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Analyzing the Paradigmatic Foundations of Knowledge Management in Agricultural Knowledge-based Companies

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Abstract:

Objective: Knowledge, as one of the pillars of success, is an essential factor for innovation, production and economic growth. Currently it has become an important tool for some type of contest between organizations. Knowledge management is a new strategy that organizations, including agricultural knowledge-based companies, would need that so as to increase their performance and success. In fact, in case companies don't use knowledge management system correctly and at proper time, they would be either faced with failure or obliged to leave the arena of contest. Agricultural knowledge-based companies have a key role for the regeneration of the agriculture and increase of the employment of agricultural graduates in this field. As presently the challenge of managers is to provide a suitable environment for the growth of the human mind in knowledge-oriented companies that embrace a cutting-edge approach to knowledge management, wherein knowledge is tailored to fit the specific context, are poised for success. By fostering effective learning, this approach leads to enhanced performance and improved efficiency.

Methods: In this study, many studies were reviewed and generations of knowledge management were analyzed with a paradigmatic approach. Almost 100 related books and articles were reviewed through archival research.

Results: The findings showed that knowledge-based companies should go from the first generation of knowledge management to the use of the fourth generation; that way the internet use, social networks, analytical tools, intelligent agents, etc., might have a great participation with one another, which leads to their stay in the contest scene, and their faster achievement of future-oriented and dynamic results.

Conclusions: Therefore, it is suggested that agricultural knowledge-based companies have focus on transformational management and its characteristics.

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1. Introduction

Nowadays, physical (tangible) assets of organizations such as money, buildings and equipment are no longer deemed as competitive advantages. Instead, it is the knowledge and intellectual capital possessed by human resources that play a crucial role in enhancing their competitive strength. To stay in the contest scene, knowledge, after capitalism, is the main source of production, productivity, innovation and wealth creation in the global economy (Drucker, 1995). In modern times, knowledge has become indispensable for organizations, surpassing the reliance on manual labor. The significance of knowledge has escalated significantly, emerging as a pivotal force to accomplish crucial objectives like ensuring food safety, safeguarding the environment, alleviating poverty, and attaining business success. Therefore, to ensure the prosperity of organizations, knowledge as a capital must be exchangeable among people and shall be expandable (Fatemi *et al.,* 2021). In the modern era, characterized by a rapidly evolving and dynamic environment, undoubtedly, what makes organizations superior to each other and gains them competitive advantage, is their high-quality, creative and dynamic human resources. This fact, although very important, has received little attention in the field of knowledge management (Thomas *et al.,* 2001).

Although the value of knowledge is ever increasing, most organizations are faced with many difficulties due to ignoring knowledge management (Maditinos *et al.,* 2011). Based on the researches, the average education level of employees in organizations, the number of employees engaged in R &D departments, and the ratio of research credits to GDP are increasing in Iran. The following indicators reflect the inclination of the nation's institutions towards knowledge-driven activities. At the macro level of society, there has been a growing focus on engaging in knowledge-based activities (McCartney, 1998). In this regard, we can refer to Iran's twenty-year vision document. This fact holds true across diverse industries, including agriculture. Since explicit and implicit forms of knowledge are complementary to each other, it would be necessary for agricultural experts, especially those active in agricultural extension, to prioritize enhancing the management of farmers' implicit knowledge by complementing it with explicit knowledge. Achieving this issue is possible when a knowledge management tool is institutionalized for the activities of agricultural extension specialists. A tool of this nature should establish its objective by focusing on the harmonious interaction between agricultural extension specialists and farmers, as integral components of a broader social framework. The collaboration between these two entities is immensely vital and indispensable, however in some cases they can interact strongly and complement each other's efforts (Rezaei-Moghaddam & Rostami, 2016).

The purpose of the knowledge management system is to facilitate collaboration among individuals, enabling them to collectively brainstorm and dedicate time to

exchanging ideas and perspectives that appear relevant to the members of the group. Knowledge management is defined as a strategy that should be developed in the organizations so as to ensure that the production of knowledge, knowledge sharing, application and storage of knowledge would lead to the development of human resources (Dashgarzadeh *et al.,* 2011). Despite the advancements in this field, it is evident that the presence of numerous problems and challenges across various levels and aspects of Iranian organizations can be attributed to the inadequacy of effective knowledge management practices. This insufficiency hampers the creation, retention, and dissemination of knowledge, resulting in significant gaps between the existing knowledge within organizations and the knowledge required for optimal functioning (Ghorbanizadeh & Mohammadi-Moghadam, 2012). Therefore, the value of knowledge, in creating countless advantages and increasing the ability of the organization, in the organizations is viewed with importance. The most important goal of using knowledge management in organizations is to increase innovation, productivity and profitability, and also paying enough attention to knowledge-based activities. To develop and supply effective knowledge management, it includes creating and researching, storing, sharing, transferring and applying knowledge (Ming Pi *et al.,* 2011).

There are many definitions about knowledge management. Knowledge management, put simply, refers to the process of organizing information for the purpose of acquiring knowledge. The objective is to actively gather crucial information about the organization, foster knowledge exchange within the organization, and ensure that this knowledge is retained in the collective memory of the organization. This concerted effort aims to enhance decision-making, boost productivity, and promote innovation. Knowledge management is the ability to use knowledge. It includes people, culture, process and technology (Mohammadinia *et al.,* 2017). Knowledge management is a process that helps organizations to identify, sort, select, organize, systematize, transfer important information and expertise those that are part of the organization's memory within the organization. Information technologies that collectively make knowledge management available throughout an organization are called knowledge management systems (Smith & McKeen, 2003). Many knowledge management efforts have focused on collecting, codifying, and sharing knowledge for individuals in organizations (Baskerville & Dulipovici, 2006). There exists a broad consensus regarding the aims and objectives of knowledge management within organizations. Nichols summarizes these goals as follows: "the basic goal of knowledge management is to apply knowledge for the benefit of the organization" (Nickols, 2000). There are several evident drivers for management, including the desire to retain talented individuals by avoiding relocation, promoting innovation across the entire organization in terms of both processes

and products, managing risks, and keeping up with the fast-paced generation of new knowledge. Some other common goals of knowledge management include facilitating the slow transfer of knowledge from retirees to their successors who are hired to fill their positions, minimizing the loss of company memory arising from erosion and retirement, identifying vital resources and vital areas of knowledge in a way that the company possesses a clear understanding of its strengths, expertise, and the reasons behind its success, creating a set of methods that can be used with individuals, groups, and organizations to prevent potential wastage of intellectual capital, and eventually understanding, focusing and managing the creation and application of systematic, explicit and deliberate knowledge; that is, managing effective knowledge processes and continuously renewing knowledge (Dalkin, 2011).

Nowadays, the activity of knowledge-based companies the life of which is based on knowledge, creativity, innovation and commercialization of ideas, is one of the necessities of the business world. In accordance with the legislation pertaining to the safeguarding of knowledge-based companies and institutions in Iran, knowledge-based companies are cooperatives or private institutions that aim to synergize science and wealth, develop a knowledge-based economy, realize scientific and economic goals, and eventually they are aimed at commercialization of research and development results in the field of superior technologies. To achieve the goals of development and sustainable economy, it would be necessary to expand knowledge-based structures; that is, the economy based on science and knowledge leads to sustainable development. According to the definition of the Economic Cooperation and Development Organization, the knowledge-based economy is an economy that is formed based on the production, distribution and application of knowledge. Special emphasis is placed on the allocation of resources towards the advancement of knowledge and basic industries. This commitment extends to all sectors, including agriculture, as they are recognized as catalysts for economic growth, employment generation, and wealth creation (Kashef Ganjdaredar *et al.,* 2022). So, it is important to pay attention to knowledge management in agricultural knowledge-based companies. The main purpose of this study has been to analyze the paradigmatic foundations of knowledge management in agricultural knowledge-based companies. In this regard, first generations of knowledge management were analyzed in detail. Later, using theoretical and paradigmatic studies of knowledge management, the new approach of knowledge management in knowledge-based companies has been accurately analyzed.

2. Literature review

Generations of knowledge management: The evolution of knowledge management has witnessed several generations along its progressive trajectory. Understanding the evolution of knowledge management and its generations

would lead to the use of correct knowledge and competitive advantage; Moreover, it would prefer the knowledge-based company.

The initial phase of knowledge management primarily concentrated on the exchange of knowledge and initial groundwork, particularly in the realm of business design and special projects. It also emphasized the storage and retrieval of information, placing significant importance on the implementation of information and communication technology. During the initial phase of knowledge management, there was a strong emphasis on the technological aspect. This led many organizations to restrict their knowledge management efforts to computer systems alone. They perceived the installation of knowledge management software as the end goal, neglecting the crucial human and business aspects of knowledge management and its significance in driving organizational transformation. The occurrence of failure on the way of achieving the goals of knowledge management, and the formation of a gap between the demands of organizations, and also the performance of knowledge management caused a review of the processes, approaches and tools of knowledge management. This accelerated the movement towards the second generation. In the first generation of knowledge management, knowledge has been considered as an objective fact (Nonaka & Takeuchi, 1995). In the initial phase, the primary focus revolved around knowledge tools and information technology as means to address and overcome problems and challenges. This highlights an illustrative instance of the aforementioned concept, being "If we knew what we know (type of knowledge)", generally (O'Dell & Grayson, 1998).

The second generation of knowledge management represents knowledge processes and participatory spaces which were mostly in the field of evaluation, assessment and measurement. In this generation, many organizations are promoting the implementation of knowledge management by emphasizing the development of the framework and structures of the knowledge management process in line with the development and technology of the organization. Moreover, in the current generation acquiring knowledge has been a process of learning and social interaction in social and management information systems (Bencsik, 2021). In simpler terms, the integration of knowledge management involved incorporating a systematic approach and, to some degree, a social outlook. This was coupled with thoughtful examination of the conceptual connection between knowledge management and business, while also disseminating information to employees about organizational, environmental, and industry-related aspects. In the second generation of knowledge management, the process and level of maturity of knowledge management were further considered by experts and organizational managers. The effort undertaken to enhance the organizational infrastructure, with a special focus on the role and significance of human resources, ushered in a more triumphant era of knowledge management

known as the second generation. The role of international consultants and multidisciplinary and interdisciplinary scientific literature has been undeniable in this success. But yet in the second generation of knowledge management, there has been a serious gap in relation to the organizational capabilities and knowledge nature of businesses (Hassanzadeh, 2021).

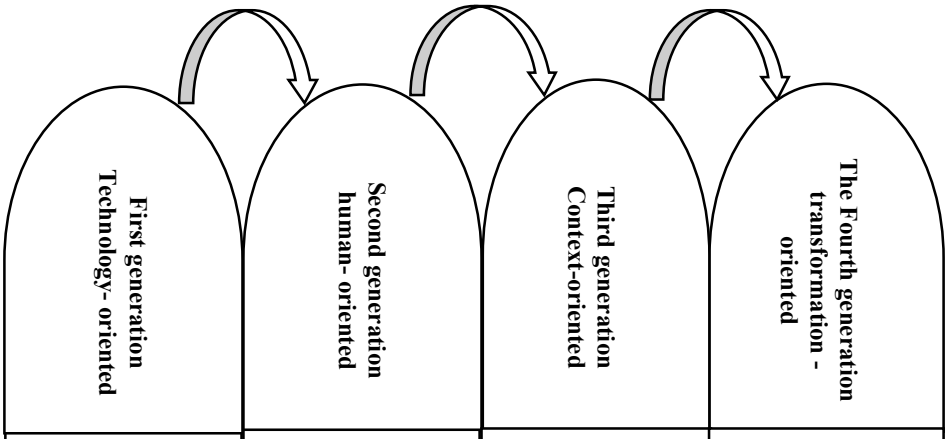
The second generation is considered as the human-oriented generation. In fact, in the first generation, due to the abundance of information, it moved to the opposite spectrum to focus on people, which can be interpreted as "if there was information and knowledge, who would know about it?" (Dalkin, 2011). As organizations wonder why new digital libraries lack content ("information junkyards") and why the usage rates are so low, there is a growing awareness of the importance of the human, social, and cultural dimensions of knowledge management. Actually, the approach of using only information technology (the first generation of knowledge management) was strongly inclined towards an integrated knowledge management system from top to bottom and at the organization level. In the evolution of knowledge management, specifically in the second generation, a human-centered approach emerged as a crucial factor for success. It became evident that embracing knowledge management from the grassroots level, while considering human and social factors, as well as acknowledging the pivotal role of individuals in the knowledge management process and organizational culture, leads to significantly better outcomes. As a result, various groups of individuals later became recognized as practical communities. These communities serve as valuable platforms for studying and sharing knowledge within an organization. They facilitate the efficient reuse of existing knowledge, promoting greater effectiveness, and also foster the creation of new knowledge to drive innovation. This innovative aspect plays a central role in the third generation of knowledge management. (Dalkin, 2011).

The third generation focuses on research-oriented knowledge management, team knowledge, social and cultural knowledge, operational and strategic organizational plans. In this generation of knowledge management, the creation of knowledge and innovative processes in the organization's structures is required to be done through organizational learning (Bencsik, 2021). In other words, knowledge management in this generation, by relying on the development of capabilities and focusing on creating a deep connection between business strategies and knowledge strategies of the organization, puts new horizons on the sight of organizations. The formation of knowledge management structures in organizations, the development of knowledge networks, an ontological look at the function of knowledge in the business environment and its connection with the surrounding ecosystem are among the characteristics of this generation of knowledge management. One of the most important distinguishing aspects of the third generation of knowledge management is paying attention to the organizational value chain. For this reason, value creation is considered as an

important part of management. Although very few organizations have kept pace with the changes in the field of knowledge management in this generation, the effort to synchronize knowledge management with global developments yet is persisting. The latest perspective on knowledge management, known as the third-generation approach, places a significant emphasis on tacit knowledge. However, it also intentionally addresses the dynamics of the knowledge ecosystem, the presence of ambiguity, and the perception of potential future prospects. In this context, implicit knowledge refers to information that has not yet been fully encapsulated and needs to be created (Scharmer, 2001). From the perspective of knowledge management, the concepts of the third generation are based on the assumption of knowledge as an "active and ephemeral process of communication" (Stacey, 2001). Thus, instead of understanding knowledge as an objective reality, it puts emphasis on the process of "knowing". In the third generation, thinking about knowledge, appearing as a network, surpasses information technology, people and even organizations (Bencsik, 2021). The concepts of the third generation of knowledge management highlight the relationship with ambiguity, complexity and paradox. They frame theses all as critical management resources. This can challenge "traditional" knowledge management practitioners who are interested in an object-like understanding of knowledge and typically strive to make knowledge transferable, manageable, and teachable (first generation) (Meissner & Wolf, 2008). In fact, in the third generation, the concept of knowledge management is perceived as a continuous process that emphasizes the significance of context and storytelling, rather than merely focusing on the information itself. (Snowden, 2002). The goal of the third generation of knowledge management in general is to systematically improve the organization's ability to mobilize knowledge with the aim of performance increase. The free flow, growth and empowerment of knowledge can be achieved through the care and application of knowledge, primarily with the help of networking and creating knowledge communities (Zamir, 2019). It is important to create a context that facilitates the unfolding of knowledge. This is the essential message of the third generation of knowledge management (Bencsik, 2021).

The fourth generation of knowledge management emphasizes on organizing knowledge, creating social networks, and sharing and collaborating knowledge efforts. On one hand, the fourth generation of rapid developments in the global arena, has made organizations face serious challenges, and on the other hand, it has made the need to provide solutions for challenges even more necessary. The increasing penetration of social networks, the emergence of phenomena related to the post-digitalization space (such as Metaverse), amazing developments in the field of artificial intelligence, the spread of digital currencies, and the intertwining of all businesses and all aspects of life with information and

communication technologies has made the great transformation inevitable. In this great transformation, simply attempting to change a part of the business or following a linear and hierarchical path of development is not the answer, rather a different kind of look, an action in a completely new direction, a unique innovation would be needed to build another world in which people and organizations might respond to new needs. In the meantime, the significance and placement of knowledge as the principal driving force has consistently maintained its vigor and steadfastness, and has even undergone enhancements. Along with moving towards the changing future, tasks and functions based on knowledge become more important. In the new age, knowledge has acquired prominancy from two points of view: First, from the point of view of its creation as a factor of movement in the cognitive system of the human factor, which forms the root of all current and future developments. Second, from the point of view of its transfer to artificial intelligent agents, future developments of which depends on their maturity. Today, intelligent agents play a decisive role in all aspects of life, from social networks to industry, defense, agriculture, education, monitoring, etc. The Internet of Things (IoT) and the connected intelligence are among the notable achievements in this field, that creating a connection between huge data treasures and dynamically defined tasks, provide the possibility of quick and accurate inference. The fourth generation of knowledge management as a transformational knowledge management, is related to value creation as the legacy of the third generation, and though responsible for facilitating the great transformation in organizations. Intelligent analytical tools are the most important drivers of fourth generation knowledge management. In transformational knowledge management, creating a connection between multiple human intelligences and artificial intelligence leads to the achievement of multiple, dynamic, scenario-oriented and forward-looking conclusions, which can be referred to as a turning point in the evolution of knowledge management. Knowledge management, being more focused on the future and horizons ahead by using analytical tools, has always been based on data, information and mental and organizational assumptions (Kashef Ganjdaredar *et al.,* 2022; Hassanzadeh, 2021). The fourth generation focuses on considering knowledge as a factor of capital and seeks to quantify. Thus, reinforcing the needs emerging in the second stage (Bencsik, 2021). At the same time, it can be seen that fundamental and conceptual developments have taken place in the first three generations, and since then, the possibilities of development, considering human power as capital, and its quantification and organizational application have come to the fore and the need for innovation has always emphasized (Bencsik & Filep, 2016). The general characteristics of different generations of knowledge management are summarized in Figure 1.



First generation Technology- oriented	Second generation human- oriented	Third generation Context-oriented	The Fourth generation transformation - oriented
-Emphasis on technology -Focus on storing and sharing knowledge - Knowledge as objective reality -Lack of attention to human dimensions -Goal: solving the problem, if we knew, what we know?	-Knowledge processes and participatory spaces with more emphasis on evaluation, assessment and measurement - Knowledge as a process of learning and social interaction in social and management information systems - Attention to the role of human and social resources - Goal: answer to the question "If information and knowledge existed, who would know about it?"	- Emphasis on the context for revealing knowledge due to the processual nature of knowledge management -Focusing on tacit knowledge and understanding knowledge as a process of knowing instead of an objective reality -Focusing on research-oriented knowledge management and team, social and cultural knowledge, operational and strategic organizational plans -Knowledge management focus on knowledge creation through learning and networking - Considering the concepts of this generation as critical management	-Emphasis on organizing knowledge, creating social networks, sharing and team knowledge - Changing the linear and hierarchical view -Advances in artificial intelligence, the spread of digital currencies -Emphasis on artificial intelligence agents for knowledge transfer - The most important achievements of this generation: Internet of Things and intelligent analytical tools -Communication between human intelligence and artificial intelligence to quickly achieve multiple, dynamic and forward-looking results

Figure 1- Characteristics of different generations of knowledge management

3. Research Methodology

The research methodology employed in this study is focused on providing a detailed description and analysis from a critical perspective. The research topic at hand is of a theoretical nature, where in the objective of the researcher is to explore and examine the connections between theoretical frameworks and various generations of knowledge management in agricultural companies that rely on knowledge-based practices. In order to achieve this goal, it is preferable to employ analytical, critical, and rational methodologies, as they are better suited for studies that aim to bring about substantial transformation or conduct comprehensive assessments, analyses, readings, and enhancements within a specific domain (Khosrupanah, 2011). Based on these methods, in this research, understanding, describing and expressing the problem and its importance has been discussed; besides, reviewing and analyzing related articles, the solutions provided, and also discovering the relationship between knowledge management, generations of knowledge management and agricultural knowledge-based companies has been considered either.

4. Results and Discussion

Paradigmatic and theoretical considerations of agricultural knowledge management: Research perspectives in social sciences seek to discover and understand correct and real knowledge. The selection of different methods depends on the researcher's understanding of social reality and the ontological and epistemological assumptions of the subject and phenomenon under study. The concept of ontology is related to the nature of phenomena. This category of hypothesis deals with the existence of social reality and the main substance. It pays attention to the essence and nature of phenomena being whether social reality is subjective or objective? Is the social reality outside the individual or the result of the individual's consciousness? Is the social reality presented outside or is created by the researcher's mind? (Blaikie, 2007). The root of these questions goes back to the discussion about formal philosophy and realism. Unlike the formal viewpoint, the view of the philosophy of realism states that phenomena have an independent existence and doesn't depend on the individual's attitude (Barbour, 2007).

Epistemology means "recognition of knowledge and its sources and limits" (Flick, 2009). This group of assumptions focuses on the common basis of knowledge and the nature and different forms of knowledge, how is knowledge obtained and how is it shared? Is the nature of knowledge hard and real or is it soft and subjective, moral and spiritual? Is knowledge unique or the result of mysticism? (Schwandt, 2001). Therefore, if objective and concrete knowledge is considered, in this case, the observational researcher, based on the positivist point of view, uses natural science methods such as quantitative methods to understand social reality. In this case, the researcher looks at the phenomenon as a natural

and objective phenomenon and investigates the relationships and rules between the variables and seeks to understand the concepts and follow the general rules about the studied phenomenon. Empirical positivist view and its influence in human sciences started with Auguste Comte in the 19th century. Although layers of this approach can also be seen in the works of David Hume and Francis Bacon. Auguste Comte believed that human phenomena might be studied in comparison to natural phenomena. Therefore, the methods used in natural sciences, as well as in human sciences have the same value. The term social physics was one of the terms he coined for sociological studies to show that the collective behavior of humans can be studied with the same method as natural phenomena. Then, the research in the field of social phenomena would be based on observations and experience with the aim of discovering the laws governing social behaviors. The researcher's recent breakthrough holds the key to comprehending and foretelling human behaviors. According to a collective of sociologists, adopting the methods employed in natural sciences within the realm of human sciences involves establishing a human entity within the same framework as a natural entity. This, in turn, leads to the harmonization of human existence with the laws governing the natural world. According to individuals such as David Thomas, the application of natural science methods in the field of human sciences is deemed accurate. This approach serves the fundamental purpose of science, which is to offer causal explanations for human phenomena, ultimately leading to the ability to exercise control and make predictions (Surush, 1987).

But if soft and subjective knowledge is considered, in this case the researcher is a dominant and creative person in the form of non-positivist logic who communicates with the research subject, initiates actions and uses qualitative and social science methods and specific techniques to understand the reality and social phenomenon under study, and examines what is important to the subject, emphasizes the relative nature of people, and seeks to understand the most detailed differences (Denzin & Lincoln, 2008). The interpretation point of view is more descriptive and emphasizes the explanation of human behavior and states that 1- People or subjects react in a purposeful way; that is, they are conscious and creative in their activities, 2- People or subjects actively shape social reality, 3- Situations and behavioral conditions are variable and are not fluid and constant 4- Events are unique and cannot be generalized, 5- Social reality should be studied in natural conditions and shouldn't be interfered by the researcher, and 6- Social reality, being complex and multi-layered, shouldn't be looked at superficially. The positivist approach is based on the belief that the epistemological and methodological resources in natural sciences and humanities are relatively the same; It has been in serious conflict with another approach considering social sciences apart from natural sciences. This difference in

perception is due to the fact that human science is a field completely related to the meaning, and this connection is due to the limitations of the method that exist in the positivist approach, which makes it impossible to access and enter meaning. Therefore, by replacing understanding and interpretation in social science studies, instead of discovery and explanation in natural science studies, purposeful separation and differentiation occurred in these two categories of studies. The separation in the goal of these two fields of study has been caused by considering of meaning as a basic element in the interpretation of the behavior of social actors. An element that doesn't exist in the behavior of natural agents. Therefore, this approach is introduced as a semantic approach. This approach mostly places meaning as the focal point of its studies in the interpretation of social factors (Fatemi *et al.,* 2021; Gaeeni & Hosseinzadeh, 2012).

In addition to providing more explanation of a behavior, the critical perspective, attempts to change the situation or phenomenon or at least provide a solution. This perspective states how behavior should be in a social situation and what components it should include. The critical perspective seeks to interpret the phenomena from the perspective of the subject itself. Critics, in fact, provides a kind of hermeneutic knowledge of the phenomenon, while positivists provide technical knowledge (Iman, 2010). A critical perspective intends to free people in a democratic society and reduces inequalities. The critical perspective is normative and unlike positivism which is descriptive, it is more prescriptive and highly pragmatic. Three perspectives of positivism, interpretive and critical are shown in Table 1:

Table 1- Positivist, interpretive and critical viewpoints

Approaches	Characteristics
The positivist approach	-Objective, tangible and technical knowledge -Phenomenon, a natural phenomenon -A descriptive perspective -Observer researcher - Using natural science methods such as quantitative and survey methods -A descriptive, explanatory point of view -Social sciences separate from natural sciences
Interpretive approach	-Considering the meaning in the interpretation of social behaviors - Targeted reaction of the subjects - Shaping social reality actively by people or subjects -Variability of the situation and behavioral conditions and the subject being affected by the conditions -The uniqueness of people and events -Complexity of social reality and deep interpretation of facts -Hermeneutic knowledge -Paying attention to the meaning and explanation of behavior
Critical approach	-Looking for a change in the situation or offering a solution -The interpretation of the phenomenon from the subject's own point of view -Seeking freedom and equality -A pragmatic and normative point of view

The ontology of agricultural knowledge in the first stage expresses a system including agricultural terms, definitions of agriculture and description of relationships between terms (Qian *et al.,* 2009). Agricultural ontology can precisely define domain knowledge because its controlled vocabulary provides semantic support that can accurately express concepts and their possible changes, conceptual features, and relationships between concepts and as a result manage, share and reuse the domain of knowledge (Zheng *et al.,* 2009).

In other words, agricultural knowledge management is a process including knowledge acquisition, knowledge representation (view), knowledge organization, knowledge exploration and developed management tools. According to this ontological perspective, knowledge management is based on the information flow of agricultural knowledge of various types. Some fields

such as food, vegetables, fruit trees and flowers, animal husbandry, fisheries, etc. This flow of information is recorded and stored as structured data relying on ontology. Then it can be published and used by communication technologies. Thus, a package of knowledge and information is provided as useful advice to users by examining their needs via data mining. Unlike general agricultural knowledge management platforms and websites, this framework can increase the intelligence and efficiency of knowledge management systems to enhance knowledge sharing and management.

In knowledge acquisition, in order to deal with the current bottlenecks in acquisition efficiency, the semantic function of ontology is used to study the model and technology of self-adaptive knowledge acquisition on a large scale (Kawtrakul, 2012). In the first stage of the representation of knowledge, domain knowledge is a set including concepts, relationships, hierarchies of concepts, relationships between concepts and axioms. In organizing knowledge, as different people act with different goals and using different methods based on understanding different and independent ontologies, ontology mapping and collaboration in single-domain and multi-domain are used to join these independent ontologies as a whole to realize knowledge organization. According to the rich expressions in the ontology in the knowledge mining, to speed up the discovery of implicit knowledge, the class is separated from the instance. In other words, the intelligent retrieval technology based on ontology is currently searching with keywords that can meet the information needs of users and conceptualize the search at the end of knowledge learning through content analysis and content expression. In management tools, the necessary systems and instruments are developed to facilitate the construction of the agricultural knowledge management (Zheng *et al.,* 2009). In the second stage, agricultural knowledge activities are considered as an objective phenomenon. In this way, for many centuries, human physical strength and animal strength have been used to provide livelihood and survival. The power of the plow, water, wind and sun keep the engine running. In the past, agriculture was traditional and there was a one-way relationship between humans and nature and the environment. But with the passage of time and the increase of population, the advancement of science and technology, commercial exchanges entered the human world, and with the discovery of iron, the use of human strength decreased, and traditional agriculture gave way to modern agriculture using different machines. As technology became more complex- nuclear technology, and the expansion of high-efficiency productions and cultivars- the use of satellites, etc. pushed the agricultural sector towards more industrial production. However, these developments and new tools made a lot of inconsistency between the goals of production and the use of natural resources and disrupted sustainable agriculture, which requires optimal management of agricultural knowledge. Agricultural knowledge management entails water management, soil, use of pesticides, antibiotics, relationship with

nature, human needs, activists, physical (hard) and soft infrastructure and legal infrastructure, rent-seeking, understanding ecological phenomena, industrial agriculture, green technology, social development, the use of non-governmental organizations, etc. to get the most benefit with the least cost (Fatemi & Rezaei-Moghaddam, 2020; Mansouri Vajari *et al.,* 2017).

Knowledge-based companies: A motivator of agricultural entrepreneurship: Currently, many developing countries are facing challenges for their all-round development in political, economic and cultural dimensions, the most important of which is the development of entrepreneurship with the aim of creating employment, reducing unemployment and poverty, creating social justice and leading people to higher level soft literacy, increasing social participation and creating equal opportunities for people and also protecting the environment (Rezaei-Moghaddam *et al.,* 2021). The experience of many countries shows that entrepreneurship is one of the most effective solutions for reducing unemployment (Golkarfard *et al.,* 2020). Entrepreneurship itself is a multi-dimensional phenomenon with multiple levels of analysis that has been created in an interdisciplinary manner (Chandler & Lyon, 2001). The interdisciplinary nature comprises different approaches such as economics, sociology, finance, history, psychology, anthropology, biology, physics, etc., and the result is the production of various insights in the field of theories and applications. In order to produce and combine different insights obtained from different perspectives, there might be need for special and appropriate methodologies to different approaches. Entrepreneurship takes help from sciences with an objective nature such as financial sciences, physics, biology, and sciences with a subjective nature such as anthropology, sociology, psychology, etc. Therefore, it can use methodologies that are suitable for each of the mentioned orientations.

Knowledge-based companies are the firms that are formed based on knowledge and realization of scientific and economic goals. These companies possess the ability to yield optimal outcomes by leveraging the knowledge and proficiency of their workforce. These corporations are established to foster the growth of creativity and breakthroughs in the realm of cutting-edge technologies. They possess the necessary technical, financial, and systemic qualities to effectively assess and acknowledge the competency of knowledge-based companies and institutions. In fact, the general theme of these companies is the commercialization of research findings. Knowledge-driven enterprises are widely recognized as catalysts for economic progress. Given the significant role that the agricultural sector plays in food production, employment generation, and trade interactions in numerous developed and developing nations, knowledge-driven enterprises have emerged as a pivotal avenue for fostering wealth creation, particularly within the agricultural domain, in developing countries (Mardanshahi, 2018). Knowledge-based companies attempt to be learning

organizations in which company members seek to improve their knowledge production capacity as a group and individually (Wang & Ahmad, 2003). Knowledge-based companies can have great effects in eliminating unemployment, improving the job pyramid, and aligning the educational system with the economic system, which is a very constructive factor in the development of the country's goals (Kashef Ganjdaredar *et al.,* 2022).

From the view of knowledge management, knowledge-based companies explain the production of knowledge and enrich knowledge and transfer knowledge and innovation (Ahmadi *et al.,* 2019). Achieving these goals in knowledge-based companies requires the guidance of entrepreneurs who have innovative ideas (Turker & Selcuk, 2009). In the field of agriculture, knowledge-based companies play an important role in the country's economic success in terms of creating jobs, developing innovation and taking advantage of new opportunities and considering the high importance of the agriculture and the potential capacity of this field in the formation of knowledge-based companies, they can achieve structural transformation in the applied fields and the growth of the country's knowledge-based economy. Research shows that the commercialization of agricultural research in Iran is not in a favorable situation and needs more attention (Fatemi & Rezaei-Moghaddam, 2019) and in terms of the creation and commercialization of agricultural technologies with new capabilities and higher performance than the existing technologies in the agricultural sector, the introduction of new methods in agricultural technology development and the creation and introduction of new technical skills in agriculture, need to review and provide improvement mechanisms. On the other hand, the goal of knowledge-based companies is to strengthen the spirit of entrepreneurship in universities and scientific societies, which has not been achieved as expected. So that the core of transforming knowledge into products in the form of modifying existing technologies or creating new technologies does not currently have suitable conditions (Tohidyan Far & Rezaei-Moghaddam, 2019).

Although there is a pressing demand for agricultural knowledge-based companies in the field of agricultural activities, the availability of such companies is severely limited. Consequently, there are various obstacles that knowledge-based companies in the agricultural sector encounter (Kashef Ganjdaredar *et al.,* 2022) and these systems are extremely susceptible to a variety of issues and experience significant rates of failure (Fakhari *et al.,* 2013). In the field of agriculture, there are challenges that are characterized by incoherence, lack of purposefulness, and influence of non-economic goals. In determining development policies, three important factors of production including technology, capital and skilled manpower, have been overlooked and undervalued (Fatemi *et al.,* 2018). Commercialization of agricultural research is not favorable. and in the agricultural research system, there is a noticeable absence of collaboration and cooperation between departments and organizations to share ideas and

experiences; besides, this lack of innovation is also observed in research activities pertaining to management, processes, and technology (Rezaei-Moghaddam & Fatemi, 2023). Knowledge-based companies compared to large companies, are highly sensitive to internal and external changes. Generally, they are faced with problems in providing their financial and human resources (Greengard, 1998). The experience of different countries reveals that in the new era, the progress of scientific and technological advancements in agriculture has finally reached its rightful position, eliminating the limitations of the past. This progress is crucial for ensuring human survival, particularly in light of the emergence of a knowledge-based economy. This shift has been facilitated by the establishment of knowledge-based companies and has had a profound impact on technological development. Consequently, farmers now have greater access to contemporary knowledge and the opportunity to acquire essential skills in managing the production process (Massa & Testa, 2009). One of these solutions dealing with the challenges of the last two decades, has been the use of knowledge management. Many companies, particularly those in the agricultural sector, face obstacles and hindered growth primarily because they fail to utilize analytical tools and views, lack effective communication strategies, neglect the potential of artificial intelligence, overlook the benefits of social networking for entrepreneurial development and participation, and generally neglect the implementation of transformative management practices. In fact, most of these companies have focus on traditional methods and have neglected the use of transformational management features in their departments.

A new knowledge management approach for agricultural knowledge-based companies: The main characteristics of the employment of knowledge management are highly dependent on the context. The characteristics mentioned in the agricultural and industrial sector are very important for understanding the organization and goals of agricultural knowledge management. Agriculture depends on natural factors and is characterized by features that regulate all activities from the organization of the enterprise to the sale of food. The seasonality or dependence on the season and weather cycle, the nature of outdoor performance as well as temperature changes, and the perishability of food products; these all determine strict time limits for its storage and trade. In modern agriculture, the acquisition of knowledge is becoming increasingly comprehensive, undergoing rapid transformations, and leading to greater complexity in farm management. Consequently, efficient knowledge management has become crucial vital for the success of the farmer. However, the practical diffusion of information and knowledge in the agricultural sector encounters various challenges, including the diverse range of users, the need to connect different disciplines, and the requirement for flexible access to information and knowledge (Carrascal *et al.,* 1995; Zecca & Rastorgueva, 2017).

Agricultural knowledge base as a knowledge management asset consists of scientific or special knowledge related to agricultural production and innovation in that production. Building such a knowledge base requires the development of specific procedures: collective experiments, building and testing prototypes, and ensuring the implementation of innovations (Labarthe, 2009). The concept of "agricultural knowledge system" includes all institutions, consultants, education and research that are involved in the realization of sustainable agriculture (Zecca & Rastorgueva, 2017) and it emphasizes the interest of producing and acquiring knowledge in the context of an agriculture with the participation of the actors of the general agricultural world (Soulignac, 2012). Knowledge management in the field of rural development includes the realization of the main functions of the management of personalized, codified and established knowledge resources, the processes with their participation and the conditions for the realization of these processes (Ziemian Vczyk *et al.,* 2014). The Farm Advisory System (FAS) is described as an essential tool for the successful implementation of the Common Agricultural Policy. The system's mission includes supporting farmers in their efforts to comply with European Union legal requirements related to the environment, food safety and animal health and welfare; Helping farmers to comply with "reciprocity" requirements and avoid loss of payment capacity. An important part of the farm advisory system includes agricultural extension services as a key factor in innovative agriculture, which remains the main source of knowledge for farmers in developing countries. In addition, extension can be considered as an informal educational function for any institution that disseminates information and recommendations with the aim of promoting knowledge, attitudes, skills and aspirations. Agricultural extension has a wide range of objectives, from technology transfer by companies organized around specific farm systems to problem-solving educational approaches or participatory programs aimed at reducing poverty and promoting community participation in the development process (Zecca & Rastorgueva, 2017). In other words, agricultural extension and consulting services can be defined as systems and mechanisms that are designed to create and strengthen the capacity of rural farmers. This is done by providing access to information and technologies, but also by increasing agricultural skills and practices, innovation capacity and addressing diverse rural development challenges through training programs, improved management and organizational techniques (Mbo'o-Tchouawou & Colverson, 2014).

A properly operating agricultural extension service holds significant importance as it enlightens farmers about the most effective methods to incorporate sustainable development practices (Jakobsson, 2014). Assessing the effects of knowledge management and agricultural knowledge extension is a challenging effort due to the intricate nature of the subject. The majority of knowledge and information in this domain is intangible, rendering measurement difficult.

Additionally, numerous other factors exert influence on the outcomes of these efforts. Some authors suggest monitoring to be used for estimating the impact of expansion. Monitoring is described as a specialized, dynamic, semi-autonomous and institutionalized management resource that helps in ensuring extension programs implementations in accordance with their design. Moreover the interests of various stakeholders are taken into account. Other than being an integral part or an important subsystem of a management information system, monitoring at the same time is of the information sources of knowledge management (Zecca & Rastorgueva, 2017).

In the realm of agricultural knowledge-based companies, industry specialists assert that companies possessing higher aptitude for learning have a better chance for enduring in the market. These companies possess superior learning capabilities and knowledge when compared to other sources. Also, knowledge-based companies synchronize themselves more than other companies with emerging changes and developments in the business environment and attempt to survive in a competitive environment through using knowledge and technology. Over the past decade, the field of knowledge management has played a crucial role by recognizing knowledge as a valuable resource within organizations (Feng *et al*., 2005). Development of this perspective, based on the positive role of knowledge management in small and medium-sized companies, led to further support for the formation of innovative knowledge-based companies with the fourth generation of knowledge management (Nonaka & Takeuchi, 1995). Based on the definitions employed in the field of knowledge management, it can be inferred that the establishment of a knowledge-based culture, encompassing both explicit and implicit knowledge, within science parks in the form of knowledge-based organizations, proves to be a highly effective approach for enhancing their productivity and efficiency. This knowledge management is the most suitable management model ever proposed for a knowledge-based company. In fact, the more a knowledge-based company uses its knowledge and structures, the more value it would gain, and the more complete the cycle of growth would be. In other words, knowledge management leads to the productivity and effectiveness of these companies. Knowledge holds significant significance in both individual and corporate domains, as intellectual capital progressively takes precedence over practical capital in the business realm. In this regard, with the increasing importance of paying attention to ideas, creativity and innovations, knowledge-based companies shall use knowledge management with the aim of increasing their chances of survival in the field of industry and society (Davis, 2009). Research indicates that knowledge-based enterprises in Iran, renowned for their role in fostering innovation, technology advancement, and serving as hubs for research and innovation-driven economy, face numerous challenges in terms of their structure and management. Therefore, irrespective of any imperfections,

small knowledge-based institutions in our nation will face challenges due to these inherent structural issues. Additionally, the economic shortcomings further intensify these structural problems, while also presenting new risks and possibilities. as a result, the performance of knowledge-based institutions of the country has been impacted (Kashef Ganjdaredar *et al*., 2022).

From the view of knowledge management, knowledge-based companies explain the production of knowledge, enrich knowledge and transfer knowledge and innovation (Ahmadi *et al*., 2019). The realization of these goals requires knowledge-based companies that are guided by the presence of entrepreneurs who have innovative ideas. So, programs aimed at teaching entrepreneurial skills are necessary both for starting and continuing entrepreneurial activities, and for continuing the activities of knowledge-based companies (Turker & Selcuk, 2009). People's skills are of the best predictors of progress and quantitative and qualitative growth of knowledge-based companies (Al Mamun *et al.,* 2019). Some researchers have asserted the success factors in knowledge-based companies to be located in three main categorizations including the uniqueness of the benefits of using innovation, the organizational characteristics of knowledge-based business, and the entrepreneur (Groenewegen & De Langen, 2012). Also, more years of professional experience, analyzing the strategies of fierce competitors, active marketing, creating and using social networks, having a business plan, using innovation as a business idea, willingness to take risks and taking risks- all of these elements are crucial for the triumph of a knowledge-driven enterprise (Brem, 2011). Devoting oneself to completing tasks through long-term effort and a team of skilled individuals, while harnessing human intellect, significantly contributes to the prosperity of entrepreneurs (Dana *et al.,* 2020). Numerous studies have delved into the realm of high technology, uncovering the firsthand encounters of numerous business founders, managers, and investors. These studies have diligently sought to identify and categorize the key elements that contribute to their success. In this way, the idea, strategy, commitment of the main team members, expertise and marketing are the success factors of the development of knowledge-based companies (Chorev & Anderson, 2006).

Based on the studies, the challenges of knowledge-based companies can be identified as lack of trust between employees and university professors, weakness in creating ideas and innovation, not using human intelligence, lack of connection with artificial intelligence and lack of sharing knowledge through social networks and smart tools, inappropriate hierarchical and governmental structure, the lack of change in this structure, education-oriented university instead of entrepreneurial university and subsequently having a linear view, lack of attention to intellectual property, lack of a suitable business model, weak material and spiritual incentives for production innovation, lack of a mechanism for a proper relationship, lack of a positive sense of understanding, lack of time, lack

of awareness and assurance of benefits, cost, lack of enthusiasm for innovation and insufficient literacy and technical skills of employees, the company's business method, lack of the necessary security, the low level of hardware and software technology, as well as intelligent analytical tools, little competition, little use by customers, insufficient government support and eventually little use by partners and suppliers (Rezaei-Moghaddam *et al.,* 2019).

The Internet of Things (IoT) is widely regarded as a modern and evolving concept in the field of information technology. Its primary objective is to establish a dynamic global network framework by seamlessly linking various types of physical and virtual objects through intelligent devices and sensors. The Internet of Things, having many applications in agriculture, can provide new capabilities and unique experience and economic opportunities for people and countries (Cui *et al.,* 2017). Measuring and controlling agricultural infrastructures such as greenhouses, setting up remote image sensor networks to detect pests and plant diseases, organizing radio frequency detector networks and near field communication to track, identifying and remotely checking product health among the applications of Internet of Things are in the field of agriculture (Tzounis *et al.,* 2017). According to its nature, Internet of Things can play its role in the quick identification and determination of soil properties, soil moisture and irrigation conditions, chemical fertilizers, plant diseases and pests, the operation of agricultural machinery, and the production and sale of agricultural products (Tohidyan Far & Rezaei-Moghaddam, 2020). The findings regarding the influence of the Internet of Things on smart agriculture reveal that it holds significant potential in delivering efficient remedies for automated upkeep and surveillance within agricultural domains, requiring limited human intervention (Farooq *et al.,* 2019). Researchers have demonstrated that the technological application of the Internet of Things is highly beneficial in enhancing the capacity of knowledge-based companies in the agricultural sector to comprehend, assimilate, adjust, innovate, network, and cultivate dynamic capabilities. In fact, knowledge-based companies in the agricultural sector can collect the data they need including product conditions, weather conditions, soil quality conditions, performance and condition of manpower and equipment used, via smart tools and sensors related to the Internet of Things (Bakhsham *et al.,* 2021). With the formation of social and knowledge networks in knowledge-based companies, the knowledge interactions of different units of these companies and thus their knowledge synergy increases either. By interactions and sharings accomplished through setting up networks, these companies can circulate the best activities and experience in the network, and make them available to different departments of the company, otherwise they would lead to waste of financial resources and low productivity (Rezaeian *et al.,* 2018). In order to remain competitive and successful, it is imperative for agricultural knowledge-based companies to

transition towards the fourth generation of knowledge management. This transition is driven by the unique characteristics exhibited by different generations of knowledge management, with particular emphasis on the utilization of diverse knowledge types and advanced technologies, innovation and learning, emphasis on entrepreneurial skills, emphasis on knowledge organization and creation of social networks, etc. In Table 2, we have explored the correlation between the success factors of knowledge-based companies and the distinct attributes exhibited by the fourth generation of knowledge management.

Table 2- Comparison of the success factors of knowledge-based companies in comparison with the fourth generation of knowledge management

The success factors of the knowledge-based company	Characteristics of the fourth generation of knowledge management
- Intellectual capital is gradually replacing practical capital in business - The importance of paying more and more attention to ideas, creativity and innovations - The attendance of entrepreneurs who possess innovative ideas. - Active marketing and creation of social networks - Dedication to carrying out tasks consistently and leveraging the power of human intellect. - Achieving triumph through the utilization of human intellect, coupled with the integration of artificial intelligence. - Success in sharing knowledge through social networks and smart tools - Achievement as a result of an appropriate and distributed framework. -Success as a result of applying a non-linear approach and using an entrepreneur university instead of an education-oriented university - Success on account of high use of hardware and software technology as well as intelligent analytical tools -Measurement and control of agricultural infrastructure and the impact of them on smart agriculture through the Internet of Things (IoT) - Knowledge synergy and knowledge interactions of different units of knowledge-based companies through the formation of both social networks and knowledge networks in the companies	-Emphasis on organizing knowledge, creating social networks, knowledge sharing and knowledge team. -Progress in artificial intelligence, the spread of digital currencies -Changing the linear and hierarchical view -Emphasis on artificial intelligence agents for knowledge transfer -The most important achievements of this generation: Internet of Things and intelligent analytical tools -The correlation between human intellect and artificial intelligence enables the rapid attainment of numerous, adaptable, and forward-thinking outcomes.

5. Conclusion

Agricultural knowledge deals with the production and processing of food. It includes the technologies of cultivation, harvesting, animal production and processing of plant and animal products for human consumption and other uses. In other words, agriculture is a practical, experimental and observable science that deals with nature. In accordance with ontology, one can assert that agricultural science is rooted in pragmatism. The approach towards managing agricultural knowledge has evolved from the initial phase that solely emphasized resources, to establishing connections between concepts by perceiving knowledge management as a dynamic process involving the organization of both knowledge and resources. It has moved from traditional agriculture to sustainable agriculture, which is based on participation and communication. Finally, the required knowledge of users, depending on their conditions and needs, has been diffused through management tools and communication technologies. Knowledge-based companies also facilitate the entry and application of new technologies in agricultural sector. These companies are supported at the beginning of their activity until the laboratory production of a product or an idea in Iran. This support continues until the mass production of the product or idea. Knowledge-based companies have used intellectual capital, and have been attempting to turn the idea into a product. Agricultural companies that leverage their expertise in organizing and managing agricultural knowledge, and share it through social networks, intelligent agents, tools, and the Internet of Things, along with analytical tools, have the potential to achieve remarkable success in transforming innovative ideas into tangible products. Based on an examination of the traits of different knowledge management generations, and with a specific emphasis on intellectual capital and paradigm analyses, it is imperative for companies to transition from the first, second, and third generations that solely concentrate on tacit knowledge, towards the fourth generation. By doing so, these companies can establish a sustainable future and progress towards a participatory approach and non-hierarchical system. In fact, knowledge management in them should be viewed as a process. The purpose of knowledge management in knowledge-based companies shall be transforming small companies into industrial companies; that is, to transform ideas into products through entrepreneurship and innovation, which are the main components of fourth-generation knowledge management in the framework of knowledge-based companies. In conjunction with the shift towards the fourth generation of knowledge management, there is a need to also transition from a positivist perspective, characterized by rigid and objective assumptions aligned with natural and technical sciences, to interpretive and critical approaches that align with social sciences. This shift is essential to adopt suitable and pragmatic behaviors that are in line with the intellectual paradigms being considered.

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تحلیل مبانی پارادایمی مدیریت‌دانش در شرکت‌های دانش‌بنیان کشاورزی

چکیده

دانش به عنوان یکی از ستون‌های موفقیت، عاملی ضروری برای نوآوری، تولید و رشد اقتصادی است که به عنوان ابزاری مهم برای رقابت بین سازمان‌ها تبدیل شده است. مدیریت دانش نیز استراتژی جدیدی است که سازمان‌ها و از جمله شرکت‌های دانش‌بنیان کشاورزی برای افزایش عملکرد و موفقیت به آن نیاز دارند و در صورتی‌که این شرکت‌ها نتوانند سیستم مدیریت‌دانش را درست و در زمان مناسب به کار ببرند، شکست خورده و از عرصه رقابت خارج می‌گردند. شرکت‌های دانش‌بنیان کشاورزی برای رونق کشاورزی و افزایش اشتغال دانش‌آموختگان کشاورزی نقش کلیدی دارند و در این زمینه شرکت‌هایی موفق خواهند شد که نسلی از مدیریت دانش را به کار گیرند که دانش در آن‌ها هم متناسب با محیط (زمینه) بوده و هم باعث یادگیری اثربخش، افزایش عملکرد و کارایی گردد زیرا امروزه چالش مدیران فراهم کردن محیط مناسب برای رشد ذهن انسان در شرکت‌های دانش‌محور است. در این پژوهش، مطالعات متعددی بررسی و نسل‌های مدیریت دانش با رویکرد پارادایمی مورد تحلیل قرار گرفت. یافته‌ها نشان داد که شرکت‌های دانش‌بنیان باید از نسل اول مدیریت دانش به سمت بکارگیری نسل چهارم مدیریت دانش بروند تا بتوانند با مشارکت، بکارگیری اینترنت، شبکه‌های اجتماعی، ابزارهای تحلیلی، عامل‌های هوشمند و ... از صحنه رقابت خارج نشوند و به نتایج آینده‌نگر و پویا سریعتر دست یابند. بنابراین پیشنهاد می‌گردد که شرکت‌های دانش‌بنیان کشاورزی بر مدیریت تحولی و ویژگی‌های آن تمرکز کنند.

کلمات کلیدی: مدیریت دانش، نسل‌های مدیریت دانش، شرکت‌های دانش‌بنیان، کشاورزی.