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The Impact of Science and Technology Talent Concentration on the Development of Digital Economy: A Review

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Abstract

By combing the relevant literature on the agglomeration effect and influencing factors of scientific and technological talents, it is found that when the research on the agglomeration effect of scientific and technological talents is mostly from the perspectives of scientific and technological talent agglomeration and industrial agglomeration, scientific and technological talent agglomeration and industrial innovation level, there are also more literatures on the relationship between scientific and technological talent agglomeration and economic development, and in-depth discussion of scientific and technological talent agglomeration and high-quality development, regional economic development of scientific and technological talent agglomeration, However, there are few literatures that systematically analyze and demonstrate the relationship between the agglomeration of scientific and technological talents and the development of the digital economy.

Keywords

Science and technology talents, gathering of science and technology talents, digital economy.

1. Introduction

The 20th National Congress of the Communist Party of China emphasized accelerating the development of the digital economy, promoting the deep integration of the digital economy and the real economy, and building a digital industrial cluster with international competitiveness, which shows the importance of the digital economy in China's economic development at the current stage. According to the Digital China Development Report (2022) released by the Cyberspace Administration of China, the scale of China's digital economy will exceed 50 trillion yuan for the first time in 2022, reaching 50.2 trillion yuan, accounting for 41.5% of GDP, and the scale of the digital economy has ranked second in the world for many years. The digital economy is a new engine of Chinese-style modernization, which has given new connotations, provided new momentum, and cultivated new advantages for Chinese-style modernization [1]. As a strategic resource for a country's innovation and development, China emphasizes the in-depth implementation of the strategy of strengthening the country with talents in the new era, cultivating, introducing and making good use of talents in an all-round way, and accelerating the construction of the world's important talent center and innovation highland. General Secretary Xi Jinping has repeatedly emphasized that to realize the transformation of economic growth mode, we must pay special attention to the cultivation of scientific and technological talents. In his report to the 20th National Congress of the Communist Party of China, General Secretary Xi Jinping also emphasized that "we must adhere to the principle that science and technology are the primary productive forces, talents are the first resources, and innovation is

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the first driving force". Scientific and technological talents have laid a good foundation for promoting the development of China's digital economy and play a vital role in regional economic development. When a large number of scientific and technological talents flow into a region, it will accelerate the flow of knowledge in the region, promote mutual learning and cooperation between talents, and then produce an "agglomeration effect", promote the improvement of the level of regional economic development and scientific and technological innovation, so as to further attract talents to the region, deepen the degree of regional talent agglomeration, and thus become a resource for the region to seek breakthroughs in economic development. In the era of knowledge economy, the concentration of scientific and technological talents is an important factor to promote regional economic growth [2].

2. Research Status

2.1. Research on the definition and characteristics of scientific and technological talent agglomeration

The research on the concept of scientific and technological talents starts from two dimensions: objective criteria such as majors and professional titles, as well as subjective criteria such as thinking and talent. He Qing (2001) argues that the concept of scientific and technological talents is based on a unified national comprehensive standard of professional positions, academic qualifications, and professional and technical titles [3]. Zhao Hua and Yao Xiufu (2018) are scientific and technological talents who have the awareness, thinking, and ability of scientific and technological innovation, and are good at discovering, analyzing, and dealing with new problems in scientific and technological development [4]. At the same time, the "Dictionary of Talents" has included the important entry of "scientific and technological talents", as the name suggests, scientific and technological talents should include scientific talents and technical talents. In scientific and technological activities, scientific and technological talents should have a high degree of creativity and exploration spirit, and can contribute to the development of science and technology. Du Qian et al. (2004) summarized the literature on scientific and technological talents, and found that there are differences in the understanding of scientific and technological talents among different scholars, and even the concept of confusion or contradiction, among which three typical views regard scientific and technological talents as scientific and technological elites, talents with scientific and technological professional certificates at or above the university level, and scientific and technological human resources, and also pointed out that there are deficiencies in these three viewpoints [5]. There are many related concepts of scientific and technological talents, and in order to strive for scientific rigor, this paper mainly follows the national authoritative policy documents. The National Medium and Long-term Science and Technology Talent Development Plan (2010-2020) also defines the term "science and technology talents", which is of great significance to the development of China's science and technology talents, which should be a more authoritative definition, that is, science and technology talents should include two categories: scientific and technological talents, and scientific and technological talents should also have professional skills, engage in scientific and technological work and have high creativity, and be able to make certain contributions to the development of science and technology.

For the research on the agglomeration of scientific and technological talents, most of the domestic and foreign studies have studied the agglomeration of scientific and technological talents from the perspective of the relationship between the development of talent agglomeration and the influencing factors and the effect of talent agglomeration. In terms of the effect of talent agglomeration, the research on the impact of scientific and technological talent agglomeration on economic development is the main direction of academic research, which is generally manifested in the promotion of scientific and technological talent agglomeration

economic development. Zhang et al. (2015) introduced the S&T Talent Concentration Index and found a positive correlation between S&T talent agglomeration and regional economic growth [6]. Chen Minghe (2017) pointed out that the talent agglomeration effect plays a role from the internal and external aspects, with the internal effect enhancing the innovation ability of talents and the external effect having a positive external effect on the region [7]. Chen Jianwu and Lin Lu (2018) constructed an evaluation system for the effect of talent agglomeration in Fujian Province from the aspects of economy, education, and technological level[8]. Shi et al. (2021) found that the agglomeration of innovative talents plays a role in promoting the economic growth of the agglomeration area, but inhibiting the economic growth of the surrounding region [9]. Some scholars have also explored the effects of the agglomeration of scientific and technological talents on productivity, innovation ability, and green development. Jie et al. (2019) used a generalized moment estimation model of a dynamic system and a panel threshold regression model to find that moderate urban population agglomeration is conducive to the improvement of urban productivity, but over-concentrated urban population distribution hinders the improvement of urban productivity [10]. Guo Jinhua and Guo Shufen (2020) found that the agglomeration of innovative talents promotes the growth of TFP value, and there is a significant spatial spillover effect, especially in social enterprises and universities [11]. Tom (2010) explored the factors influencing the level of regional innovation, and found that the number of R&D personnel, the level of economic development, the number of universities and research institutions, the comprehensive quality of the labor force, and the potential employment labor resources have a significant impact on the level of regional innovation [12]. Xu Junhai and Huang Yongchun (2021) used panel data from 30 provinces, municipalities, and autonomous regions in China from 2010 to 2017 to demonstrate that the agglomeration of scientific and technological talents can have a significant positive impact on regional green development, and the improvement of innovation ability has a significant mediating effect on the agglomeration of scientific and technological talents and regional green development [13]. Li Hongyu et al. (2022) pointed out that the distribution of scientific and technological talents in the Beijing-Tianjin-Hebei "Innovation Triangle" is uneven, and the talent agglomeration has a spatial spillover effect, and there is a significant correlation between talent agglomeration and regional distribution [14]. In terms of the influencing factors of talent agglomeration, the regional environment is the most important factor affecting the agglomeration of scientific and technological talents, among which the level of economic development and social security are the core parts. Romer (1990) pointed out that factors such as knowledge spillover effect and economic development level will affect the concentration of scientific and technological talents [15]. Su Chu and Du Kuanqi (2018) pointed out that the level of social security and the degree of environmental livability are the positive influencing factors of the spillover of R&D talent gathering space [16]. Yan Qing et al. (2019) believe that economic development, science and technology, and social security are the positive influencing factors of talent agglomeration[17]. Shen Lihong (2021) believes that economic level is the key factor to attract talents, higher education penetration rate and social innovation investment are positive factors to promote talent agglomeration, and transportation convenience and medical and health level are important influencing factors of talent agglomeration [18]. Sun et al. (2021) found that regional GDP, marine output value, marine education level, marine science and technology level, cultural atmosphere, and public service level are positive factors for the concentration of marine science and technology talents [19]. Of course, factors such as education level, salary level, and ability to buy a house also significantly affect the agglomeration of scientific and technological talents. Based on the Poisson regression model, Haining et al. (2020) pointed out that the level of academic resources, regional belonging, and urban livability are the main reasons for overseas talents to settle down in employment [20]. Marian & Arensbergen (2015) measured talent development from both individual and organizational perspectives, stating that the

coordination between individuals and organizational environments is more conducive to talent development [21]. Gierczyk & Pfeiffer (2021) used semi-structured, in-depth interviews to qualitatively analyze the impact of the school environment on the personal development of gifted students in Poland and the United Kingdom, and found that teachers play an extremely important role in talent development, and that the school environment in the United Kingdom is more conducive to student development than in Poland [22]. Qi et al. (2020) analyzed the influencing factors of talent agglomeration by industry, and found that the pull effect of the service industry was obvious, while the manufacturing industry was not prominent, and pointed out that the level of higher education and high salary were the positive influencing factors of the agglomeration of high-skilled talents [23]. Li Zuoxue and Zhang Meng (2022) believe that the level of culture and education is a necessary condition for the agglomeration of scientific and technological talents [24]. Wang Gaofeng and Yang Haodong (2022) found that regional wage level and housing purchase ability are the key factors for the positive development of scientific and technological talent agglomeration, and the impact of housing purchase ability on scientific and technological talent agglomeration is significantly different between high-tech enterprises and ordinary industrial enterprises [25].

2.2. Research on the connotation characteristics of the digital economy

The term "digital economy" was first coined by Tapscott Don (1996), who had a thorough understanding of the Internet economy and believed that the digital economy was inseparable from the level of economic development[26], but the quantitative research on the digital economy was not reflected in this paper. Brent R. Moulton (1999) and R. Kling &R. lamb (1999) show that information technology is the foundation of the digital economy, and that e-commerce has developed as a new form of expression, transmitting tangible goods and providing intangible services in a digital environment[27][28]. Cohen et al. (2000) argue that modern information technology has changed the world, and directly define digital information technology as a digital economy [29]. Zimmerman (2000) first defined the digital economy as an economic community, and then integrated technology and infrastructure to give the basic characteristics of the digital economy [30]. Carlsion (2003) pointed out in his published article that the digital economy is a transitive dynamic economy, which is a behavior between individuals caused by the digital penetration process of the network, and is a new economic form. In 2012, the Australian government argued that the development of the digital economy is largely dependent on technological progress, and ultimately constitutes an economic network.

In 2014, China mentioned the concept of "big data" for the first time in a government report. At the beginning of 2015, Premier Li Keqiang first clearly put forward "Internet +" in the specific action plan for the government to carry out various tasks, and then repeatedly emphasized in the government work report that it is intended to promote the integration of the Internet and other industries, encourage China's public innovation, and promote the healthy development of the economy and society. According to the 2016 G20 Digital Economy Development and Cooperation Initiative, the definition of digital economy refers to economic activities in which the application of Internet digital expertise and information technology has become an important element, the modern Internet has become the main carrier, and the efficient application of information and communication has become the main driving force for efficiency improvement and optimization of the national economic structure. In 2017, the China Academy of Information and Communications Technology (CAICT) divided the digital economy into the basic part of the digital economy and the integrated part of the digital economy, which has been recognized by many academic and scientific research organizations. CCID consultants pointed out that the digital economy is the sum of various related business activities based on digitalization. Pei et al. (2018) used Marxist political economy and its related basic principles

to discuss the social reproduction process of the digital industry, described the characteristics of the digital economy industry, and put forward the meaning of the new economy, arguing that the digital economy is a part of it [31]. Lin Yueqin (2017) refers to this process of integration and re-creation of technology and knowledge in the context of the digital economy as the digital economy [32]. Zhang Yuzhe (2018) argues that the digital economy, as an integrated economy, includes two parts: the new economy and traditional industries [33]. Later, Zhang Liangliang et al. (2018) pointed out that the digital economy is a new economic form that relies on technology, uses network information systems as the medium, and uses technology as a means to provide corresponding products and services after technological integration, industrial penetration, and the integration of producers and consumers [34].

2.3. Research on the agglomeration of scientific and technological talents and the development of digital economy

At present, there are few studies on the impact of scientific and technological talent agglomeration on the development of digital economy, and most scholars pay attention to the relationship between scientific and technological talent agglomeration, economic growth and economic development, and all believe that the agglomeration of scientific and technological talents will have an impact on economic development, and its impact can be mainly divided into two aspects: nonlinear impact and linear impact. In terms of nonlinear impact, Liu et al. (2018) took the Beijing-Tianjin-Hebei region as the research object to investigate the relationship between the agglomeration of scientific and technological talents and economic development, and found that the agglomeration of scientific and technological talents is positively correlated with economic development, and the agglomeration of scientific and technological talents can promote economic development, but the promotion effect will be attenuated, so he believes that the impact of scientific and technological talent agglomeration on economic development may turn from positive to negative in the long term [35]. Guo Jinhua et al. (2021) studied the impact of urban scientific and technological talent agglomeration on total factor productivity (TFP) in prefecture-level cities in China, and argued that the agglomeration of scientific and technological talents and total factor productivity are inverted U-shaped, that is, the excessive scale of scientific and technological talent agglomeration will not be conducive to the improvement of total factor productivity, but from the current point of view, most cities are still before the inflection point, mainly exerting a positive impact [36]. Shi et al. (2021) used provincial-level data as a sample to find that talent agglomeration has the effect of first promoting and then inhibiting regional economic growth [37]. Cui Xiangmin et al. (2022) studied the impact of urban innovative talent agglomeration on high-quality economic development in the Yangtze River Delta, and found that the impact also has the characteristics of first increasing and then decreasing, showing an inverted U-shaped relationship [38]. It can be seen that the nonlinear impact of the agglomeration of scientific and technological talents on economic development is mainly manifested in the negative impact of excessive agglomeration in the later stage of the development of scientific and technological talents, which leads to the hindrance of further economic development. However, as far as China's current development situation is concerned, the negative effect of the agglomeration of scientific and technological talents has not yet been highlighted, and the positive effect is still dominant.

In terms of linear impact, Bala et al. (2001) proposed to give full play to the agglomeration effect of scientific and technological talents to promote regional economic growth [39]. Porter (2011) argues that talent agglomeration not only has a positive impact on regional economic development, but also plays a role in reducing social costs [40]. However, the premise of this positive effect is that effective agglomeration can promote regional economic growth by solving the problem of talent mismatch [41]. Olfert M R et al. (2011) argue that the concentration of

scientific and technological talents can bring about the improvement of regional innovation capabilities, thereby bringing more advantages to regional economic development [42]. Niu et al. (2010) believe that the concentration of scientific and technological talents can help promote regional economic growth and the convergence of regional economic growth [43]. Xu Guanglin et al. (2014) took Anhui Province as the research object and found that the concentration of scientific and technological talents can significantly promote regional economic development, and the two are positively correlated [44]. Sun Jie et al. (2014) studied the impact of scientific and technological talents on regional economic development in the three major regions of China, and found that the role of scientific and technological talents in the eastern region on regional economic development is the most obvious [45]. He et al. (2019) measured the contribution of talent agglomeration to economic growth in 31 provinces and cities in China, and in general, the higher the degree of talent concentration, the greater the contribution may be greater [46]. Xu Bin et al. (2019) found that talent agglomeration has a promoting effect on economic development through empirical analysis, but there may be a certain lag in this effect [47]. Yang et al. (2020) took Shandong Province as the research object and found that the concentration of scientific and technological talents significantly promoted economic growth [48]. Li Peiyuan et al. (2019) found that the rational flow of scientific and technological talents can have a positive effect on high-quality economic development [49]. Ma Ru et al. (2019) also believe that scientific and technological talents are conducive to high-quality economic development, but the positive role of scientific and technological talents in high-quality economic development still needs to be further exerted [50]. In addition, Liu Yajun (2021) studied the impact of talent agglomeration on regional economic development in 30 provinces and cities in China, and found that the former has a significant promoting effect on regional economic development by further dividing talents into professional knowledge and professional skill talents, while the latter shows a negative effect [51]. Cai Wenbo et al. (2020) took 30 provinces and cities in China as the object, and found through the spatial Durbin model that the agglomeration of scientific and technological talents is conducive to improving the quality of economic growth in the region, but is not conducive to the improvement of the quality of economic growth in the surrounding areas [52]. Guo Jinhua et al. (2021) proposed that the agglomeration of scientific and technological talents can promote high-quality economic development, and it is mainly achieved through technological and structural dividends [53]. Yang et al. (2022) took the western region of China as the research object and found that the benign interaction between talent agglomeration and regional innovation can promote high-quality economic development [54].

3. A review of the current state of research

Scholars at home and abroad have carried out a lot of research and discussion on the agglomeration of scientific and technological talents and the development of the digital economy, and the digital economy plays a pivotal role in the national economic construction. From the perspective of the agglomeration of scientific and technological talents and the level of industrial innovation, there are also many literatures on the relationship between the agglomeration of scientific and technological talents and economic development, and in-depth discussions on the agglomeration of scientific and technological talents and high-quality development, regional economic development of scientific and technological talents, and the agglomeration of scientific and technological talents and green development, but few literatures have systematically analyzed and demonstrated the relationship between the agglomeration of scientific and technological talents and the development of the digital economy.

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