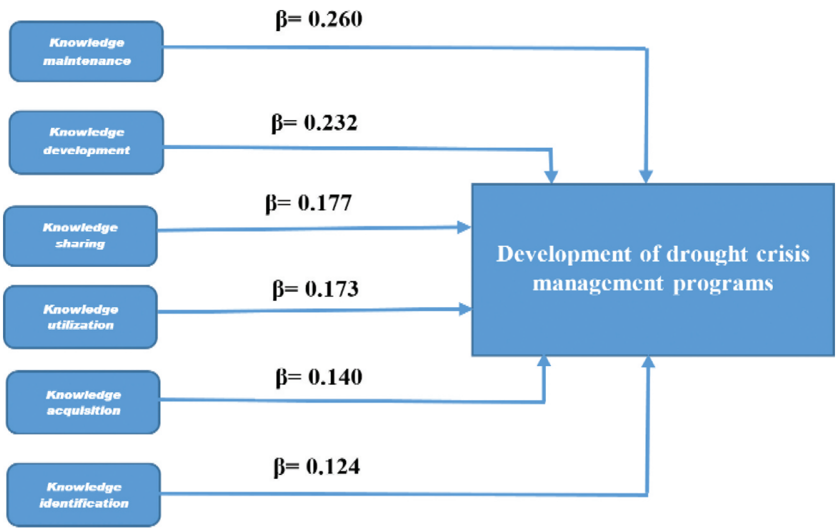

Figure 2. The relative importance of knowledge management components in the development of drought crisis management programmes.

identification, knowledge acquisition, knowledge development, knowledge sharing, knowledge utilisation, and knowledge maintenance) were used, and the regression equation was obtained. The details of the regression are summarised in Table 11. It should be noted that 54% of the variance in the dependent variable was accounted for by the six variables.

The knowledge maintenance component with Beta = 0.260 had the most explanation on the dependent variable from the independent variables (Table 11 & Figure 2).

Focusing on the success and failure of management programmes, Jafari et al. (2014) focused on the development of KM processes based on the factors affecting the success of the KM cycle in the agricultural sector. Their results revealed that, according to Friedman's ranking, incentives and motivational factors were: the senior management support and leadership, teamwork, knowledge transfer channels, trust, employee empowerment, etc.

In line with the research conducted by Tandi Lwoga (2011), in the present study, the results of the knowledge sharing component ranking show that farmers seek to use the experience of other beneficiaries and encourage each other to share their experiences. In addition, in limited meetings, they share this knowledge and information from their experience, but no institution supports the dissemination of information derived from the experience of the beneficiaries. Therefore, it is suggested that an institute is set up in villages capable of conducting drought crisis management programmes in the region, and the experience of beneficiaries is collected and transferred to others.

According to the findings, Figure 2 shows the relative importance of KM components in the development of drought crisis management programmes based on the β coefficients. The results of the study showed a positive and significant relationship between KM components and development of drought crisis management programmes, which indicates the great influence of KM components on the development of drought crisis management programmes. These results are consistent with the research of Jafari et al.

Table A1. Relevant studies on knowledge management models.

Tittle	Researchers	Variables	Limitations
Boisot's Knowledge Category Model	Boisot (1987)	Propriety Knowledge, Public Knowledge, Personal Knowledge, Common Sense	In comparison to Iranian farmers, this model suffers from ignoring knowledge localisation, acquisition, development, sharing, utilisation, and maintenance.
Kogut and Zander's Knowledge Management Model	Kogut and Zander (1992)	Knowledge Creation, Knowledge Transfer, Process & Transformation of Knowledge, Knowledge Capabilities, Individual "Unsocial Sociality"	This model overlooks knowledge maintenance, which is one of the most important factors among Iranian farmers.
Nonaka's Knowledge Management Model	Nonaka & Takeuchi, 1995	Socialisation, Externalisation, Internalisation, Combination	This model also overlooks knowledge maintenance.
Hedlund and Nonaka's Knowledge Management Model	Hedlund and Nonaka (1993)	Individual, the Group, the Organisation, and the Inter Organisational Domains	This model pays attention to the different domains involved in knowledge management but does not consider the process of localisation, acquisition, development, sharing, use, and maintenance of knowledge.
Skandia Intellectual Capital Model of Knowledge Management	Lank (1997)	Intellectual Capital	This model focuses on general issues and does not take the details into account.
Gilbert Practical Knowledge Management: A model that works	Probst (1998)	Localisation of Knowledge, Acquiring Knowledge, Developing Knowledge, Sharing Knowledge, Knowledge Utilisation, Maintaining Knowledge	This model is the most appropriate model for Iranian farms, which urgently draws the attention of policymakers to managing different levels of knowledge.
Demerest's Knowledge Management Model	McAdam and McCreedy (1999)	Knowledge Construction, Knowledge Embodiment, Knowledge Dissemination, Use	This model is somewhat similar to the Gilbert Practical Knowledge Management Model. The difference is in the location of knowledge, which is very important in the Iranian farmers' contest. In addition, the maintenance of knowledge is one of the most important aspects of sustainable knowledge management.
Frid's Knowledge Management Model	Frid's (2003)	Knowledge Chaotic, Knowledge Aware, Knowledge Focused, Knowledge Managed, Knowledge Centric	In this model, an organisation passes different levels to achieve maturity. Level 1: Understanding and implementing objectives, vision, and other KM indices, Level 2: Advocating and adopting departmental KM vision and goals, Level 3: Starting to focus on new activities, Level 4: Embedding KM in performance reviews and in business plans, Level 5: Institutionalising initiatives and evaluating intellectual assets. This model is more suitable for organisations than for farmers.
Ologbo 7-Circle Model	Ologbo and Nor (2015)	KM initiative, KM culture, KM people, KM mechanisms, KM technology, KM interaction, KM motivation	This model consists of seven circles that are far from the situation and perspective of farmers. These seven circles include Circle 1: Developing KM initiative/strategy, Circle 2: Creating and recognising KM culture, Circle 3: Choosing the right KM people, Circle 4: Choosing the right KM mechanisms, Circle 5: Choosing the right KM technology, Circle 6: Co-ordinating KM interaction, and Circle 7: Implementing KM motivation system. This model also ignores the role of knowledge maintenance.

(2014), Wang et al. (2017), Letonja and Duh (2016), and Wipawayangkool and Teng (2017).

The results of the research show that the component of knowledge development is the second most influential component in predicting the development of drought crisis management programmes. Considering the role of this component, it is recommended to determine and implement drought crisis management programmes with the full participation of the beneficiaries. Moreover, the results indicate that the components of knowledge utilisation, knowledge sharing, knowledge acquisition, and knowledge identification are significantly related to the development of drought crisis management programmes. These findings are consistent with the results obtained by Rahimian (2016), Ghorbani et al. (2016), Jafari et al. (2014), Badriazin et al. (2012), Wang et al. (2017), and Letonja and Duh (2016).

5. Conclusions and suggestions

The results of the ranking of the items related to the development of drought crisis management programmes showed that obtaining permission for wells and water use for agricultural purposes have decreased since the implementation of drought crisis management programmes, so special attention should be paid to the implementation of agricultural water use programmes, including the use of pressurised irrigation systems and the motor pomp idle hours. On the other hand, due to frequent droughts and reduction of rainfall in the area, the use of dams to control surface water and feed reduced groundwater has decreased.

The knowledge identification component rankings indicate that beneficiaries use their knowledge to manage their drought crisis management programmes more than other sources, and, on the other hand, beneficiaries do not have enough knowledge of their information needs and knowledge about drought crisis management programmes. Therefore, it is recommended that the information needs of the beneficiaries be identified by the region's extension agents, and the knowledge necessary for better implementation of the drought crisis management programmes be made available (see Barbero-Sierra et al., 2018).

The ranking of the components of knowledge development shows that the beneficiaries believe that new knowledge and experience will lead to better implementation of drought crisis management programmes. There are also many innovative suggestions in this regard. Therefore, it is recommended that authorities take advantage of the participation of the beneficiaries in determining and implementing drought crisis management programmes and make information available and accessible according to their needs. The results from the ranking of the component of knowledge utilisation reveal that beneficiaries are using new information to implement drought crisis management programmes. However, knowledge sources about drought crisis management programmes cannot be utilised by the beneficiaries. There are also no posters or booklets on drought crisis management programmes at the regional level, so it is suggested to provide new and comprehensive information proportional with the information needs of the beneficiaries in each region in the form of posters or booklets available for the beneficiaries so that they can use them to solve their problems and meet the information needs. This will address the ambiguities, problems, and better implementation and will also encourage others to implement drought crisis management programmes in the region.

Based on the results obtained for the ranking of the components of knowledge utilisation, beneficiaries believe that past knowledge and experience help them meet present needs and decisions about drought crisis management programmes; however, the experience of beneficiaries in implementing drought crisis management programmes and experiences with the failures and successes of drought crisis management programmes are not considered for future decision-makers. This could be mentioned as a point of weakness in the development of drought crisis management programmes for sustainable rural development.

From the point of view of the beneficiaries, the investigation of the status of KM components showed that the knowledge identification component had the greatest impact on the development of drought crisis management programmes. It can be inferred that farmers have a lot of information and experience about drought crisis management programmes. They also have a high ability to use this information and know their knowledge and information needs well. The component of knowledge development had the least impact on the development of drought crisis management programmes. These results indicate that the tacit knowledge of the beneficiaries and their participation are not used in the planning of drought crisis management programmes. In other words, the programme developers place less importance on beneficiaries' knowledge and use more explicit knowledge. Therefore, little new knowledge and information are provided to the beneficiaries, and this limited information fails to meet their information needs.

Pearson correlation test was used to explore the role of KM components in developing drought crisis management programmes. The results of multiple regression analysis showed that among the six components of KM, the knowledge maintenance component is most influential in predicting the development of drought crisis management programmes in Kerman province. Therefore, officials should have a specific strategy for documenting and maintaining the knowledge of these individuals, while other beneficiaries can access and use this knowledge. The results indicate that the maintenance of beneficiaries' experiences, the successes and failures resulting from the implementation of drought crisis management programmes for future decisions of drought crisis management programmes, and easy access to the Internet for storing information have a significant impact on the development of drought crisis management programmes. In other words, maintaining and storing knowledge and its availability for other beneficiaries can influence the development of drought crisis management programmes. It is, therefore, recommended that managers of organisations pay more attention to other beneficiaries to transfer knowledge and experience of them and further develop these programmes.

Therefore, it is suggested to prepare a poster or booklet of new information and farmers' experiences about the drought crisis management programmes for farmers to make more use of their experiences and new information by Agricultural Jihad and Agricultural Service Centre and also identify the information needs of the beneficiaries by the change agents and help to meet the needs of the beneficiaries by increasing the educational-extensional courses on drought crisis management programmes and their sustainability in rural areas.

The results of this study are expected to be effective in using the management and integration of explicit and tacit knowledge in the development of drought crisis management programmes in local communities facing drought phenomena. However, this study should be reviewed in other areas affected by drought to determine the relationship between KM and the development of drought crisis management programmes. In addition, the present study merely examined the relationship between KM and the development of drought crisis management programmes among farmers in rural communities.

Disclosure statement

No conflicts of interest to declare.

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