Quantification of Knowledge Work Productivity-Conceptual Model and Variables Measure

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Abstract. This paper constructs the conceptual model and variable measure of the quantitative research of knowledge work productivity based on the perspective of information technology, knowledge element and relational network. In the new economic era with information, knowledge, technology and capital as the core factors of production, the research on the knowledge of deconstructing the growth path of knowledge work productivity from micro and macro levels and exploring the optimization mode of knowledge work productivity will have rich guidance for the improvement of enterprise knowledge management and knowledge work efficiency.

Keywords: Information technology · Knowledge element · Relational network · External knowledge · Structural holes

1 Introduction

Since knowledge work rarely has a correct outcome or method of completion, externally specified, quantitative performance measures may not always be the most appropriate means of managing knowledge worker performance (Quinn, 2005) [1]. Hirsch (2005) argues that for the few scientists who have won the Nobel Prize, the impact and relevance of their research is unquestionable. For others, how to quantify the cumulative impact and relevance of an individual's scientific output is a question worthy of study [2]. Academic productivity affects nearly every aspect of a researcher's career, from their initial position as a faculty member to decisions about obtaining grants and tenure. The rich diversity of productivity patterns revealed here requires us to reassess the traditional descriptions of careers in academia. Research investigating the impact of this traditional narrative on promotion, retention, and funding decisions would be of great value (Way et al., 2017) [3]. The rich and diverse characteristics of the knowledge work productivity model make the evaluation of knowledge work productivity an epoch-making topic, and its measurement difficulty is the bottleneck of exploring this topic. This paper is to extend the practical boundaries of productivity quantification research, discuss the knowledge work productivity conceptual model.

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2 Information Technology and Knowledge Work Productivity

Sustained productivity growth requires subversive innovation and technological paradigm revolution. Enterprises need to manage the productivity dilemma through positive technological change, expand the breadth and complexity of technology portfolios, overcome inertia through structural design, and build strategic and risk-oriented entrepreneurs Spirit (Jianze et al., 2020) [4]. Technological breadth diversification and technological depth diversification have a significant positive impact on innovation performance, absorptive capacity and technological integration capacity play different roles in technological diversification and innovation performance, and technological breadth diversification mainly improves innovation performance through absorptive capacity, and technological deep diversification mainly affects innovation performance through technological integration capabilities (Xu Lei et al., 2019) [5]. Kim et al. (2012) found that the information technology services provided by computer call centers are characterized by constant changes in relevant knowledge and various support requests. Measurements of learning and knowledge transfer contribute to the development of experience-based IT knowledge workers' learning behaviors (Kim et al., 2012) [6]. Bertschek, et al. (2004) analyzed the relationship between information communication technologies (ICT) investment, non-ICT investment, labor productivity and corporate restructuring. If the productivity gains from corporate restructuring outweigh the associated restructuring costs, the firm is assumed to restructure the workplace. If workplace reorganization is implemented, the overall labor productivity distribution shifts significantly to the right, indicating that the increase in labor productivity is due to the complementarity between various input factors and workplace reorganization [7].

Ding et al. (2010) explored the impact of information technology on productivity and cooperation patterns in academia, using a scientific productivity model to explain how information technology affects productivity and cooperation, assuming that the production creation of scientific knowledge requires effort, materials, equipment, skills and knowledge. Productivity studies usually employ surrogate measures of input factors. The findings suggest that information technology is a balancing force that provides the possibility of rapid productivity growth for scientists with lower status in academia, as well as more opportunities for collaboration [8].

Through the above theoretical research, it is found that under the concept of global advocacy of technological innovation, the marginal output of information technology on the productivity of knowledge work is positive. In the field of enterprise practice and academic research, information technology plays a positive role in the development of productivity. Technology has changed the mode of production, and changed the content, elements, and structural patterns of knowledge work input and output. At the same time, information technology has provided an effective work platform. Therefore, to study the productivity level of knowledge work, it is necessary to strengthen the research on the breadth and depth of technology. In view of the above research results, this paper proposes theoretical hypothesis 1: Information technology is positively related to knowledge work productivity. Hypothesis 1a: Technological breadth positively moderates knowledge work productivity; Hypothesis 1b: Technological depth positively moderates knowledge work productivity. The conceptual model presented in this study is shown in Fig. 1.

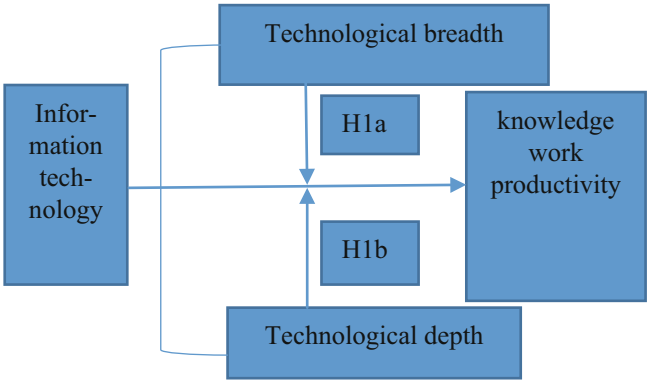

Fig. 1. Information Technology and Knowledge Work Productivity Conceptual Model

3 Knowledge Elements and Knowledge Work Productivity

Zeng Deming et al. (2015) proposed that innovation is the reorganization of existing knowledge elements, and the collection of various knowledge elements in the enterprise constitutes the knowledge base of the enterprise. Modern technological innovation theory regards innovation as the reorganization of existing knowledge, and believes that structural knowledge is more important than component knowledge [9]. Levin et al. (2004) proved that strong ties are more conducive to obtaining useful knowledge than weak ties; the link between strong ties and obtaining useful knowledge is mediated by ability-based and goodwill-based trust; if these two trustworthiness dimensions are controlled, The structural benefits of weak connections are revealed, that is because weak connections provide access to non-redundant information; competency-based trust is particularly important for the acquisition of tacit knowledge [10]. Yang Dan (2010) pointed out that for knowledge work, the process of programming and normalization does not necessarily lead to the optimal productivity, and the productivity of knowledge work shows a trend of rising first and then decreasing with the improvement of the degree of programming and normalization. At the same time, for different types of knowledge work, due to the different innovative requirements and the complexity of the work tasks, the degree of programming and standardization corresponding to the optimal productivity is also different [11].

From the above analysis, it is found that there is a certain connection between knowledge density, knowledge content, knowledge work structure characteristics, knowledge structure and knowledge work productivity and performance. The lower the knowledge content, the higher the structural degree corresponding to the optimal productivity; The higher the knowledge content, the lower the structuring degree corresponding to its optimal productivity. Architecture knowledge is more important than component knowledge, and there is a significant inverted U-shaped relationship between knowledge substitution, complementarity and technological innovation performance. Knowledge elements, knowledge content, knowledge density, knowledge breadth, and knowledge structure are the important connotations and characteristics of knowledge work. Therefore, studying the essential issues of knowledge work productivity requires in-depth analysis of the

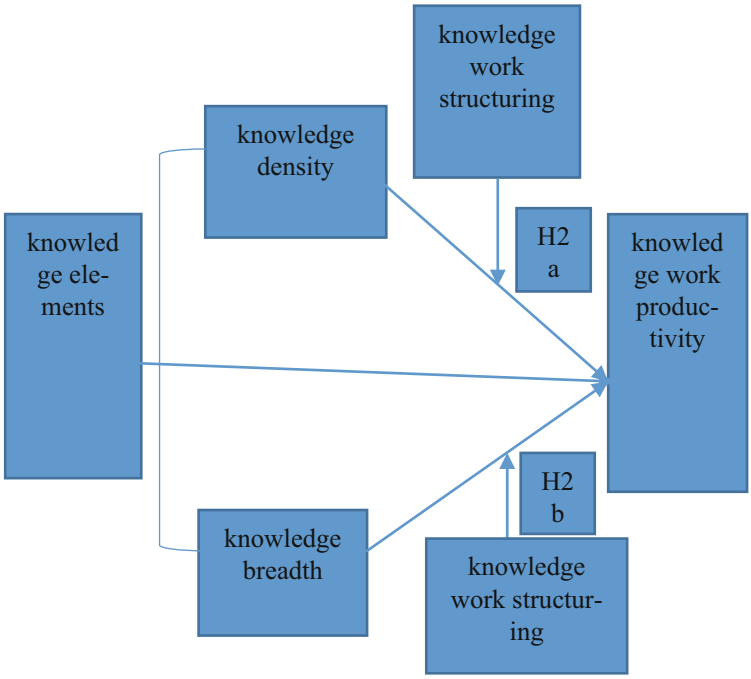

Fig. 2. Conceptual Model of Knowledge Elements and Knowledge Work Productivity

relevant variables of knowledge work. In view of the above theories, this paper proposes theoretical hypothesis 2: there is a correlation between knowledge elements and knowledge work productivity; Hypothesis 2a: knowledge density positively affects knowledge work productivity; knowledge breadth positively affects knowledge work productivity; 2b: knowledge work is structured in knowledge work Density and knowledge work productivity play a moderating role; knowledge work structuring plays a moderating role between knowledge breadth and knowledge work productivity. The conceptual model presented in this study is shown in Fig. 2.

4 Relationship Network and Knowledge Work Productivity

Ahuja, G. (2000), in order to assess the impact of firm relational networks on innovation, elaborates a theoretical framework that links three aspects of firm self-networking, which are direct, indirect, and structural holes to firms' innovation output. The results of a longitudinal study of international chemical companies show that the results of direct and indirect prediction are supportive, but in the inter-firm cooperation network, adding structural holes has a negative impact on innovation [12].

Tortoriello (2015) builds on absorptive capacity and social network research to examine how individuals within an organization use external knowledge to generate innovation. Through the collection of raw sociometric data on 276 scientists, researchers, and engineers from the R&D departments of large multinational high-tech companies, it was

found that the impact of external knowledge on individuals' ability to innovate depends on the individual's position in the internal social structure. The results show that the positive impact of external knowledge on innovation becomes more pronounced when it spans the structural holes of the internal knowledge sharing network [13].

Ye Jiangfeng et al. (2016) proposed the intermediary mechanism of absorptive capacity and knowledge restructuring has the opposite effect, resulting in an inverted U-shaped relationship between external knowledge heterogeneity and innovation performance. High external knowledge heterogeneity may face great difficulties in the process of knowledge transfer and absorption, and it is difficult to really promote enterprise innovation; low external knowledge heterogeneity also inhibit enterprise innovation [14].

Through the above theoretical basic research, it is found that the enterprise relationship network and external heterogeneous knowledge are also important factors affecting the innovation output of knowledge work. In inter-firm cooperation networks, increasing structural holes has a negative impact on innovation. The influence of external knowledge on the individual's ability to innovate depends on the individual's position in the internal social structure. The intermediary mechanism of absorptive capacity and knowledge restructuring has the opposite effect, resulting in an inverted U-shaped relationship between external knowledge heterogeneity and innovation performance. Therefore, this paper proposes theoretical hypothesis 3: External heterogeneous knowledge, structural holes and knowledge work productivity are related. Hypothesis 3a: External heterogeneous knowledge affects knowledge work productivity through innovation output; Hypothesis 3b: Structural holes affect knowledge work productivity through innovation output. The conceptual model presented in this study is shown in Fig. 3.

5 Conclusions

5.1 Theoretical Contributions

The structural change reflects the difference in value-added growth between industries with low and high knowledge density. Through this change, the proportion of output share of knowledge intensive industries in total economic output will increase. The characteristic of structural upgrading is different performance of enterprises within the industry, without necessarily changing the overall composition of economic activities (Janger et al., 2017) [15]. Based on the above conceptual model research, this paper extracts the measurement variables of knowledge work productivity, mainly including knowledge capital; Knowledge breadth and depth; Knowledge elements and knowledge network density; Technical breadth and depth.

From the perspectives of information technology, knowledge elements, and relational networks, this paper constructs a conceptual model for quantitative research on knowledge work productivity, and proposes a theoretical model: information technology is positively correlated with knowledge work productivity, technological breadth positively regulates knowledge work productivity, and technological depth positively regulates knowledge work productivity. Moderate knowledge work productivity; there is a correlation between knowledge elements and knowledge work productivity, knowledge density positively affects knowledge work productivity, knowledge breadth positively affects knowledge work productivity, and knowledge work structuring moderates the

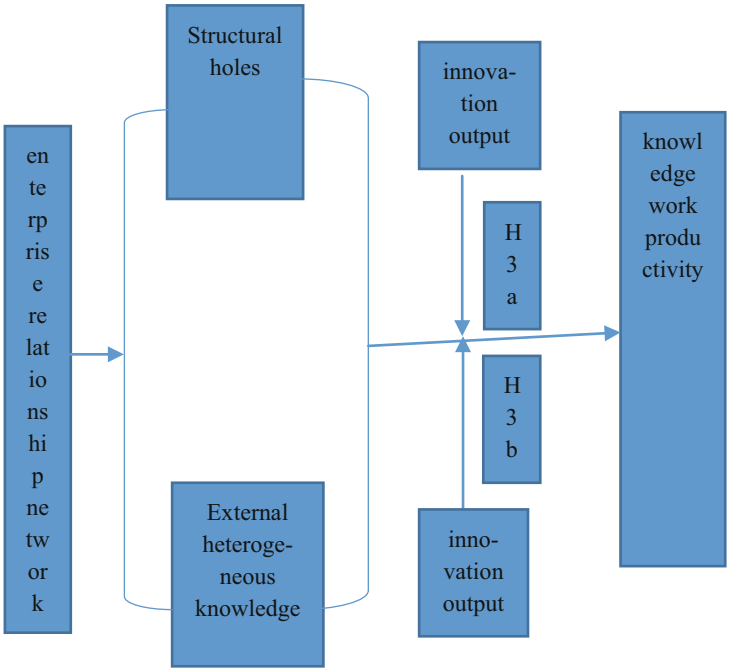

Fig. 3. Relational Networks and Knowledge Work Productivity

relationship between knowledge density and knowledge work productivity Knowledge work structuring plays a moderating role between knowledge breadth and knowledge work productivity; external heterogeneous knowledge, structural holes and knowledge work productivity are correlated, external heterogeneous knowledge affects knowledge work productivity through innovation output, structural holes Influence knowledge work productivity through innovation output. Through the above research conceptual model, the research boundary of knowledge work productivity in the field of enterprise management has been expanded, and the information, technology, knowledge and modern work processes and modes have been combined, which has enriched the theory of enterprise knowledge management and promoted the research results of productivity theory to production. Efficiency and effectiveness of practice transformation. This paper explores the theoretical basis of knowledge work productivity measurement research, and proposes specific measurement variables. Therefore, knowledge work productivity measurement has a profound theoretical thought and research foundation, and at the same time endows productivity research with rich economic connotations and management ideas.

5.2 Practical Inspiration

The dynamic characteristics of productivity show the important practical value of knowledge work productivity research. In the long history of human development, productivity research is an endless theme. The optimization mode of knowledge work productivity can significantly improve the work efficiency of enterprise employees, and create

more technological achievements and innovative products for enterprises and society. To achieve quantitative research on knowledge work productivity and effective application of results, enterprises can strengthen research on variables such as technology breadth, technology depth, knowledge density, knowledge breadth, external knowledge, structural holes, relational networks, and knowledge work productivity variables. Work productivity input-output process and information technology, knowledge elements, and relationship network are integrated and researched to promote the better development of enterprises and society on the basis of realizing the effective allocation of resources.

5.3 Research Limitations and Future Prospects

This paper focuses on the theoretical model and variable measurement of knowledge work productivity measurement, and explores the core of knowledge work productivity measurement method conceptually. There is a lack of empirical research on enterprise practice, and the effectiveness of its method needs to be tested. In the future, the Poisson series regression model can be used for research, and the negative binomial regression model can be selected to model and analyze enterprise knowledge work samples, verifying the reliability and validity of the conceptual model, which is also the further research direction of this paper. The development of science and technology, the use of robots in knowledge work, and the significant impact of robots on knowledge work productivity are important research topics in the era of artificial intelligence. Exploring quantitative research on knowledge work productivity from the perspectives of information technology, knowledge elements, and relational networks, combined with artificial intelligence, more valuable results will be obtained.

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