

Empirical Study on The Relationship Between Digitization and Industrial Innovation--Taking Wuhan New Display Industry as An Example

Yaqing Jing¹, Zixuan Xia¹, Xiaoxiao Li¹, Ke Fan¹, Xingyue Ming²

¹ Department of Economics, Wuhan University of Technology

² National Department of Education, Wuhan University of Technology

Abstract. This study explores the empirical relationship between virtual agglomeration and industrial innovation in the context of digitalization, taking Wuhan's new display industry as an example. Firstly, the key concepts of digital industrialization, industrial digitization and enterprise technology innovation are clearly defined, and the research framework is constructed on this basis. The rationality and reliability of the model are verified by constructing a VAR model and adopting methods such as unit root test and Granger causality test. The empirical results show that digital industrialization is self-promoting, industrial digitization is independent and subject to external influences, and enterprise technological innovation has complex dynamic responses. Based on the empirical results, it is proposed that the government should strongly support the application of digital technology in traditional industries, promote the internal digitization of industries, and actively promote the construction of technological innovation platforms. The research in this paper helps to deeply understand the regularity of industrial development in the context of digitization, and provides an important reference for the transformation and upgrading of new display industry in Wuhan.

Keywords: Wuhan digitalization level, new display industry, VAR model, technological innovation.

1. Introduction

Since the early 1990s, the digital economy, as one of the most revolutionary economic forms in the 21st century, has experienced a profound change from a technological tool to a global economic transformation drive, the concept of which was initially put forward by Don Tepescott [1] in 1996 and further established by the U.S. Department of Commerce in 1998. At the same time, with the development of the digital economy, digital transformation has become a key force to promote the development of various industries. Especially for the high-tech industry, digitalization not only reshapes the industrial structure, but also promotes virtual agglomeration within the industry, i.e., the effective concentration of geographically dispersed enterprise resources, knowledge and skills through information technology to form virtual industrial clusters.

Virtual agglomeration can not only promote the efficient utilization of resources, but also accelerate the innovation and dissemination of knowledge and provide impetus for the sustainable development of the industry, while enterprise technology innovation is particularly important in this process. As the state has included the new display industry in the key strategic industries to be supported, and emphasized the development of advanced display technology, and proposed to vigorously improve the level of industrial technology, enterprise technological innovation has become one of the core driving forces for the development of the industry. As an important branch in the field of electronic information, new display industry is facing the challenge of transformation from traditional manufacturing to high-tech services. Since the "13th Five-Year Plan", the introduction of policy documents such as "Guidelines for the Development of Key Common Industrial Technologies" has provided policy support and strategic guidance for enterprise technological innovation. At the same time, the centralized support of special funds such as strategic emerging industry special projects and industrial transformation and upgrading funds has also provided financial guarantee for enterprise technological innovation.

In this process, exploring the technological innovation of virtual agglomeration of new display industry in Wuhan under digitization has important theoretical and practical significance for the

national new display industry, and also provides experience and inspiration for other high-tech industries. Due to the limited development of virtual agglomeration of new display industry in Wuhan and the inability to accurately assess the degree of industrial digitization, this paper mainly uses the overall digitization level of Wuhan, i.e., the level of digital industrialization and industrial digitization, to conduct an empirical study on virtual agglomeration and industrial innovation under digitization, with a view to providing useful references and suggestions for industrial development and policy formulation.

2. Literature Review

Traditional industrial clusters are important network environments for enterprises, with advantages of economies of scale such as technological spillover and sharing of intermediate goods [2]. And driven by digitalization and Internet technology, enterprises and institutions in different geographic locations achieve a new form of industrial organization through network platforms for resource sharing, information exchange, technical cooperation and knowledge innovation - industrial virtual clustering, this form of clustering exceeds the dependence of the traditional industrial clustering on physical space and emphasizes virtual space. This form of agglomeration exceeds the dependence of traditional industrial agglomeration on physical space and emphasizes the synergy and interaction in virtual space.

Some scholars have either attempted to extend industrial clustering to regional clustering or tried to adopt spatial measurement tools to analyze the causative factors of virtual clustering, reflecting marginal contributions to this academic field. Sun Yaowu [3] and others argue that the evolution of innovation models, innovation networks based on technological standards and industrial virtualization are the keys to the development of virtual clusters. Song Yuwen and Yu Bo [4] argued that the spatial expansion of industrial agglomeration and the construction of virtual enterprise platform promote the formation of virtual clusters. Wang Ying [5], on the other hand, emphasized the influence of survival pressure, benefit inducement, extensive user demand and economies of scale on virtual information service industry clusters. Fan Wenying [6] explored the causes of virtual clusters in terms of the trust mechanism between enterprises. Chen suggested that urban innovativeness, knowledge spillover and city size have a positive effect on the clustering of productive service firms, while information technology and government size may have a diffusion effect. Sheng Long and Lu Genyao [7] argued that the demand for secondary industries, the level of informationization, knowledge intensity and human resources are the main factors for the agglomeration of productive service industries. Zhong Haidong et al. verified the spatial agglomeration characteristics of C2C sellers in China through the spatial analysis tool ArcGIS, which was used as empirical evidence of geographic agglomeration of Internet enterprises and also included in the study of virtual agglomeration.

Virtual agglomeration can significantly enhance the technological innovation ability of enterprises, and then promote the development of regional economy. Chen Bin and He Sisi [8] showed that increasing the level of virtual agglomeration can promote the rapid development of technological innovation of enterprises in urban agglomerations, and the superimposed effect of virtual agglomeration and traditional agglomeration has a more significant impact on the enhancement of technological innovation ability of enterprises. Wang Chunyue [9], on the other hand, emphasizes the positive role of virtual agglomeration in promoting economy and trade, and suggests building a virtual agglomeration network platform by promoting digital technological innovation in order to promote the transformation and upgrading of informationization of many small and medium-sized microenterprises in the agglomeration space, and inject a new impetus for the development of the regional economy.

In the research field of new display industry, many scholars mainly focus on technological breakthroughs to promote the further development of related industries. Gao Weinan [10] and other scholars have discussed the strategic, supportive and guaranteed role of new display key materials

and processes in the development of new display technology and industry, sorted out the research status and development trend of representative new display key materials, condensed the problems existing in the field of materials technology and application technology in China, and put forward the development objectives and key directions of new display key materials in China. The development goals and key directions of new display key materials in China are proposed. Cao Yong et al [11] developed a new type of thin-film transistor driver panel based on metal oxide active semiconductor materials; Wang Xiao [12] prepared a dispersant for electrically wetting display non-polar ink materials.

At present, academics have conducted in-depth discussions on the strategic development of new display materials, specific breakthroughs in technology and process, and the causes of virtual agglomeration, etc., but there are fewer studies on the virtual agglomeration of specific industries of new display materials and how to promote innovation through virtual agglomeration. There are two major innovations in this paper: first, it is a targeted study of specific regions, choosing Wuhan City, a representative city for the development of new display industry agglomeration, as the research object; second, it is an in-depth exploration of the relationship between regional digitalization and innovation of the new display material industry, revealing the unique paths and mechanisms of the development of regional industrial innovation, and providing customized suggestions for local policy making.

3. Variable Definition, Data Sources And Processing

3.1. Definition of Variables

3.1.1 Digital industrialization

Digital industrialization refers to the process of transforming traditional industries using digital technologies. It involves the adoption of information and communication technologies (ICT), such as big data, cloud computing, the Internet of Things (IoT), and artificial intelligence (AI), in order to increase productivity, reduce costs, improve product and service quality, and create new business models in traditional industries. The goal of digital industrialization is usually to enhance the competitiveness and innovation of industries.

3.1.2 Industrial digitization

Industrial digitization is the process of applying digital technologies within industries, especially in non-technical industries, in order to change operating models and generate new value. This can include automating processes, optimizing supply chains, digitizing customer interactions, and improving the quality of decision-making through technology. Digitization of industries is not limited to production processes, but also includes changes in the way businesses are managed and approached in the marketplace.

3.1.3 Enterprise technology innovation

Enterprise technological innovation is the activity of a firm that introduces or develops new technologies, or significantly improves existing technologies. This can include product innovation (the development of new products or significant improvements to existing products) and process innovation (new ways of producing or delivering products). Technological innovation is usually aimed at increasing efficiency, reducing costs, improving product quality or creating entirely new market opportunities.

3.2. Data sources and processing

The sample period selected for this paper is from 2017 to 2023, in which the data of digital industrialization and industrial digitization are all derived from the annual Chinese city digitization report published by Xinhua San Group, in which the industrial digitization mainly uses the platform infrastructure score. The enterprise technology innovation data mainly use the sum of the number of

national patent authorizations of Wuhan's new display innovation mainstay enterprises (i.e., enterprises whose number of patent authorizations in recent years ranked in the top 30 among all organizations each year), with data from the Flush database, Wuhan National Invention Patent Statistical Analysis Report, and Wuhan City Statistical Yearbook.

3.3. Construction of VAR model

Vector autoregressive model, abbreviated as VAR model, is an autoregressive model that generalizes univariate to multivariate on the basis of data statistics, not based on economic theory, and using multiple equations of association. The main modeling idea of VAR is to consider endogenous variables in the model as explanatory variables for lagged values of other variables in the model. The VAR model can be expressed mathematically as:

$$Y_t = V + A_1y_{t-1} + A_2y_{t-2} + \dots + A_p y_{t-p} + \varepsilon_t$$

$$t = 0, \pm 1, \pm 2, \dots, \quad y_t = (y_{1t} \dots y_{nt})$$

$t=1, 2, \dots, T; (n \times 1)$ are random variables and A_i are coefficient matrices.

4. Empirical Analysis

4.1. Smoothness test of variables

VAR model requires the use of smooth series, and the data of time series itself has special characteristics, it is likely to appear not smooth phenomenon, so it is necessary to test the smoothness of the data in this paper. The standard method to check the smoothness of the series is the unit root test. In this paper, the unit root test is performed for each variable using Eviews 5.1 statistical software and using the most commonly used unit root test, i.e. ADF test. The test results are shown in Table 1.

From Table 1, it can be seen that digital industrialization, industrial digitization, and enterprise technological innovation variables are all smooth time series at the 5% significant level, thus satisfying the conditions of Granger causality test.

Table. 1 Results of variable smoothness test

Variable	P-value	ADF critical value			Conclusion
		1%	5%	10%	
Digitalization of industry	0.000***	-6.045	-3.929	-2.987	plateau
Digitalization of industry	0.000***	-6.045	-3.929	-2.987	plateau
Enterprise technology innovation	0.002***	-5.354	-3.646	-2.901	plateau

Note: ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

The unit root test has proved that digital industrialization, industrial digitization, and enterprise technological innovation are unit roots, and thus the Granger causality test can be conducted. Before conducting the Granger causality test, this paper determines the optimal lag of the VAR model is 4, i.e., VAR (4), based on the criteria of LR, AIC, and SC.

4.2. Granger causality test

There are some variables in the economic variables are significantly correlated, but they may not have economic significance, that is, there is a pseudo-regression phenomenon. For the problem of determining whether the change of one variable is the cause of the change of another variable, Granger proposes the test method of causality test [13]. This paper uses this test method to test whether there is a significant Granger causality between the technological innovation of new display

enterprises and digital industrialization and industrial digitization level, and the test results are shown in Table 2. From the results, it can be seen that: the technological innovation of enterprises is the Granger cause of digital industrialization, that is, the technological innovation of enterprises can cause changes in digital industrialization. However, industrial digitization is not a Granger cause of digital industrialization, i.e., industrial digitization does not have a significant effect on digital industrialization. Meanwhile, both digital industrialization and industrial digitization fail to show significant effects on enterprise technological innovation in a specific new display industry.

Table. 2 Granger causality test results

Sample Pairings		F	P
Industrial Digitization	Enterprise Technology Innovation	0.527	0.520
Enterprise Technology Innovation	Industrial Digitization	0.499	0.531
Digital Industrialization	Enterprise Technology Innovation	1.268	0.342
Enterprise Technology Innovation	Digital Industrialization	52.233	0.005***
Digital Industrialization	Industrial Digitization	0.006	0.941
Industrial Digitization	Digital Industrialization	0.375	0.583

Note: ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

For whether the VAR model is stable or not, it is necessary to carry out further ADF test, it is easy to see that all the unit roots fall within the unit circle, thus proving that the VAR model has smoothness as well as the existence of the relationship between the variables and the lagged variables that affect each other. All the points are located within the unit circle; thus, it can be judged that the VAR system is stable, and the model can be further impulse response analysis and variance decomposition.

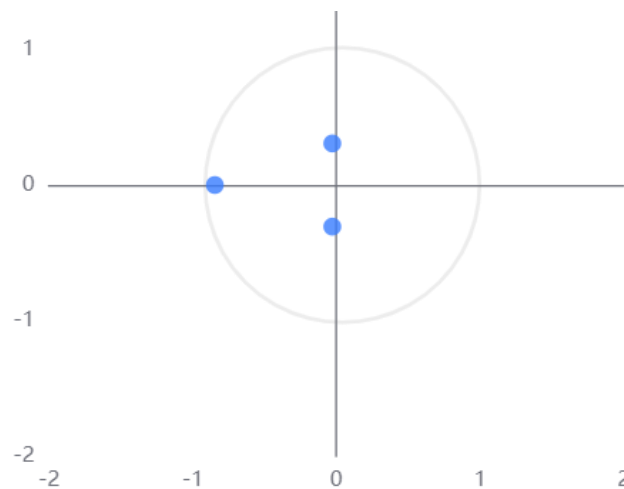


Fig. 1 Plot of unit root validation results

4.3. Impulse response analysis

In order to better reflect and study the dynamic relationship between variables, this paper adopts Cholesky (Cholesky) decomposition method [14], through the error term orthogonalization impulse response function to analyze the dynamic relationship between technological innovation of new display enterprises in Wuhan City and the digital industrialization and industrial digitization level.

As can be seen from the impulse response curve in Figure 2, in the initial stage (period 1), firms' technological innovation has a negative response to the shock of digital industrialization, implying that the shock may lead to a short-term decline in technological innovation activities. By periods 2 and 3, the response effect quickly turns positive, suggesting that firms' technological innovation is beginning to adapt and possibly recover from the shock of digital industrialization. From period 4 onwards, the response effect stabilizes at a positive value, but this positive effect seems to diminish over time. The 95% confidence intervals contain zero throughout the 10-period period, especially in period 1 and from period 4 to 10. This suggests that the response effect is not statistically significant

at all time points. Combining the response effects and confidence intervals, we can infer that although digital industrialization may have a significant impact on firms' technological innovation in some periods, this impact is not always stable and consistent.

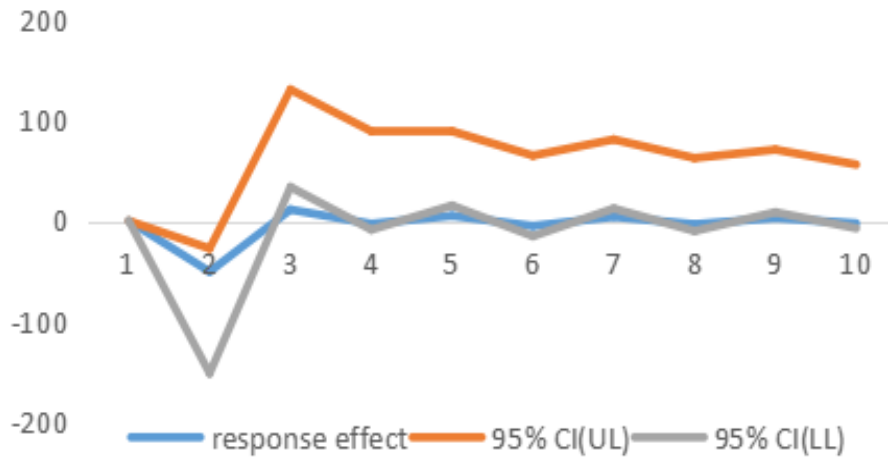


Fig. 2 Impulse response graph of digital industrialization

As can be seen from the impulse response curve in Figure 3, the response effect is close to zero at the onset, then rises to a positive peak and then declines, showing a fluctuating trend. Two significant high points are reached at about time point 4 and time point 8, which may indicate that industrial digitization has a significant positive impact on firms' technological innovation during these periods. It is important to note that at most of the time points, the confidence intervals include the zero line, which means that statistically we cannot be fully confident that the shock of industrial digitization is significant at these points, as the confidence intervals include the possibility of no effect. In contrast, the response effect appears to be significant around time points 4 and 8, as the blue line (response effect) is above the lower limit of the confidence interval at these points.



Fig. 3 Impulse response graph for industrial digitization

Also, from the impulse response curve in Figure 4, it can be seen that the response effect peaks in the 2nd time unit, indicating a significant positive response to digital industrialization shortly after the technological innovation. After that, the response effect decreases rapidly and has fallen back to a level close to zero in the 3rd time unit, and then maintains at a lower level in the subsequent time units. At the same time, the 95% confidence interval also peaks in the 2nd time unit and widens over time, suggesting that uncertainty about the response to the shock increases with time delay.

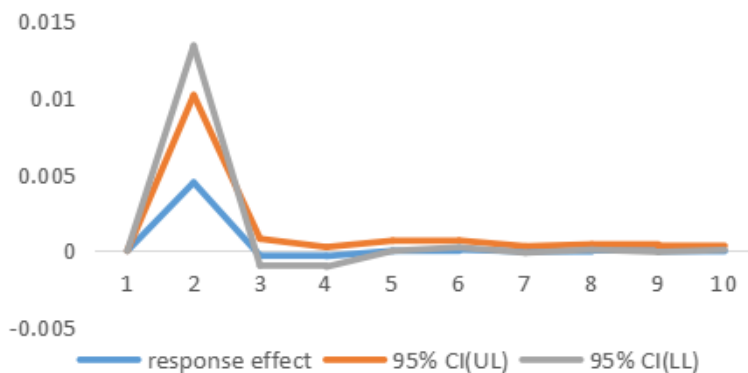


Fig. 4 Impulse Response Plot of Enterprise Technological Innovation

4.4. Variance decomposition

Variance decomposition is to further evaluate the importance of different structural shocks by analyzing the contribution of each structural shock to the change of endogenous variables. In order to better analyze the interaction relationship between digital industrialization, industrial digitization and technological innovation of new display enterprises in Wuhan, and to further clarify the degree of their mutual influence, this paper makes variance decomposition for the VAR model.

Table. 3 Predictive variance decomposition of digital industrialization

Order	Standard deviation	Digital industrialization %	Industrial Digitization %	Enterprise Technological Innovation%
1	1.039	100	0	0
2	1.23	74.233	25.767	0
3	1.313	73.541	26.459	0
4	1.372	70.251	29.749	0
5	1.397	69.212	30.788	0
6	1.414	68.703	31.297	0
7	1.427	68.312	31.688	0
8	1.436	68.026	31.974	0
9	1.442	67.829	32.171	0
10	1.447	67.691	32.309	0

As shown in Table 3, digital industrialization is only affected by its own fluctuation in the 1st period, and the impact of industry digitization and enterprise technological innovation on digital industrialization is only presented in the 2nd period, the impact intensity of industry digitization is small, only 25.77%, and the technological innovation of Wuhan's new display enterprises has almost no impact intensity on digital industrialization. After that, the impact intensity of industrial digitization rises slowly and reaches 32.31% of the maximum predicted variance decomposition value in the 10th period. It is worth noting that the contribution of industrial digitization to digital industrialization never exceeds the contribution of digital industrialization itself. It can be seen that in the short term, the contribution of industrial digitization to digital industrialization is small, and digital industrialization has a greater contribution to itself.

Table. 4 Predicted variance decomposition of industrial digitization

Order	Standard deviation	Digital industrialization %	Industrial Digitization %	Enterprise Technological Innovation%
1	12.507	40.206	59.794	0
2	16.24	43.707	56.293	0
3	18.648	44.501	55.499	0
4	20.21	44.69	55.31	0
5	21.243	44.806	55.194	0
6	21.951	44.887	55.113	0
7	22.443	44.939	55.061	0
8	22.788	44.972	55.028	0
9	23.031	44.995	55.005	0
10	23.204	45.011	54.989	0

As shown in Table 4, industrial digitization is mainly affected by its own fluctuation and digital industrialization in period 1, and the technological innovation of Wuhan's new display enterprises has no effect on it. After the 2nd period, the contribution of industrial digitization to itself gradually and steadily decreases, but it is still greater than the contribution of digital industrialization. It can be seen that digital industrialization has a greater positive effect on improving industrial digitization.

Table. 5 Predictive variance decomposition of enterprise technology innovation

Order	Standard deviation	Digital industrialization %	Industrial Digitization %	Enterprise Technological Innovation%
1	316.528	94.175	5.825	0
2	477.462	64.65	35.35	0
3	542.356	58.959	41.041	0
4	578.656	57.426	42.574	0
5	604.234	56.564	43.436	0
6	622.249	55.966	44.034	0
7	634.759	55.574	44.426	0
8	643.52	55.317	44.683	0
9	649.707	55.141	44.859	0
10	654.093	55.02	44.98	0

As shown in Table 5, the technological innovation of new display enterprises in Wuhan is mainly affected by the fluctuation of digital industrialization in period 1, while the contribution of industrial digitization is relatively small, at 5.83%. Starting from the 2nd period, the contribution of digital industrialization begins to gradually decrease, but relative to other factors, its contribution is still the

largest; the contribution of industrial digitization shows a gradual upward trend, especially the rapid increase in the 2nd period. It can be seen that digital industrialization and industrial digitization are important factors affecting the technological innovation of Wuhan new display enterprises, and the level of digital industrialization and industrial digitization should be improved at the same time as the technological innovation of Wuhan new display enterprises, so that the technological innovation advantage of Wuhan new display enterprises can be fully developed.

5. Conclusion And Policy Recommendations

This paper analyzes the relationship between digital industrialization, industrial digitization and enterprise technological innovation from an empirical point of view by selecting the digital development index and innovation data of new display enterprises in Wuhan from 2017 to 2023, establishing a vector autoregressive model (VAR) and utilizing the corresponding econometric methods, and drawing the following conclusions.

First, digital industrialization is self-promoting. Digital industrialization is mainly affected by its own fluctuations at the initial stage, indicating that it has a certain self-promotional nature. With the passage of time, the influence of industrial digitization on digital industrialization gradually appears, and although the growth is slow, it shows a continuous upward trend, which indicates that with the enhancement of industrial digitization infrastructure, its role in promoting digital industrialization is increasing.

Second, industrial digitization is independent and subject to external influences. Industry digitization was mainly influenced by itself and digital industrialization in the early days, but over time, industry digitization has maintained a leading position in terms of its influence on itself. This reflects that industrial digitization is an independent process to a certain extent, but at the same time, digital industrialization still has a certain positive influence on it.

Third, enterprise technology innovation has a complex dynamic response. The technological innovation of new display enterprises in Wuhan is initially mainly influenced by digital industrialization, and this influence declines over time. This may be due to the fact that as firms' technological innovation capability improves, they are increasingly able to be independent of the impact of external digitalization changes. In addition, the impact of industrial digitization on technological innovation is small at an early stage but gradually increases over time, suggesting that the potential impact of industrial digitization in promoting technological innovation is positive over a longer time span.

Based on the empirical findings and combining the results of related research scholars [15-25], we put forward several policy recommendations. First, the government should continue to encourage and support the application of digital technology in traditional industries to improve productivity and product quality. This includes providing policy measures such as financial subsidies, tax incentives, and support for technology research and development. Second, the Wuhan government and enterprises should collaborate to promote internal digitization of the new display industry and enhance the depth and breadth of industrial digitization by formulating corresponding industrial standards, promoting the cultivation of digitization talents, and establishing industrial digitization demonstration projects to accelerate the process of virtual agglomeration of the new display industry. Again, the government actively promotes the establishment of a new display technology innovation platform, strengthens the protection of intellectual property rights, and promotes the transformation of scientific and technological achievements to provide support for the technological innovation of new display enterprises. Finally, when formulating local economic development strategies, given the time lag in the impact of digital industrialization and industrial digitization on the technological innovation of new display enterprises, the relevant policies should be predictable and sustainable, not only focusing on short-term results, but also maintaining support for long-term development to ensure sustainable development.

References

- [1] Tapscott D. The Digital Economy: Promise and Peril in the Age of Networked Intelligence [M]. New York: Mc Graw-Hill, 1996.
- [2] Ruan Jianqing, Shi Qi, Zhang Xiaobo. The dynamic evolution law of industrial clusters and local government policies [J]. Management World, 2014, (12): 79-91.
- [3] SUN Yaowu, TAN Yuanfang. Research on technological leadership and its structural evolution of modular innovation network dominated enterprises [J]. Science and Technology Progress and Countermeasures, 2018, 35(01): 80-87.
- [4] SONG Yuwen, YU Bo. Exploration of the organization mode of virtual industrial clusters and policy suggestions [J]. China Science and Technology Forum, 2008, (11): 52-56.
- [5] Wang Ying. Research on Virtual Information Service Industry Cluster [D]. Central China Normal University, 2009.
- [6] Fan W.-Y. Research on trust mechanism among enterprises in virtual industry cluster [D]. Lanzhou: Lanzhou University, 2010.
- [7] Sheng Long, Lu Genyao. Research on the agglomeration of productive service industries and its influencing factors in China: An analysis based on industry and regional levels [J]. Nankai Economic Research, 2013(5): 115-129.
- [8] CHEN Bin, HE Sisi. Virtual agglomeration and manufacturing technology innovation in the era of digital economy—Empirical evidence from China's urban agglomerations [J]. Southern Economy, 2023, (08): 72-92.
- [9] Wang Chunyue. Research on the Impact of Economic Agglomeration on Enterprises' Export Choice [D]. Supervisor: Dai Meihong. Northeast University of Finance and Economics, 2022.
- [10] Gao Wei-Nan, Xu Zu-Yan, Bi Yong, et al. Current status and trend of laser display technology development [J]. China Engineering Science, 2020, 22(3): 72-77.
- [11] CAO Yong, TAO Hong, ZOU Jianhua et al. Metal-oxide thin-film transistors and their applications in novel displays [J]. Journal of South China University of Technology (Natural Science Edition), 2012, 40(10): 1-11.
- [12] WANG Xiao, DANG Yong, YE Dechao et al. Preparation and application of new dispersants for electrowetting display ink materials [J]. Journal of South China Normal University (Natural Science Edition), 2019, 51(06): 31-35.
- [13] Cao YF, A review of Granger causality test [J]. Statistical research on world economy [J], 2005. 52(2): 16-21.
- [14] Qiang Chen, Advanced Econometrics and Stata Applications [M], Higher Education Press, 2014.
- [15] Tian Lin, Han Yanbo. A review of the theory and application of virtual agglomeration [J]. Journal of Chongqing University (Social Science Edition), 2021, 27(01): 77-90. [10] Tian Lin, Han Yanbo. A review of the theory and application of virtual agglomeration [J]. Journal of Chongqing University (Social Science Edition), 2021, 27(01): 77-90.
- [16] WANG Ruyu, LIANG Qi, LI Guangqian. Virtual agglomeration: A new form of spatial organization for the deep integration of new generation information technology and real economy [J]. Management World, 2018, 34(02): 13-21.
- [17] Zhang Fan. Theoretical research on the knowledge spillover effect of virtual clusters in financial industry [J]. Research Management, 2016, 37(S1): 409-416.
- [18] ZHANG Qing, RU Shaofeng. Research on the path of new digital infrastructure to promote the virtual agglomeration of modern service industry [J]. Exploration of Economic Issues, 2021, No. 468(07): 123-135.
- [19] ZHANG Ruiqian, LIU Haozhong, XIE Yizhen et al. Virtual agglomerative network relations, institutional logic differences and digital empowerment enterprise growth - a study based on cloud computing enterprises [J]. Research Management, 2021, 42(08): 92-101.
- [20] LI Ang, GAO Ruize. Stimulating the market potential of electric power industry: Exploration of "virtual agglomeration" of power grid scheduling [J]. Economic Management, 2015, 37(05): 22-31.

- [21] Li Lei, Zou Yifeng, Huang Fei et al. Patent predicament and patent pool construction countermeasures in China's new display industry[J]. China Invention and Patent,2023,20(04):14-22.
- [22] Yu Xinchuang. Hefei New Display Industry Development Experience and Insights[J]. China Economic and Trade Review,2023(01):61-63.
- [23] Zhou Shuqian, Chen Tiebing. Discussion on the development process of new flat panel display material industry cluster[J]. New Material Industry,2020(04):16-19.
- [24] Yang Siwei. China should grasp the opportunity to accelerate the transformation and upgrading of global new display industry[J]. World Telecommunication,2014(12):19-25.
- [25] Guo Qian. China's new display industry to speed up to the high-end[N]. Economic Reference News, 2022-12-08(006).