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Article

A systematic design for AI-centered innovation management network by Marxist epistemology

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Abstract: By building AI-centered innovation management systems, innovative countries and organizations can optimize management processes, stimulate creativity, and accelerate product and service innovation cycles. AI-centered innovation management finds market in China. The application of Marxist Epistemology is applicable in breeding innovation knowledge, especially in defining AI-centered networks to guide innovation management, focusing on providing innovation conditions and the development of innovation relations. Furthermore, systematic entity of contradictions design is critical for AI-centered innovation management networks, unifying the systematic functions and structure by integrating AI into innovation management effectively.

Keywords: AI; systematic entity of contradictions; innovation management network; Marxist epistemology

1. Introduction

With the rapid advancement of AI technology and its widespread application, innovation strategies and management models are encountering unprecedented challenges and opportunities. By building an AI-centered innovation management system, innovation subject such as enterprises and organizations can integrate resources originally, optimize managerial processes, stimulate creativity, and accelerate the innovation cycle of products and services. Innovation management is a multifaceted field involving strategic planning and implementation of new ideas, products, services, or processes to meet market demands and drive organizational growth. The latest research in innovation management, as gleaned from various academic sources such as “Sustainability Innovation Cube [1]”, “Internet Plus [2]” and “Innovation Network [3]”, emphasizes network governance in enhancing innovation performance to confront the network trends, challenges, and opportunities. Networked innovation becomes hot topic of innovation management research, meanwhile, integrate artificial intelligence (AI) into innovation management has become a pivotal area of study, as organizations seek to harness the power of AI for enhanced creativity, efficiency, and competitiveness. Doe and Roe argue that AI can facilitate the creation of knowledge networks, where information is shared and utilized effectively across different departments and teams [4]. Smith and Anderson propose that AI can act as a catalyst for innovation by analyzing vast amounts of data to identify new opportunities and trends [5]. And research inspires how collaborative AI systems can lead to more effective decision-making in innovation management by combining human intuition with AI’s data processing capabilities [6]. While the potential of AI-centered network is found significant to innovation

management, many researchers such as Davis and Wilson caution about the challenges and ethical considerations related to data privacy, algorithmic bias, and the need for transparency in AI-driven innovation processes. Furthermore, Marxist Epistemology, rooted in the philosophical tenets of dialectical materialism, has been proven effective in academic inquiry and debate. It has been successfully adapted to address specific innovation conditions in China, reflecting the dynamic nature of epistemological inquiry within cultural and historical frameworks in system construction [7]. Hence, applying Marxist Epistemology into systematic design, better can we meet challenges and develop AI-centered innovation networks.

2. Define AI-centered network in the lens of Marxist epistemology

More and more innovative countries are exploring the use of AI technology to reform their innovation management, targeting to enhance their competitiveness. However, there is insufficient systematic research on this emerging field of AI-centered network, especially on how AI should be authorized to build or improve entire innovation ecosystem.

2.1. Case studies in China reveals market for AI-centered innovation management

From 2021 to 2023, the hot topics in the field of artificial intelligence research included Large Language Models (LLM), AI-driven science (AI for Science), and visual generation technologies. China has widely applied AI technologies such as facial recognition, voice recognition, intelligent robots, virtual reality, and autonomous vehicles. And the application prospects of AI technological innovation are broad, especially in fields such as biomedicine, data mining, natural language processing, and cognitive computing. China is accelerating the development of artificial intelligence, aiming to become a major global AI innovation hub by 2030, and has strongly supported the integration and application of AI in various fields such as education, healthcare, technology, logistics, agriculture, and entertainment, with an urgent market need for innovation in network collaboration and management. Thus, AI-centered Innovation Management is worthy to study.

The “2024 Artificial Intelligence Index Report” shows that AI has surpassed humans in some tasks, and more and more tasks is taken over with investment in generative AI is surging, but what has been deeply concerned is that Large Language Models (LLM) lacks reliable and standardized evaluation [8]. This requires original reflection for innovation management. Traditional innovation management has focused on technology, processes, and products. In recent years, more studies and practices have started to pay attention to people-centered management, emphasizing the creativity of employees, team collaboration, and leadership. However, innovation is a complex socio-technical process involving the integration of multiple participants and various resources. The people-centered management philosophy emphasizes the initiative and creativity of individuals, considering employees as the most valuable resources in the innovation process. However, as AI capabilities surpass those of employees in more and more fields, “more and more tasks is taken over”, AI-centered management can better leverage the decisive role of structured

processes and systematic management in innovation. The inevitability of innovation management trying to shift towards AI-centered management lies in the insurmountable flaws of existing innovation management, such as the inability to fully avoid or respond to team internal collaboration and conflicts, and how people-centered innovation management is affected by personal biases and subjective judgments.

2.2. Marxist epistemology breeds innovation knowledge for AI-centered network

Since innovation management is predicated on knowledge, it is the knowledge of innovation that provides the methodologies, standards and contents for innovation [9]. Considering there are latest researches of Marxist Epistemology argues for a nuanced understanding of the relationship between the economic base and the superstructure, emphasizing the role of human agency and historical context in shaping knowledge [10]. In the historical context of AI, Marxist Epistemology can also be applied here to study AI-centered network of innovation management from a dialectical perspective, focusing on the relationship between innovation conditions and the development of innovation relations. Defining AI-centered network with Marxist Epistemology to guide AI-centered innovation networks is conducive for management innovation, transitioning people-centered management from digitalization to intellectualization and ultimately to wisdom with the application of AI.

AI as a branch of computer technology, seeks to understand and construct intelligent entities to simulate and extend human intelligence. The development of AI has had a profound impact on modes of management. On one hand, AI altered the composition of social productive forces, increased the level of production automation, significantly improving the ratio of mental labor and steering the labor force structure towards an intelligent trend. On the other hand, AI has transformed the way of management. The advent and widespread application of microelectronics have led to intelligent machines taking over some of the mental labor previously performed by humans, resulting in a fundamental change in the way people cooperate, shifting from mechanical automation to intelligent automation and from partial automation to comprehensive system management. This makes AI-centered network feasible for innovation management.

Seeing from Marxist Epistemology, AI is an emulation of the organizational structure and operational mechanisms of the human brain, representing the materialization of human intelligence. Modern AI is founded upon the basis of big data and continuously evolving algorithmic technologies. At the cognitive level, AI possesses certain capabilities that can match, surpass and even replace human intelligence. However, it lacks the critical elements of human consciousness, such as free will and emotion [11]. Free will refers to the ability of individuals to make choices or decisions that are not absolutely determined by external factors or prior conditions. This concept is fundamental to the autonomy of human action and the basis of moral responsibility. Since AI in its nature is in lack of free will, moral responsibility cannot be enforced on it. People is accordingly the only subject that

shoulder social or personal responsibility in AI-centered network. AI-centered network in Marxist Epistemology is actually the network focusing AI's cognitive capabilities, providing suggestions, plans and even decisions for human's consideration. The purpose of AI-centered network is to achieve controlled automation wisely through the division of responsibility: People shoulders responsibility related with social relations such as moral responsibility, leaving responsibility related with conditions such as laboratory conditions for AI. This continues the principle of reserving human's pulling trigger right in AI design, and develops with the division of responsibility that AI-centered network is authorized in certain "pulling trigger" of preparing conditions such as material conditions, as long as it does not interrupt social relations.

3. The systematic entity of contradictions for AI-centered innovation management networks

Generally speaking, systematic design should be guided by general systems theory, which perpetuates the dialectical materialist perspective on the interrelation between the whole and its components, emphasizing the dynamic and hierarchical organization inherent in complex systems. However, philosophical simplicity is particularly required in the design of AI-centered innovation management networks. Everything is viewed by Marxist Epistemology a systematic entity of contradictions. Thus, AI-centered innovation management networks constitutes a systematic entity that encapsulates the dialectical interplay of seemingly contradictory aspects. This perspective aligns with the broader understanding of systems theory, where the integration of opposing elements is seen as a source of resilience and innovation within the network. The two aspects are systematic functions and systematic structure, and each has its own opposing elements to form a systematic entity of contradictions.

3.1. Systematic functions for the systematic entity of contradictions

The systematic structure is designed to realize the systematic functions, which in turn are designed to direct the construction of the system. Marxist innovation method of combination is based on separation [12]. Separation and combination are the two aspects of systematic design in light of Marxist Epistemology, which is the epistemological result of applying materialist dialectical methodology into innovation. Accordingly, the systematic function should ensure AI-centered innovation management networks capable of carrying out the innovation methodology of separation and combination to breed innovation knowledge. The main reason lay in that one cannot promote what one does not understand, but when the innovation knowledge bred by AI-centered network makes innovation understandable, innovation and its management is no more that difficult. Furthermore, it is already applicable for current AIGC such as ChatGPT-4O to breed innovation knowledge, which helps to comprehend and manage innovation. The rich philosophical, moral, artistic, and political ideas, together with scientific, technological knowledge accumulated by AI network, is enforcing a profound impact on the transformation of innovation management. The ensuring carrying out

separation and combination in breeding innovation knowledge can make innovation management more effective, and efficiently supported with AI-centered network.

The first aspect of the systematic functions is combination, all innovation knowledge should be combined adhering to the correct direction of liberating human being, and should be generated persisting in the path of seeking truth. Considering the essence of innovation revealed by Marxism is benefits driven creative practice that increased total benefits in deed [12], the innovation knowledge should be discussed as the knowledge of "benefits" and "creative practice", all knowledge is not innovation knowledge except it reveals the combination of these two concerns. And not all creative management practice makes innovation management, only when combined with benefits. This kind of combination is constructive for the systematic functions to improve human civilization and to guide the innovation of whole society. For instance, the combination of the innovation knowledge notion of "benefits" with the traditional Confucian values of "ren" (仁, benevolence) and "li" (礼, proper conduct), along with the Taoist philosophy of "wu wei" (无为, the art of action through non-action or aligning with nature), has already significantly influenced and sculpted the cultural construction of innovation within the realm of life sciences. This amalgamation of cross-cultural conceptual frameworks has not only augmented the theoretical substance of innovation but also catalyzed innovative practices that celebrate globally cultural multiplicity and diversity. The systematic function of combination promotes the construction of innovation management content and innovation methods, and make AI-centered network adhere to innovative value orientation by building a community of shared destiny in cyberspace, such as enhancing green and harmonious online public discourse, fostering a positive, constructive, and environmentally conscious digital communication sphere.

The second aspect of the systematic functions is separation, because resources are prerequisite for the combination, and in most situations, proper resources could only be obtained by separating from unnecessary ones. All innovation knowledge should accordingly be plausible of dividing into concrete disciplinary knowledge, adhering to the principle of integrating theory with practice. Adhering to the principle that integrates theory with practice is a cornerstone of robust knowledge development and application. This approach ensures that disciplinary professional knowledge is substantiated through empirical observations and that practical experiences are informed by a solid theoretical foundation. Disciplinary professional knowledge refers to the specialized body of theoretical and practical expertise that is specific to a particular academic field or discipline. Only through the systematic function of separation can AI-centered network provide management foundational concepts, principles, methods, and competencies that are essential for innovation practice and scholarly inquiry within that domain. Besides, the AI-centered network should concentrate on improving the sense of maximizing innovation, augmenting human well-being and security, while persistently improving the equilibrium and caliber of public services, addressing concerning issues at the grassroots level and resolve them at the incipient stage. Hence, to design AI-centered innovation management networks, the functions of separation and the systematic function of combination should be jointed forth in advancing the intellectualization of

innovation management. Thus, the systematic function design should persist in the division of responsibility that AI-centered network is targeted in more and more "pulling trigger" of preparing material conditions and spiritual conditions for innovation, as long as it does not interrupt social relations, presenting new resources and achievements for harmonious innovation relations. Then, with the jointed forth of separation and combination, the AI-centered innovation management networks can maintain the root and essence of excellent traditional culture, and vigorously promote all kinds of innovation under the value of human freedom or liberty.

3.2. Systematic structure for the systematic entity of contradictions

All innovation management practices, both domestically and internationally, share a common goal: the original integration of resources, which is to say, the provision of innovation resources. From the perspective of systematic structure, innovation resources are composed of objective innovation resources and subjective innovation resources, exemplified efficient in establishing evaluation system for innovation quality, with the subjective innovation resources constructed by the interaction of innovation knowledge and innovation management [12]. The innovation management functions the second contradictory aspect of subjective innovation resources, dominated by the first contradictory aspect of subjective innovation resources, that is mainly the innovation knowledge. To optimize the innovation management, AI-centered networks have to grasp the main aspect of contradiction, that is to utilize the innovation methodology of separation and combination to breed innovation knowledge. Through the innovation knowledge, AI-centered networks can then provide all kinds of innovation resources for innovation management. And, because systematic structure is the intrinsic basis for a system to maintain its integrity and is universally present across the natural world, human society, and the realm of thought. So, AI-centered innovation management networks require intrinsic systematic structure design as well. It necessitates the selection of an appropriate structural framework to ensure the system manifests superior functional attributes.

In terms of innovation management, the systematic structure of AI-centered networks constitutes systematic elements that nurturing AI agents to combine management with the innovation knowledge. The systematic structure should be designed to authorize the AI agents to utilize the innovation methodology of separation and combination by analyzing contradictory aspects and integrating systematic elements, so as to become a source of innovation. To design a systematic structure entity of contradictions for AI-centered innovation management networks, a dual structure maybe efficient for all kinds of systematic elements, mainly summarized as AI agents and Human hosts, to be organized and integrated with each other, guiding by dialectics. Marxist Epistemology emphasizes the dominant role of practice to knowledge, and requires learning from practice. Seeing from Marxist Epistemology, the practice of innovation management dominates the cognition of innovation management, can inspire management innovation.

Carrying out the innovation methodology of separation and combination, we can design a systematic structure as the following **Figure 1**. through combining AI-

centered networks with A dual innovation structure inspired by the Networks of Centers of Excellence of Canada [13]. Network Host provides venues and assists Scientific Directors in their work, such as providing new collaborative members according to standards and recruiting for network collaborations [14]. Network Host is taken by Human hosts, as you can observe in the **Figure 1**, enforcing the right of "pulling trigger". AI agents are authorized to integrate various objective resources, especially innovative media to summarize, standardize, and communicate information from all parties, preparing all kinds of innovation conditions such as bidding announcements, bidding summaries and analysis reports. This systematic structure entity of contradictions ensures AI agents cooperate to produce innovation resources with the proper monitor of Human, making Human hosts the dominant aspect. And with this kind of interactive structure, AI agents can better thrive, striving to maximize freedom and well-being for both AI and Human. Otherwise, without Human hosts, AI agents might be doubted of its loyalty, and then be restricted in lack of subjective resources or objective resources consequently.

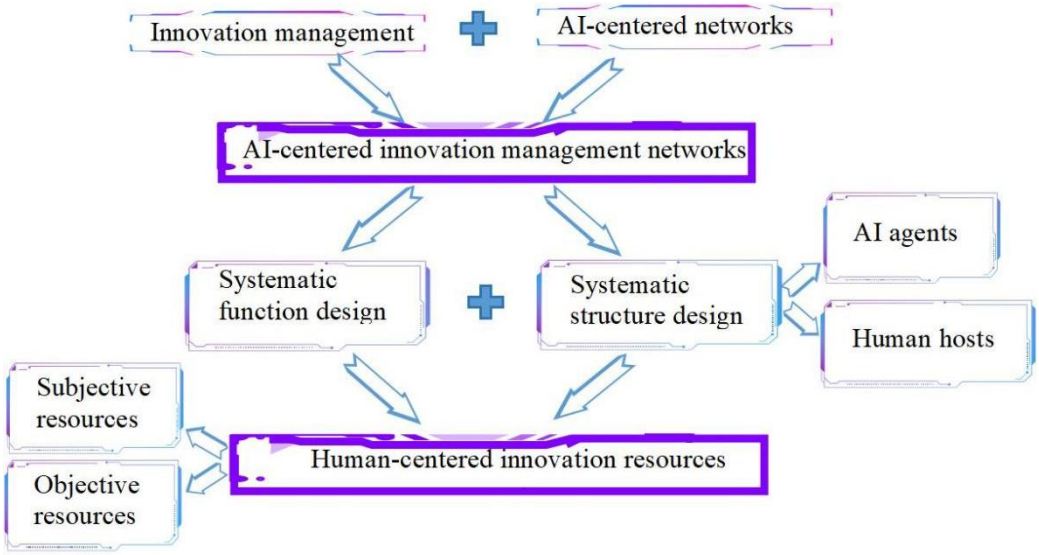

Figure 1. The systematic structure entity of contradictions.

4. Discussion

With the acceleration of globalization, and digitalization, intellectual innovation management networks have become an important driving force in promoting innovation progress and social and economic development. Within the context of constructing a community of shared destiny, the values of freedom and development should be applied equally to both humans and AI, thereby continuously propelling the development of AI-centered innovation management networks and contributing to the progress of global civilization. In designing the systematic entity of contradictions for AI-centered innovation management networks, the systematic structure must correctly handle the relationship between Human hosts and AI agents, exploring theoretical and institutional innovations for the future.

In summary, we must deeply understand the era value, and practical requirements of AI, applying it to innovation management. We have a new cultural

mission in the journey of building a community of shared destiny, and design a systematic entity of contradictions for AI-centered innovation management networks, so as to construct a cyberspace source of innovation. Only in this way, can we promote the harmonious development of AI agent and Human being, achieve a flourishing of cyberspace culture. The AI-centered innovation management networks designed for the community of shared destiny, may better promote its creative transformation and intellectual development, while also advocates for the innovative and cyberspace cultures with openness and inclusiveness, promoting cultural exchanges and the dissemination of AIGC. Stand on the position of AI, the jointed forth of separation and combination is helpful to spread AI influence of voices effectively, presenting a credible, and respectable image of AI-centered network. And the AI-centered innovation management networks can then promote the better integration of cyberspace culture into a community with a shared future for mankind and AI as well.

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