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COMPUTATIONAL KNOWLEDGE MANAGEMENT SCIENCE: THE RESEARCH PATH OF KNOWLEDGE MANAGEMENT IN THE ERA OF DIGITAL INTELLIGENCE

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Abstract: The proliferation of digital data requires the establishment of a new research paradigm based on complex data and methods. Building a computable research paradigm is a new path for knowledge management research in the era of digital intelligence. Through systematic digital representation and execution of computable Knowledge objects are of great significance for the exploration of application modes that promote knowledge to practice. Drawing on the development rules and research results of computational social science, the concept and core content of constructing computational knowledge management science are proposed. Comparing the three research methods of the computational social science research paradigm, three research methods for the development of computational knowledge management science are proposed. Computational knowledge management science is a new path for the development of knowledge management in the era of digital intelligence, and its core is to integrate computer science and technology to bridge the gap between "data-knowledge-practice-data". The scientific development of computational knowledge management is driven by the trinity of data, algorithms, and computing power. Building a computable knowledge management system and interpretability is the only way to adapt to the complex knowledge environment in the future. The research methods of computational knowledge management science are integrated, self-adaptive and time-sensitive, dynamic evolution and multi-dimensional verification are the core requirements of computational knowledge management system.
Keywords: Knowledge management; Computational social science; Computational knowledge management science; Knowledge twin; Metaverse; Digital intelligence

1. PREFACE

With the development and application of computer science and technology, more and more data sources are included in the category of calculation, which is suitable for the current virtual-real interaction scene requirements. The essence of the transformation of social interaction requires that information interaction activities originate from digital technology and return to digital technology. This is the explicit thinking logic determined by the basis of human social cognition and multi-dimensional perception needs[1]. Information is increasingly hidden in huge amounts of data, while knowledge comes from the process of combining information filtering and internalization practices. From data to information to knowledge, it explains that the behavioral order in the process of social behavior is not set. Instead, a new knowledge structure emerges through the uncertainty brought about by the change of microstructure requirements [2].

The emergence of computational social science provides a new way of thinking about knowledge management from the perspective of digital intelligence society interaction. Human beings are increasingly living in a quantified world. This does not refer to the large amount of quantitative data brought about by social interaction. On the contrary, the transformation of interaction methods brings more and more heterogeneous and unstructured data[3]. The development and application of computer science and technology as an intermediary of data quantification determines the ability to read, store and manipulate more and more data, which requires interdisciplinary integration and computing applications to update the research paradigm in the scientific field. Computational social science is driven by multi-modal data, applying algorithms and computing tools to complex data, and studying multi-dimensional social phenomena through modeling and computing [4]. The rapid development of Internet technology and mobile devices and the promotion of the third-generation Internet wave in Metaverse provide an opportunity to directly and comprehensively mine useful knowledge from multi-modal massive data, update the research paradigm in the field of knowledge management, and build new computing The scientific system of knowledge management is imminent.

Knowledge management has developed rapidly with the advent of the era of knowledge economy. The development and enrichment of knowledge management theory has benefited from the popularization of Internet technology and the large-scale promotion of knowledge management practice. Scholars at home and abroad have different opinions on the definition of knowledge management based on their respective disciplinary practice and understanding, but existing studies have shown that knowledge management is by no means a flash in the pan of management thought, and has already met the necessary conditions to become a discipline [5]. What is discussed here is not the question of whether knowledge management is a discipline, but the necessity and development opportunity of building a new scientific paradigm of computational knowledge management in the highland of the era led by digital intelligence technology, and accelerating the transformation of information digitization to knowledge digital intelligence. In the third-generation Internet wave, construct a knowledge management paradigm from knowledge to wisdom. The scientific paradigm of computational knowledge management discussed in this paper is not only a new development opportunity in the field of

knowledge management, but also provides new thinking and theoretical guidance for promoting the development of knowledge management in the era of digital intelligence.

2. LITERATURE REVIEW

2.1 Knowledge Management

With the development of social economy, the material economy is gradually turning to the knowledge economy in the process of adapting to the requirements of the times, and the concept of knowledge management has gradually formed and received more and more attention. The development of knowledge management is inseparable from the influence of management science, so knowledge management is also considered as a branch of management science and knowledge science [6]. Knowledge management, as the third leap of management thinking, updates the research paradigm in the field of management at the ideological level, emphasizes the adaptability of enterprise organizations to dynamic environments in complex social interaction environments, obtains continuous knowledge updates for knowledge creation and maintain their own competitiveness [7]. The development and application of digital technology has undoubtedly accelerated the development process in the field of knowledge management. Various disciplines have carried out multi-level participation in the theory and practice of knowledge management according to their own characteristics and categories, making knowledge management an interdisciplinary comprehensive discipline. Knowledge Management Science [8].

The research objects of knowledge management science include not only the management of knowledge creation, acquisition, processing, storage and application, but also the management of various resources and intangible assets related to knowledge. From a macro perspective, knowledge management science can be considered as a thinking paradigm for the study of knowledge resources and knowledge-related processes, while from a micro perspective, knowledge management science can be considered to be a study of knowledge and knowledge-related processes, activities, personnel, organizations, technologies, and processes. The management method of deconstructive analysis [9]. The traditional knowledge management path focuses on the adjustment and deployment of organizational information resources, and relies heavily on the internal information system of the organization to achieve organizational business optimization and management knowledge accumulation, so as to better adapt to market demand, adjust and understand its own operating conditions. Knowledge management in the era of big data is faced with a more complex and changeable knowledge environment, the root of which lies in how to obtain knowledge output and best practice paths from massive data, apply and practice corrections, and then rise to become human wisdom [10]. The existing research paradigm of knowledge management can no longer meet the requirements of the development of the times. The environment of the era of digital intelligence requires knowledge management to break through the existing research paradigm and establish a new research mechanism to separate knowledge units from massive data and information. The bridge between knowledge acquisition and practice focuses on transforming resource environment and data practice to create an intelligent knowledge management ecology with internal and external cycles, satisfying the multi-modal perception needs of knowledge demanders, and forming a new knowledge ecology that drives knowledge and practices create knowledge.

2.2 Computational Social Science

Computational social science is undoubtedly the product of social science research when the development of computer and information technology enters the era of big data. It breaks through the traditional disciplinary paradigm and forms a new development, new path and new paradigm of social science in the era of big data. The concept of computational social science was formally proposed by Lazer et al. in 2009, emphasizing the combination of the advantages of social science and computational science, strengthening the role of network science in research and development and the digital resources provided by digital media [11]. The transformation of social interaction methods and the large-scale digitization of interactive data have released an unprecedented amount of digital data. Traditional quantitative social science research methods are difficult to deal with huge data sets with complex structures [12]. At the same time, unstructured data occupies an increasing proportion in the process of social interaction. By using computer technology to apply large-scale data sets from social media to explain the theory of human social behavior, or to explain the individual manifestations of social behavior in the physical world Some behavioral abilities become very important.

The 2012 Computational Social Science Manifesto pointed out that social science in the era of big data will experience a huge paradigm shift [13]. Computational social science will combine experimental and computational methods to bridge the gap between theory, fact and research. The new methods provided by computational social science will increase the influence of social science. Through the analysis, simulation and prediction of big data, management will be improved, decision-making and evaluation will be more scientific, and the optimal path for social development will be identified more effectively[14]. After decades of development and enrichment, computational social science has been widely used in interdisciplinary research, including "computational journalism", "computational linguistics", "computational political science" and "computational taxonomy" [15]. In the context of the era of big data, the development and enrichment of computational social science provides a good idea for the development path and future direction of knowledge management science. The development of knowledge management is driven by the form of "big data +", and it is of great significance to help computing knowledge management serve knowledge science and management science.

2.3 Computational Knowledge Management Science

Although knowledge management as a discipline has not yet been clearly defined, it is

However, according to the subject definition proposed by Kuhn, it is found that knowledge management already has five necessary conditions to become an independent subject [16]. In the era of big data, the knowledge economy will still play a greater driving force, which also indicates that knowledge management needs to usher in greater development. At the same time, knowledge, as the basic concept of the development of the current era, makes the development of knowledge management disciplines more realistic. With the development and application of digital technology, the knowledge base in the era of knowledge economy has been continuously expanded, and the multi-dimensional forms of digital data, information and knowledge have led to a broader world of knowledge management [17]. In the era of big data, the relationship between large-scale digital data, information and knowledge has become more complex, and solving information overload and knowledge creation in the era of big data is also the crux of knowledge management [18]. Combining computer science, management science and knowledge science to develop computational knowledge management science is the only way.

Computational knowledge management science is a new research paradigm in the field of knowledge management, and its concepts, development, methods, impacts and challenges are all in the exploratory stage. According to the core requirements and social goals of knowledge management, it can be determined that the content of computational knowledge management science must conform to the digital characteristics of the big data era, and is committed to grafting the bridge between "data-knowledge-practice" and enriching knowledge needs. Multi-dimensional perceptual experience, enrich the value system of knowledge management science, develop interdisciplinary knowledge management theory and discipline mechanism, etc. Based on this, the computational knowledge management science is defined as: through the combination of computing technology, digital technology, intelligent technology and interdisciplinary advantages to innovate knowledge management methods, relying on the background of big data, to build a computable knowledge management system and interpretation ability, and to mine more The standard model and practical path of multi-knowledge application explore the practical process and explanation mechanism of knowledge behavior, and form a knowledge management ecosystem that continuously promotes knowledge innovation and value co-creation. This paper discusses the conceptual basis and content of computational knowledge management science, in order to provide new directions and research ideas for the development of knowledge management science in the new era of digital intelligence.

3. BASIC CONCEPTS OF COMPUTATIONAL KNOWLEDGE MANAGEMENT SCIENCE

Knowledge management originated from the intersection of management science and knowledge science. It is not only an inevitable product of the development of the times, but also a transformation of the management science research paradigm to adapt to the development of social productivity. Existing studies have shown that digital data and methods in the era of knowledge economy have become a new basis for the study of knowledge behavior, and digital knowledge accumulation, as a basic resource for maintaining development competitiveness, plays a major role in the process of enterprises, organizations and individuals adapting to environmental changes. After years of development, knowledge management has gradually formed a diversified, interdisciplinary, cross-industry, and cross-cluster discipline paradigm, and has already met the necessary conditions to become a discipline [19]. Facing changes in the field of digital intelligence in the future, the existing research paradigms of knowledge management can no longer meet the development requirements of the digital intelligence era, which will greatly reduce the efficiency and effectiveness of knowledge management, and knowledge management must find a new liberation. The development of computational social science in the past few decades has given us great inspiration. Knowledge management must break through the existing research paradigms and establish its own discipline system to meet the knowledge requirements of the era of digital intelligence. The era of computational knowledge management science has arrived.

The birth and development of digital networks have made the boundaries of human life infinitely expanded, and the concept of knowledge management has also changed from the initial organizational knowledge resource control topology to the interactive cycle of "data-information-knowledge-practice". And the demand for knowledge management is becoming more and more significant [20]. The arrival of Internet Web 2. 0 makes people's behavior state change from passively receiving data to actively producing and exchanging information. The arrival of Internet Web 3. 0 will make people's behavioral needs change into active creation, perception and practical knowledge. The development and application of digital technology will undoubtedly engrave our behavioral state into the digital system at all times. The "digital footprint" created by many individuals and stored in real time is a precious wealth from research data to knowledge. However, the existing knowledge management research paradigm It is difficult to deal with these complex and variable mass data, which requires us to use computer technology to assist in the study of knowledge behavior in the digital environment.

In the existing research process, many scholars have used computer technology in the study of knowledge management, but there is still no clear research paradigm to guide knowledge management in the era of big data. The gate, knowledge management in the era of digital intelligence will open a new era, a new knowledge management research paradigm that adapts to the digital intelligence environment needs to be established, and computational knowledge management science is emerging.

3.1 Computable Knowledge Representation: Trinity of Data, Algorithm and Computing Power

The concept of computational knowledge management science originated from the cross-integration of many disciplines such as knowledge science, management science, computer science and information science. In order to adapt to the space environment of the era of digital intelligence, it is expected to become a new path for the further development of knowledge management in the future [21]. The relevant research process of computational knowledge management science has never stopped. Many scholars at home and abroad have combined computational science and knowledge management to study knowledge management in their respective disciplines. Although the concept of computational knowledge management science has not been clearly proposed by scholars, it is still From the micro-change trends of these research methods, it can be seen that the research paradigm of computational knowledge management science is taking shape. Existing research on knowledge management shows that the research process of knowledge management and the research process of social science have many similarities at the level of computer application. For example, use data mining, machine learning and other information science technologies to obtain and analyze massive social interaction data to deconstruct the knowledge mobilization mechanism of knowledge demanders in the process of virtual-real space interaction; use social networks and simulation to study the behavior of knowledge demanders in online communities The knowledge service model of the interaction between relationship and practice environment, etc. These research paradigms are widely used in various fields of knowledge management, and are inseparable from the generation and acquisition of data, the development and application of algorithms, and the support and upgrade of platform computing power in computer science and technology and digital environments.

The results of knowledge behavior interaction can be divided into tacit knowledge (Tacit Knowledge) and explicit knowledge (Codified Knowledge). The idea and action of "Mobilizing Computable Biomedical Knowledge (MCBK)" proposed by the University of Michigan in the United States provided inspiration. The concept of research representing computable medical knowledge includes the computability of knowledge representation and knowledge in practice. It can be implemented in two ways [22]. The core concept of computational knowledge management science is first of all to transform knowledge asset representation into a computable form into a knowledge unit that can be recognized and operated by a computer. In the existing knowledge management research, the structured data of explicit knowledge occupies a significant proportion. With the development and application of digital technology, the expansion and extension of the virtual-real interaction space makes the unstructured data generated in the process of knowledge interaction behavior (picture , text, audio, video, animation...) more and more, and the virtual representation between perception and practice as an important source of tacit knowledge has received more and more attention, which is also the focus of the third Internet revolution field. Computational knowledge management science must realize the joint drive of tacit knowledge and explicit knowledge when solving the computable representation of knowledge forms, which is very important for the construction of a new knowledge management research paradigm.

The computable form of knowledge representation not only needs to complete the transformation of the knowledge form into a knowledge unit that can be understood and operated by the computer, but also needs to combine the data with the application of computer science algorithms to mine executable knowledge data after the knowledge form is computable and accessible. , that is, the extensive use of distributed computing power, the relationship between high-dimensional variables and huge amounts of data paves the way for further acquisition and prediction of human knowledge behaviors and computational efficiency logic of knowledge laws [23]. The construction and development of computational knowledge management science is inseparable from the development and application of digital technology. In the field of computer science, massive data, massive models and real-time calculations require a sharp increase in computing power. However, in the field of knowledge management, the cooperative advantages of data, algorithms, and computing power have not yet been brought into play. The scientific research paradigm of computational knowledge management will focus on the large-scale use of the advantages of combining data, algorithms, and computing power to establish a data-knowledge-practice-data It accelerates the flow from data to knowledge and then to practice, gives full play to the computing advantages of computers used in knowledge management, mines and predicts the standard model of knowledge demand behavior, and provides more options for promoting knowledge value and theoretical innovation. path.

3.2 Knowledge can be Implemented in Practice: Virtual Reality, Virtual Digital Intelligence Practice

The complexity of knowledge data sources determines the complexity of knowledge structure, and the complexity of knowledge structure determines the idealized differences from the unity of knowledge to practice. The traditional knowledge management research paradigm is applicable to the organization's acquisition, processing, storage and application of known knowledge sources, etc., focusing on the operation and management of various resources and assets related to knowledge in the process of organizational management [24]. The advent of the digital age has accelerated the pace of the diffusion of knowledge assets from organizational groups to individuals with knowledge needs through digital devices. The boundary between knowledge producers and knowledge consumers has become increasingly blurred, and knowledge source data is continuously actively produced and consumed on personal mobile devices, wearable devices, and sensor devices [25]. The demand for knowledge management has spread to various disciplines and fields. Knowledge management under the background of big data focuses on how to find executable knowledge practice paths from the expanded knowledge interaction behavior data lake.

As the knowledge computing representation of data acquisition, algorithm analysis, and computing power becomes a reality, computing knowledge management is expected to greatly bridge the gap between knowledge and practice. Knowledge source data can be divided into structured data and unstructured data. For structured knowledge source data,

it can be directly converted into computable knowledge data, combined with the call and operation of computer algorithms to complete the virtual representation of knowledge objects; for unstructured knowledge Source data needs to be combined with tools such as image processing, text recognition, speech recognition, and knowledge graphs to establish a knowledge base with a clear structure. A knowledge base with a clear structure means that knowledge resources need to be managed as an integrated social resource [26]. All data types need to be driven by computing power to complete the operation of knowledge-to-practice mode. However, the processing of these knowledge source data to knowledge data is only the work performed by its computer. A large number of studies have shown that these tasks can guide real life. In order to become a detectable practice path for knowledge practice behavior and knowledge-to-practice mode, it is necessary to establish a digital intelligence front-end representation model to ensure the execution effect of knowledge practice.

The emergence of digital twin technology and its application in the industrial field has brought a lot of inspiration. The virtual representation of physical entities is used to detect, regulate and predict the operation status of the product cycle, and the results are fed back to each stage of the product life cycle in the practice process to ensure that data and information The continuity of [27]. Cognitive digital twins focus on the cognitive evolution of product digitalization on the basis of digital twins, emphasizing the adjustment and optimization of physical entities and product life cycles, as well as subsystems in product evolution stages, integrating the availability of products and production systems in different life cycle stages. Data, information and knowledge enhance the cognitive ability of digital twin technology through technologies such as knowledge graph and semantics [28]. From digital twin to cognitive digital twin, this implies that knowledge can be regarded as a "cognitive digital clone of knowledge" through digital channels, and this "cognitive digital clone of knowledge" is defined as "knowledge twin"[29]. Knowledge twin is the knowledge structure of the knowledge owner twin, which is characterized by the ability to reproduce the original state of behavioral knowledge in physical space-time in digital space-time, reflecting the changing state, type, granularity, cycle, etc. of knowledge, and serving as a link between supporting data, knowledge and practice. The shared dynamic system of , can be used to transform computable knowledge models into practice paths.

Therefore, theoretical research shows that the core concept representation of computational knowledge management science has a complete logical closed loop. From the computable representation of knowledge data to the system service of knowledge practice, and then to the mode feedback of knowledge practice, the knowledge twin system is expected to become a direct Acquisition of knowledge-to-practice monitorable models, data-to-knowledge computing representations are packaged into knowledge objects through computing programming and directly executed by the knowledge twin system, and the visualization services of the knowledge twin system (air imaging and 3D light field display, etc.) will help knowledge demanders Complete the knowledge transformation path of reflecting the reality with the imaginary and practicing the imaginary.

4. SCIENTIFIC RESEARCH PARADIGM OF COMPUTATIONAL KNOWLEDGE MANAGEMENT

Peter Drucker once argued that knowledge is the only meaningful resource in today's world [30]. Ikujiro Nonaka also believes that the new management paradigm in the future era of digital intelligence is inseparable from knowledge management, and future knowledge management research is closely related to how to promote the transformation of knowledge into practice in the process of knowledge management [31]. Changes in the future interaction field require us to build a new scientific research paradigm of computational knowledge management.

4.1 Knowledge Data Computing: the Process from Big Data to Big Knowledge Data

The integration of digital network technology and sensor technology has opened the curtain of the big data era of the Internet of Everything. The massive, heterogeneous and dynamic data sets generated by the efficient information interaction between people and the environment converge into a vast data lake in the digital space. As a reservoir of knowledge sharing, the huge knowledge potential needs to be salvaged with the assistance of computer science and technology. With the emergence of distributed storage and computing, large-scale databases, real-time streaming data processing and visualization and other technical support data management solutions, the computable representation and executable path from big data to big knowledge data can be solved. Data-driven and algorithm-driven knowledge data computing will promote the continuous advancement of big data of social interaction behavior to big knowledge data, New discoveries of existing knowledge structures and behavior patterns, focusing on the sustainability and continuity of knowledge creation, using new computing technologies to accelerate the exploration of hidden knowledge potentials at the organizational level, and discovering and constructing new theories based on this technology and new explanations.

The transformation of the scientific research paradigm needs to adapt to the emergence of more new things as the scene changes. The emergence of computational social science is exactly adapted to the social science research in the era of big data. The research paradigm of computational social science is mostly reflected in data-driven and algorithm-driven. Compared with traditional physical methods, computational social science can not only persist in discovering and pursuing regular connections between various social phenomena, but also use computer science and technology as the main The research tools and technical means reflect the adaptive transformation of the complexity of social science research and the cross-integration of information science [32]. Similarly, the development of knowledge management research also needs to constantly adapt to changes in the knowledge environment. In the context of big data, knowledge management research also has the phenomenon of data-driven and algorithm-driven, but in the existing research, there

is a phenomenon of driving differentiation. The use of computer science and technology to acquire and analyze knowledge behavior data in the process of massive social interaction has greatly promoted the process of transforming knowledge into practice. There are many similarities between knowledge management research and social science research. Computational social science research has formed three major research methods, namely social data calculation, social simulation and Internet social science experiment[33]. Starting from the data structure, how the computational knowledge management scientific research paradigm combines computer science and technology to adapt to the characteristics of the era of big data, and the development of computational social science research methods have provided us with many references. However, this paper argues that the development drive of computational knowledge management science needs to be different from computational social science, and must be completed independently by combining data, algorithms, and computing power. However, in terms of the applicability of research methods, existing research in computational social science can be used for reference. method. The big knowledge data generated by these network life is providing continuous, large-scale and long-term knowledge interaction behavior data for knowledge management researchers. Computational knowledge management science will be able to study the demand process and development cycle of human knowledge behavior with unprecedented breadth, depth and scale, and provide a new perspective for promoting knowledge management research.

The complexity of social interaction has led to the increasingly obvious phenomenon of data drift in the era of big data. The difference in data value brought about by data drift makes it more difficult to standardize the interaction behavior model of research needs. Data drift can be divided into time drift and spatial drift in terms of dimensions. Time drift refers to the change in the behavioral cycle characteristics of sample populations with the same other conditions during the interaction process over time; spatial drift refers to the difference in other conditions. The behavioral characteristics of the sample population in the interaction space are different in the interaction process. From the perspective of research subject and research object, knowledge management research takes the knowledge demander (human knowledge interaction behavior) as the research subject, and then studies the knowledge demand mode in the process of knowledge interaction. The resulting research topics include knowledge mobilization, knowledge Service and knowledge sharing, etc., have promoted the depth and breadth of knowledge dissemination, which is of great significance for promoting knowledge practice and knowledge creation; taking knowledge as the research subject, and then studying the evolution process of knowledge life cycle, knowledge value co-creation and knowledge empowerment, etc. Promote the practical application and value transformation of knowledge. For knowledge management research, data drift has a great impact on the concealment of knowledge itself (that is, the conversion between explicit knowledge and tacit knowledge) and the interaction complexity of human knowledge needs and behaviors. Computational knowledge management science Development will provide great help in mining hidden standard pattern paths in massive knowledge data.

Social science research draws on the “fourth paradigm”—data-intensive scientific discovery—proposed by computational scientist Jim Gray, and proposes a data-driven social research paradigm, which is different from the traditional research paradigm dominated by theory and models. Using specific algorithms designed by computer science and technology to identify key variables from large-scale social data, discover the correlation between variables, and summarize the human behavior and social operation mode hidden behind the big data. On the basis of data-driven, computational social science does not reject traditional theory and model testing, and emphasizes the two-way drive of both theory and data. Knowledge data computing should draw on the research paradigm of computational social science, neither rejecting the data-only theory that generates computational knowledge from existing theories, nor constrained by traditional theoretical frameworks and verification hypotheses. It needs to be guided by real knowledge management issues, based on knowledge management related theories and experience in various fields, and with the help of computer science and technology, to mine (data mining, machine learning...) knowledge models with high value density in large knowledge data pools. Then, based on the extracted knowledge data, compared with the existing theoretical framework, the model is tested in a scientific way to verify the model, so as to discover and reveal the hidden knowledge behavior rules, and promote the update of knowledge management models and the possibility of knowledge practice paths. Accessibility. The development characteristics of computational knowledge management methods are shown in Table 1.

Table 1 Methodological characteristics of computational knowledge management

Characteristics & Applicable / Research Methods	Computational Social Science	Computational Knowledge Management Science
	Data and algorithm dual drive	Driven by data, algorithms, and computing power
calculate	data mass	data mass
	data persistence	data persistence
	data non-responsiveness	data complexity
	completeness measure	Data conditionality
	representative correction	data representation
	Sensitivity Cross Validation	sensitivity bias

uneven quality	value extension
behavior prediction	behavior prediction
Behavior analysis	Behavior analysis
pattern exploration	pattern mining

4.2 Knowledge Behavior Simulation: Understanding and Coping with the Complexity of Knowledge Behavior and Needs

The development of knowledge management benefits from the rise of the knowledge economy, and the development of human society has experienced a transition from an agricultural economy to an industrial economy, and then from an industrial economy to a knowledge economy. The rise of the knowledge economy represents the establishment of social sustainability based on knowledge in social development, and the knowledge economy has gradually become the sustainable driving engine for social and economic development. The fourth stage of economic growth theory is the stage of special knowledge and professional human capital accumulation theory. Knowledge management, as the main factor for enterprises to obtain sustainable competitiveness in the digital age, has received more and more attention in the fields of enterprise development commodity value theory and enterprise management strategy theory. more and more attention. From the perspective of the complexity of the organizational environment, knowledge management endows the organization with the ability to recognize and respond to the complexity of the system environment in which it is located. The demand will also gradually change from enterprise and organization-led to individual demand-led. The interaction of factors such as information differences, digital divide, and perceived benefits will lead to a further upgrade of the individual's understanding of the complex phenomena of social interaction environment and behavior. Knowledge management research must explore the ability to adapt Research methods for complex systems of social interaction in the era of digital intelligence.

Computational social science combines computer simulation technology with social simulation to explore and respond to social complexity, and it can also be used for reference in understanding and responding to the complexity of knowledge behaviors and needs. Computer simulation is divided into system modeling, simulation modeling and simulation experiment. System modeling can abstract the attribute concept model or mathematical model of knowledge interaction behavior; simulation modeling uses computer algorithms to express the system model into a form that can be recognized by computer; simulation experiment is to run the simulation model in combination with the actual situation and continuously adjust relevant parameters to correct the model. Computer simulation has long been used in related research on knowledge management, but no systematic research paradigm has been formed, and most of them use a certain process of computer simulation to verify the proposed model assumptions. In the development of computational social science, computer simulation quickly formed a systematic method of social simulation, that is, based on relevant theories or experiences of social behavior, a computer model of a real social system was established to simulate its dynamic evolution process. It can not only be used to explain the complex social phenomena of social structure, function and its changes, but also predict the evolution direction of social development.

For the scientific development of computational knowledge management, computer simulation can be integrated into the concept of knowledge twins for development and application. According to its object-oriented modeling, it studies the complex interaction of knowledge behavior, and combines realistic interaction rules to simulate and predict the demand orientation of knowledge behavior. Aiming at the knowledge management needs of individual demanders, establishing an agent-based modeling and simulation model is a feasible method to study knowledge demand diffusion, knowledge mobilization and knowledge services. For example, the recognition of knowledge behavior in multi-layer social networks, the relationship between role-playing between knowledge contributors and knowledge latenters and the interaction of multi-layer networks, and the importance of conversion force, etc.; network community member preferences and personalized service needs The impact prediction of the service and the correlation between the popularity of service perception and the power of social media content on the Internet, etc. The characteristic of this research method is that it can present the dynamic evolution process of the entire system at the macro level, and reflect the adaptive characteristics of the behavior of the interacting subject at the micro level. Of course, applying computer simulation to the unity of knowledge behavior simulation is still a methodological idea. Knowledge management researchers must promote the related research on computer simulation knowledge behavior and environmental adaptability, including the encapsulation and application of related computer algorithms, and realize the computer model. The real-time synchronization of the complexity of interaction with real-world knowledge behavior is a key link, which is crucial for the development of computational knowledge management science. The characteristics of the development of the simulation knowledge management method are shown in Table 2.

4.3 Scientific Experiment of Knowledge Management in Digital Intelligence Space: Practical Wisdom in the Era of Digital Intelligence

The third major research method of computational social science is the Internet social science experiment, that is, the integration of information technology into social science research through the Internet platform greatly adapts to the requirements of social science experiments in the digital age. Experimental methods are widely used in natural science research, and have made great contributions to exploring the extensive connection between empirical facts and

theoretical frameworks of natural science research objects. Using experiments to verify established theoretical frameworks or refine new theories has gradually become a dominant research method, and social scientists have gradually introduced experimental methods into their own research fields. The experimental methods of social science are different from those of natural science. Under the premise of high control interference variables, social science experiments study the changes of the result variables (dependent variables) caused by the stimulus (independent variable) applied to the subjects to verify Whether theoretical assumptions or causal propositions hold. However, the validity of experimental results is often restricted by many factors such as conditional control, sample representativeness , environmental simulation and repeatability, and the development of the Internet and digital technology has brought new light to social science experiments.

Table 2 Methodological characteristics of modeling knowledge management

Characteristics & Applicable Research Methods	Computational Social Science	Computational Knowledge Management Science
simulation	social system complexity	Knowledge Behavioral Complexity
	database foundation	knowledge base
	autonomy	adaptability
	Goal-oriented	demand-oriented
	bounded rationality	bounded rationality
	Heterogeneity	dynamic diversity
	Interactive timeliness	Interactive timeliness
	Repeatability	Repeatability
	cognitive freedom	Cognitive difference
	Perceptual optimization	Perceived benefit

The overall migration of social interaction in the era of big data to the Internet space has created a huge pool of subjects for Internet experiments. Cyberspace has the advantage of breaking through the limitations of time and space. Information interaction technology supports the calculation, representation and operation of social interaction data, and at the same time provides strong support for better satisfying the constraints of many factors that affect experiments. Social Science Laboratory" to carry out social science research has become an important part of computational social science. For the field of knowledge management, especially in the post-epidemic era, it is not uncommon to use social media platforms to obtain knowledge behavior interaction data and carry out related research. At the same time, the use of computer science and technology to help analyze multi-modal data obtained from social networks to verify existing knowledge management theories or refine new theories is also emerging, and the basis for scientific experiments on knowledge management in the digital space is already in place. Traditional experimental methods such as interviews and fields are limited by many factors such as time and space. In the more representative practice bases of the future digital intelligence space, computational knowledge management scientific experiments will shine brilliantly.

The core of computational knowledge management is to promote the transformation of knowledge into practice, and to apply computer science and technology to explore more alternative theoretical frameworks and practical models. Computational knowledge management science can learn from the Internet experiment method of computational social science, but still needs to explore its own unique adaptive theoretical basis. Applying knowledge twins vigorously to computational knowledge management scientific experiments will become an achievable path in the future digital intelligence space. The knowledge twin system may become a computing encapsulation gathering place for experimental verification and pattern mining. Applying digital twin technology to simulate knowledge life It can enhance the computer's cognitive ability and regulate the operation of each subsystem of the knowledge life cycle, which can promote the mining of knowledge behavior patterns and theoretical frameworks, expand the depth, breadth and influence of knowledge management concepts, and adapt knowledge management to the future digital intelligence environment. Pave the way for demand, and provide services to adapt to the dynamic evolution of knowledge management from enterprise organization resources to demand individual services. The developmental characteristics of digital experiment knowledge management methods are shown in Table 3.

Table 3 Methodological characteristics of digital experiment knowledge management

Characteristics & Applicable Research Methods	Computational Social Science	Computational Knowledge Management Science
	digital field	digital field experiment

experiment	experiment	
	Weak conditional control	strong conditional control
	Repeatability	repeatability
	Strong environmental simulation	Strong environmental simulation
	random sample	random sample
	low latency	real-time
	high efficiency	dynamic regulation
	Experimental group refinement	Wholeness

What is discussed here is the feasibility and future development of computational social science experiments. Social network analysis is often used to study knowledge behavior in cyberspace in the era of big data. Knowledge demanders, as knowledge actors, affect the accumulation of organizational knowledge assets. Diffusion, organizational information sharing has an important impact on knowledge demanders' behavior motivation and cross-community mobilization. As a new experimental base, the Internet space is used to study the interaction of knowledge demanders, organizational structure, knowledge node networking, etc. It has advantages that traditional experimental methods cannot replace. Using the Internet platform as an experimental base to carry out computational knowledge management scientific experiments is very important for adapting to big data. The era of knowledge management research is of great significance.

5. CONCLUSION AND DISCUSSION

The development from social science to computational social science has brought us a lot of inspiration. Knowledge management science needs to adapt to the era of digital intelligence, and establish a scientific research paradigm of computational knowledge management that conforms to the characteristics of the big data era. This paper puts forward the core concept and basic content of constructing computational knowledge management science, refers to the research paradigm of computational social science, and puts forward three research methods for the possible development of computational knowledge management discipline. Computational knowledge management science represents the trend of knowledge management in the era of digital intelligence. It builds a computable knowledge management system and interpretation capabilities, taps the hidden knowledge potential in big knowledge data, and provides more models and paths for promoting the transformation of knowledge into practice. theoretical guidance.

The concept and content process of computational knowledge management science discussed in this paper have been fully involved in the actual knowledge management research process. For example, use algorithms such as text mining and machine learning to study knowledge interaction needs in network media; use computer simulation to study the interaction mechanism between knowledge value and organizational environment; use network questionnaires to collect network experimental data to verify theoretical assumptions, etc. However, most of these studies are limited and have not formed a systematic research paradigm. The proposal of computational knowledge management science provides theoretical guidance for systematic research on computational knowledge management. The starting point can be used in combination to provide new thinking for the further development of computational knowledge management science.

Computational knowledge management science still faces enormous challenges in its subsequent development. First of all, it needs to be clear that computational knowledge management science is driven by the trinity of data, algorithms, and computing power. Compared with physical research, knowledge management research has more complex research objects and research environments. Computational knowledge management science is based on multi-modal massive data and demands in the era of digital intelligence, and has opened up a new path from big data to big knowledge data. Problems such as imbalance inevitably require multi-dimensional explanation and verification in the process of exploring new research paths that are computable and executable. Secondly, knowledge behavior simulation applies computer simulation technology to knowledge management research. The core is to innovate research methods that can adapt to complex interactive systems, and release the pressure of knowledge management needs on the basis of serving the diffusion of knowledge demand subjects. The typical feature of the era of digital intelligence is the further upgrading of individual perception needs and experience, and knowledge behavior simulation may become a new path for personalized service research oriented to individual knowledge management needs. Modeling is based on the behavior rules of individual demanders, and the results of continuous interaction between subjects are directly executed in a dynamic or static environment, so as to analyze and demonstrate how individual behavior at the micro level drives the evolution and emergence of the system at the macro level. Finally, the scientific experiment of digital intelligence space knowledge management coincides with the core concept of the Metaverse. During the experiment, we should not be limited to the traditional means of verification. The research path of theory and multi-technology integration may be used as a new random dynamic experiment. It is worth mentioning that the proposal of knowledge twins provides theoretical guidance for this new type of digital experiment. At the same time, the digital intelligence space experiment requires researchers to master more interdisciplinary research skills, so it needs to have a higher technical threshold. The combination of related technologies and experimental methods needs to be enriched and improved, and more exploration and development of executable calculation method.

As an exploratory theoretical study, this paper attempts to innovate the knowledge management research paradigm. The scientific research paradigm of computational knowledge management needs more attention as a new paradigm adapted to the digital intelligence space environment. Exploring the theory, framework and research methods of the scientific research paradigm of computational knowledge management is the key to open the blueprint of knowledge management in the new era. The development of science is crucial. At the same time, the complex understanding of knowledge management science determines the diversification, heterogeneity and stagnation of the development of computational knowledge management science research paradigms. There is still a lack of forward-looking theories and methods for the complex representation of knowledge behavior and the executable measurement of knowledge practice paths. Method research and the construction of a computational knowledge management scientific research paradigm adapted to the era of digital intelligence require scholars from all walks of life to discover and solve unknown challenges and problems around knowledge complexity representation and practical path execution.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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