Relationship between Technological Innovation and Economic Benefits in Virtual Academic Communities

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Abstract: The virtual academic community serving as an online platform provides a space for researchers to communicate and cooperate. The purpose of this paper is to study the relationship between technological innovation and economic benefits in the virtual academic community. Through the analysis of existing literature review and empirical research, the paper explained the positive role of virtual academic platform, and found that technological innovation had a positive impact on economic benefits in virtual academic community. Through technological innovation, virtual communities can promote knowledge sharing, improve research quality, accelerate the research process, and eventually translate into economic benefits. In addition, this paper discussed the impact of technological innovation on the virtual academic community itself, including the development of the community, user satisfaction and the sustainability of the community. Finally, this paper made some suggestions to promote the further development of technological innovation and economic benefits in the virtual academic community.

1. Introduction

In today's highly developed information technology, the virtual academic community, as an emerging academic exchange platform, has become an important part of the academic circles. By providing online forums, blogs, academic resource sharing and other functions, the virtual academic community provides a convenient, open and interactive academic exchange environment for scholars, so as to promote academic research and discussion. In this virtual community environment, user scholars can share their research results, discuss academic issues, and cooperate and communicate with other scholars.

The rise of virtual academic communities has not only changed the way of academic exchange, but also had a profound impact on technological innovation and economic benefits. The virtual academic community provides an extensive platform for scholars to communicate, and promotes the intersection and integration of different disciplines. Through the virtual academic community, Zhang Rui believes that it is more convenient for scholars to obtain research results and views in other fields, thus stimulating new innovative ideas and research directions [1]. Parmaxi Antigoni

proposed that such interdisciplinary communication and cooperation would help to promote the development of technological innovation and bring new breakthroughs and progress to the academic community [2]. The emergence of virtual academic communities can also bring more economic benefits to academia. Gourlay Lesley has improved learning efficiency and reduced the cost and threshold of academic exchange by providing functions such as academic resource sharing, online conferences, and seminars through a virtual academic community [3]. Scholars communicate and collaborate with scholars worldwide through virtual academic communities, no longer constrained by geographical location and time constraints. This convenient and efficient way of academic exchange helps scholars improve research efficiency and academic influence, thereby bringing them more economic returns [4]. However, the development of virtual academic communities also faces some challenges and problems. For example, the issues of information quality and authenticity in virtual academic communities. There are also some false information, pirated resources, and academic misconduct. These issues not only affect the quality of academic exchanges, but also have a negative impact on technological innovation and economic benefits. Therefore, how to establish a sound management mechanism and normative system to ensure the good operation of virtual academic communities has become an urgent problem to be solved.

In summary, there is a close relationship between technological innovation and economic benefits in virtual academic communities. The virtual academic community provides an open, convenient, and interactive academic exchange environment for scholars, promoting the intersection and integration of disciplinary fields, and promoting the development of technological innovation. At the same time, virtual academic communities have also brought more economic benefits to scholars, improving their research efficiency and academic influence. However, the development of virtual academic communities also faces some challenges and problems, which require further strengthening management and standardization to ensure their good operation.

2. Demand for Technological Innovation in Virtual Academic Communities

By summarizing relevant research, it can be found that faceted navigation services, as a well-known hotspot navigation service in recent years, have advantages such as topic result analysis, the ability to manually define topic categories, and the design of China Eastern Airlines' strategies [5]. However, its application in virtual academic communities is relatively limited. However, the existing methods for constructing a facet system mainly rely on expert research and professional classification catalogs, which lack sufficient description of the content characteristics of the data. This is also the facet system structure adopted by most virtual academic communities at present [6]. For academic communities, knowledge services are the ultimate goal of knowledge aggregation [7]. However, in terms of existing knowledge aggregation methods, there is little attention paid to the application of knowledge aggregation results in specific knowledge services. In practical application, there are still problems such as low value of aggregation results and poor user experience in knowledge aggregation applications. If a specific faceted navigation service mode is used, sufficient knowledge aggregation process would greatly improve the value of knowledge aggregation applications and provide users with a better user experience. Therefore, faceted navigation would be one of the important forms of visualizing knowledge aggregation results. A detailed segmented navigation service model based on user generated content knowledge aggregation in virtual academic communities is shown in Figure 1 [8]. Therefore, simply combining knowledge aggregation with faceted navigation services and constructing a user generated content knowledge navigation service framework for virtual academic communities based on knowledge aggregation can expand and deepen the theoretical system of knowledge aggregation and faceted navigation services, thereby optimizing the effectiveness of virtual academic community knowledge
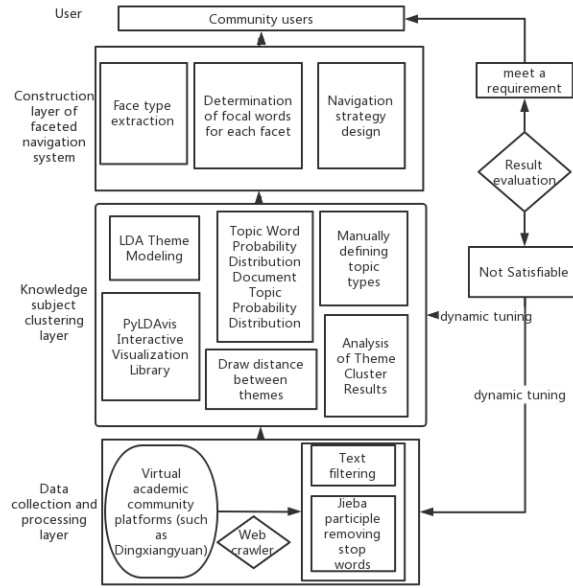
navigation services [9].

Figure 1: A Faceted Navigation Service Model Based on User Generated Content Knowledge Aggregation in Virtual Academic Community

Due to the openness and freedom of virtual academic communities, there are issues with the quality and authenticity of information in the community. Considering this issue, this article takes the active information index of community members as a key factor in technological innovation affecting virtual academic communities. It comprehensively considers the influence factors of community environment and virtual community population, and applies the LDA (Latent Dirichlet Allocation) theme model as the analysis model for member texts, in order to obtain clear theme clusters in the text and observe their academic authenticity and quality, for corresponding technological innovation and improvement [10]. Consider each document as a mixed Dirichlet distribution of several potential topics, and each potential topic can be regarded as a probability distribution of the vocabulary in the document set, which can calculate the probability of each feature word appearing in a document, as shown in formula (1):

$$p(\text{feature words} \mid \text{document}) = \sum_{\text{theme}} p(\text{feature words} \mid \text{theme}) * p(\text{theme} \mid \text{document}) \quad (1)$$

In the formula, p (featurewords | document) represents the probability of each feature word appearing in the document, p (featurewords | theme) represents the probability of each feature word appearing in the topic, and p (theme | document) represents the probability of each topic appearing in the document

Due to the possibility of avoiding topic redundancy and information loss, the Perplexity Score index is commonly used to evaluate the predictive and generalization abilities of topic models. The lower the degree of confusion, the better the performance of the model. The calculation formula for confusion is shown in formulas (2) and (3):

$$\text{perplexity}(D) = \exp[\frac{\sum_{d-1}^{M} Nd}{\sum \log p(w)}] \quad (2)$$

$$p(w) = p(z \mid d) * p(w \mid z) \quad (3)$$

In the formula, d represents a document, p (w) represents the probability of each word appearing, p (w | z) represents the probability of each word appearing in a certain topic in the dictionary, and p (z | d) represents the probability of each topic appearing in the document.

Due to the randomness of LDA topic word calculation, there are slight differences in the clustering results obtained each time, which requires multiple iterations in the experiment to obtain the closest topic word effect. To better understand the relationship between active interaction metrics of community members and technological innovation in virtual academic communities [11], technicians will merge the title and content stickers in the virtual community to form a dataset, and use the LDA Model function in the Python based machine learning toolkit gensim to achieve article knowledge aggregation for LDA user upload and communication [12]. The selection of the number of topics is very important for modeling LDA topics. Excessive or insufficient number of topics can weaken the effect of knowledge clustering, making it difficult to distinguish topics. This article uses consistency indicators as a supplement to measure whether words within the same topic are consistent. The higher the consistency, the more words within the topic can support each other and prove the reliability and authenticity of the document [13]. This article evaluates the optimal number of topics based on the confusion and semantic consistency of the observed community population, in order to balance the depth and width of the topics. The experimental results are shown in Figures 2 and 3. From Figure 2, it can be seen that when the number of topics is 11, the consistency score is highest, so 11 is used as the maximum number of topics.
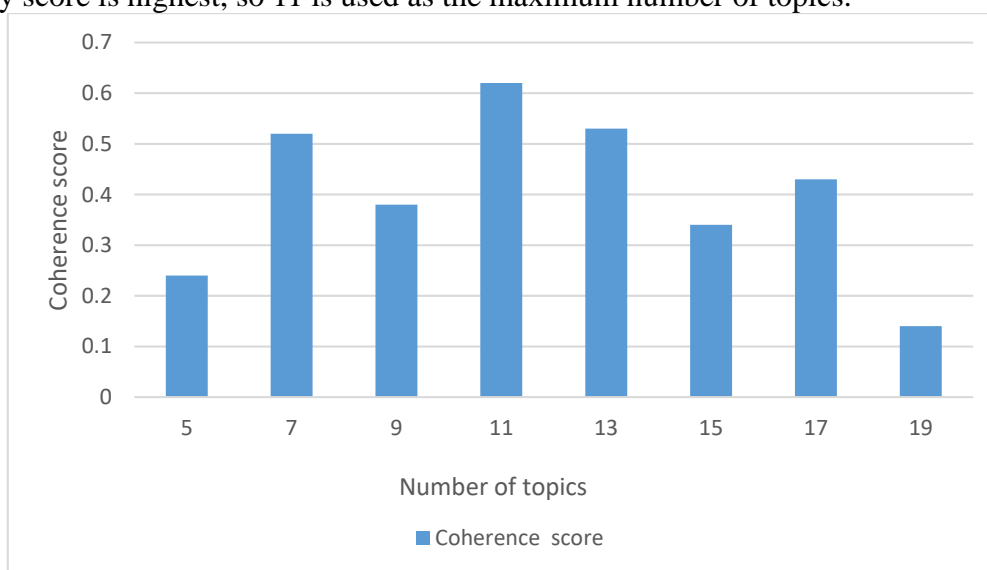

Figure 2: Coherence Results

The confusion score result is shown in Figure 3. The higher the number of topics appearing, the lower the confusion of readers. However, when combined with consistency, the value around 11 and the expected effect are more obvious. From this, a relatively comprehensive and stable knowledge clustering result has been obtained, which can be used for preliminary screening, and technological innovation can be used to influence interventions and create higher economic effects. Moreover, technological innovation can also enable virtual academic communities to provide a more convenient and efficient communication platform [14]. Through technological means such as the internet, social media, and online conferences, scholars can engage in academic exchanges anytime and anywhere, without being limited by time and geography. This greatly improves the efficiency and frequency of communication among scholars, promoting the development of academic cooperation and collaborative innovation [15]. All these make it more convenient for scholars to obtain various academic resources. Through virtual academic communities, scholars can easily

access global academic journals, papers, research data, and other resources, no longer limited by traditional academic publishing channels [16]. This provides more reference and support for scholars' research, accelerates the research process, and promotes the development of academic innovation.
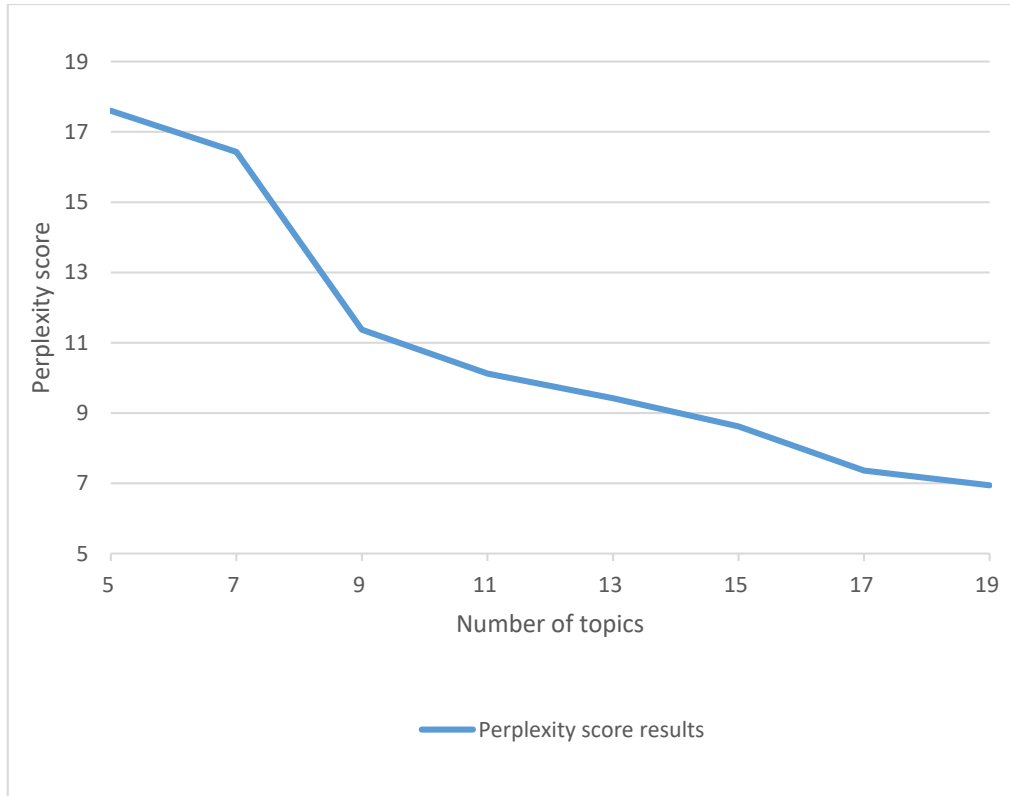

Figure 3: Perplexity score results

3. Impact of Technological Innovation on Economic Benefits

By simulating the corresponding impact of technological innovation on a certain virtual academic community and comparing the results of similar academic communities that have not yet been optimized, the impact of virtual academic community optimization on the corresponding economic benefits is obtained as shown in Table 1.

Table 1: The impact of optimizing virtual academic communities on corresponding economic benefits

	Academic community before optimization	Academic communities of the same nature	Optimized academic community	Academic communities of the same nature but not optimized
Browsing proportion	43.956%	56.044%	73.651%	36.349%
Capacity within the same sector	3264	4133	5126	4263
Direct economic benefits of sector related industries(yuan)	6542360	6542360	8230130	8230130

By comparing Table 1, it can be intuitively observed that the virtual academic community optimized by technological innovation has increased both in terms of daily browsing and production of corresponding section content by community users. The proportion and synchronous increase in the number of articles from 43.956% before technological innovation to 73.651% after optimization confirm the potential of the optimized virtual academic community platform. The article quality and segmented navigation services brought by optimization enable related industries to have higher quality content for communication, thereby driving the direct economic benefits of corresponding sectors to increase [17]. Therefore, technological innovation in virtual academic communities has a positive impact on economic benefits. By improving research efficiency, promoting academic cooperation and collaborative innovation, and expanding academic influence, the technological innovation of virtual academic communities has brought more economic returns to scholars, while also promoting the growth and development of community users or corresponding industries. The specific impacts are as follows:

① Improving research efficiency: The technological innovation of virtual academic communities provides higher quality online forums, blogs, academic resource sharing, and other functions, making it easier for scholars to access and share research results [18]. This convenient way of academic exchange can save time and costs, and improve research efficiency. Scholars can quickly access the latest research progress, thereby accelerating their research process and further promoting the development of technological innovation.

② Promoting academic collaboration and collaborative innovation: Virtual academic communities break down geographical and time constraints, making it easy for scholars around the world to communicate and collaborate. User scholars can find suitable partners through the virtual academic community to jointly develop the research project [19]. Such cross-regional and disciplinary cooperation can gather the professional knowledge and resources of all parties faster and promote the generation of cooperative innovation. User scholars can further promote the development of technological innovation by sharing research results and learning from each other.

③ Reduce R & D costs: Technological innovation in the virtual academic community can reduce R & D costs and improve R & D efficiency by sharing resources and open innovation, so as to save costs for enterprises and improve economic benefits.

④ Promoting the development of the digital economy: The technological innovation of virtual academic communities can promote the development of the digital economy, promote the rise of digital industries, promote the formation of new economic growth points, and bring new growth drivers to the economy.

4. Impact of Technological Innovation on the Virtual Academic Community Itself

The impact of technological innovation on virtual academic communities is comprehensive, which can enhance user experience, expand community functions, strengthen community interaction, improve community management efficiency, and inject new impetus into the development and sustainability of virtual academic communities [20]. The specific details are as follows:

① In terms of user experience: Technological innovation can improve the user interface, interaction design, and functionality of virtual academic communities, enhancing the user experience. By introducing new interactive methods, intelligent recommendation systems, virtual implementation technologies, etc., users can more conveniently access information, communicate, and collaborate, thereby improving user satisfaction.

② Expanding community functions: Technological innovation can add new functions and services to virtual academic communities, enriching their content and activities. For example, new

technologies such as online conferences, webinars, and virtual laboratories can be introduced to provide more possibilities for academic exchange and cooperation, meeting the diverse needs of users.

③ Strengthening community interaction: Technological innovation can promote direct interaction and cooperation among members of the virtual academic community. Social networks, collaborative tools, and other technologies can be used to promote academic exchange, collaborative research, and project management, strengthening connections and interactions among community members.

④ In terms of community management efficiency: Technological innovation can improve the management and operational efficiency of virtual academic communities. By introducing new technologies such as big data analysis and artificial intelligence, community managers can better understand the needs of community members, optimize resource allocation, and improve community operational efficiency.

5. Prospects for Economic Benefits of Technological Innovation in Virtual Academic Communities

With the continuous development of virtual academic communities and the emergence of technological innovation, relevant research would better enable users to understand the impact of technological innovation on the economy and provide more insights, policy recommendations and strategic guidance for promoting economic development and social progress. Interdisciplinary research can be conducted, combining multiple disciplines such as economics, information technology, and innovation management to explore the impact mechanism of technological innovation on economic benefits in virtual academic communities, as well as how to maximize the promoting effect of technological innovation on the economy. Empirical research can also be conducted to collect case data on technological innovation in virtual academic communities, analyze the actual impact of technological innovation on the economic benefits of enterprises and industries, and provide a basis for economic policy formulation and strategic decision-making of enterprises. Long term effects research can be developed to focus on the long-term effects of technological innovation in virtual academic communities. This article explores the long-term impact of technological innovation on economic structure, industrial upgrading, employment opportunities, and other aspects, providing long-term strategic guidance for future economic development.

6. Conclusions

This article focuses on the relationship between technological innovation and economic benefits in virtual academic communities. Through investigation and research, the faceted navigation service model can be used for the innovative changes and positive impacts of virtual academic community platforms, as well as the potential impact of active information indicators of community member users on technological innovation. This demonstrates the impact of technological innovation in virtual academic communities on economic benefits. It can be inferred from experimental data that technological innovation can truly bring more intuitive economic effects. It elaborates on which aspects of technological innovation can enhance the virtual academic community and proposes a perspective on the relationship between technological innovation and economic benefits.

References

[1] Zhang Rui, Hu Lina, and Huang Wei. Research on the Evolution of Multi Agent Simulation for Knowledge Exchange in Virtual Academic Communities. Modern Intelligence 43.10 (2023): 16-26.

[2] Parmaxi, Antigoni. "Virtual reality in language learning: A systematic review and implications for research and practice." Interactive learning environments 31.1 (2023): 172-184.

[3] Gourlay, Lesley. "There is no'virtual learning': The materiality of digital education." Journal of New Approaches in Educational Research 10.1 (2021): 57-66.

[4] Singhal R, Kumar A, Singh H, et al. Digital device-based active learning approach using virtual community classroom during the COVID-19 pandemic. Computer Applications in Engineering Education, 29.5 (2021): 1007-1033.

[5] Wei Ling, and Quan Chenxue. A Virtual Academic Community Group Recommendation Model Integrating Multidimensional Features and Interest Drift. "Modern Intelligence 43.07 (2023): 48-63.

[6] Wang Pengmin, and Luo Gongli. Analysis of User Knowledge Interaction Behavior in Virtual Academic Communities from a Subjective Game Perspective. "Modern Intelligence 42.08 (2022): 61-73.

[7] Gu Jiayun, Xiong Huixiang, and Xiao Bing. Research on Scholar Recommendations Integrating User Dynamic Interests and Social Relationships in Virtual Academic Communities. "Library and Information Work 66.11 (2022): 110-120.

[8] Tan Chunhui, and Ren Jihan. A Study on the Combination of Factors Influencing User Information Search Behavior in Virtual Academic Communities - Based on Fuzzy Set Qualitative Comparative Analysis Method. "Modern Intelligence 42.04 (2022): 39-51.

[9] Sheng Xiaoping, and Tang Junjie. Analysis of user interaction characteristics and patterns in virtual academic communities from the perspective of social networks. "Modern Intelligence 42.01 (2022): 64-71.

[10] Wang Zhanping, et al. "Factors Influencing User Community Identity in Virtual Academic Communities." Library Forum 41.04 (2021): 132-140.

[11] Giddens, Jean, et al. "Enhancing learning in an online doctoral course through a virtual community platform." Journal of Professional Nursing 37.1 (2021): 184-189.

[12] Winarno, Winarno. "Implementation of Virtual Office Management and Virtual Assistant Applications in Improving the Quality of Learning in Vocational Schools." FALASIFA: Jurnal Studi Keislaman 14.02 (2023): 96-100.

[13] Adebayo, Tomiwa Sunday, and Dervis Kirikkaleli. "Impact of renewable energy consumption, globalization, and technological innovation on environmental degradation in Japan: application of wavelet tools." Environment, Development and Sustainability 23.11 (2021): 16057-16082.

[14] Kihombo, Shauku, et al. "Linking financial development, economic growth, and ecological footprint: what is the role of technological innovation?." Environmental Science and Pollution Research 28.43 (2021): 61235-61245.

[15] Kelly, Bryan, et al. "Measuring technological innovation over the long run." American Economic Review: Insights 3.3 (2021): 303-320.

[16] Tan Chunhui, Wang Yiwen, and Guo Yang. Research on the Stability of Research Cooperation in Virtual Academic Communities Based on Symbiosis Theory. "Modern Intelligence 41.03 (2021): 15-28.

[17] Buglioni, Laura, et al. "Technological innovations in photochemistry for organic synthesis: flow chemistry, high-throughput experimentation, scale-up, and photoelectrochemistry." Chemical Reviews 122.2 (2021): 2752-2906.

[18] Culver Joseph. Environmental Management System for Nature Reserves Integrating Virtual Simulation Technology. Nature Environmental Protection 4.1 (2023): 60-69.

[19] Usman, Muhammad, and Nesrine Hammar. "Dynamic relationship between technological innovations, financial development, renewable energy, and ecological footprint: fresh insights based on the STIRPAT model for Asia Pacific Economic Cooperation countries." Environmental Science and Pollution Research 28.12 (2021): 15519-15536.

[20] Adu-Danso, Emmanuel, and Emmanuel Abbey. "Does foreign ownership enhance technological innovation amongst manufacturing firms in Sub-Saharan Africa?." Journal of Small Business & Entrepreneurship 34.2 (2022): 195-221.