
Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

Kun Liu¹, Imelda L. An²

¹Hunan University of Information Technology, Changsha, China

²Lyceum of the Philippines University, Batangas, Philippine

ABSTRACT: This study analyses the use of new quality productivity theory in higher education management and develops a framework called the "multi-dimensional collaborative innovation management model" to tackle the challenges of globalisation and information technology. This concept combines the three dimensions of scientific and technological innovation, management innovation, and system innovation to promote effective resource allocation, improve educational quality and efficiency, and increase the education system's adaptability. This study uses mixed-methods research to verify the model's effectiveness in practical educational management as well as to present fresh theoretical perspectives and practical tactics for cultivating high-qualified talents who will satisfy the needs of future society.

KEYWORDS: new quality productivity theory, university education management, innovation management framework, scientific and technological innovation, system innovation.

INTRODUCTION

In today's fast-changing globalisation and information age, higher education, as the primary driver of societal progress, faces tremendous problems and opportunities. Globalisation has not only dramatically expanded the boundaries of education and promoted the global flow of knowledge, but it has also had a considerable impact on education's management mode, quality, and innovation ability, as well as raised higher education standards.

The notion of new quality productive forces emphasises the central role of knowledge, information, technology, and innovation while also providing a new source of power for modern economic activity. This theory's proposal represents a significant shift in our understanding of traditional production forces, and its gradual application to the reform and innovation of higher education administration has demonstrated significant application potential. Some universities, for example, have considerably improved management efficiency and educational quality by implementing intelligent management systems and big data analytics.

Although the new quality productivity has promising prospects in education management, determining how to effectively apply its theories and methods to address challenges such as resource allocation efficiency, education quality improvement, and innovation ability enhancement remains an urgent problem. The goal of this study is to investigate the application and practical importance of new quality productivity in higher education management, as well as to develop a "multi-dimensional collaborative innovation management model" that satisfies the needs of the new period. This model not only provides a new theoretical perspective and framework for educational management, but it also provides innovative management strategies and methods at the practical level, with the goal of improving management efficiency and education quality by incorporating new technologies and ideas, as well as promoting education quality and university competitiveness. Furthermore, this study contributes to higher education's long-term development by demonstrating how new quality productivity becomes a critical factor in encouraging higher education management innovation.

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

2. LITERATURE REVIEW

2.1 The theoretical foundation of new quality productivity.

The theory of new-quality productivity has been extensively researched and used in the field of educational management. Sebayang (2005) stresses the theory's potential for fostering educational equity and boosting educational quality. Wolf (2002) discussed how to improve learning efficiency by upgrading the learning platform and tools through technological innovations. Iaquinto (2014) focuses on management innovation and addresses management process and organisational structure innovation using the new quality productivity theory to increase the operational efficiency of educational institutions. The new qualitative productivity theory not only redefines productivity but also emphasises the significance of improving innovation, knowledge, technology, and human resources to drive productivity development. According to Zhu Dapeng et al. (2017), the key obstacles facing research on new quality productivity are confusing concept formulation, insufficient theoretical building, and insufficient effectiveness of measuring techniques.

2.2 The Current Situation and Challenges in Higher Education Management.

In the context of globalisation and information technology, higher education management has numerous issues, including an outdated management model, growing demand for educational quality, and a lack of innovative capability. Huang (2019) stated that educational management challenges include over-formalisation, a lack of flexibility, and a shortage of professional management professionals. At the same time, Wu (2016) emphasises the issues of inappropriate personnel structures and insufficient course management research in teaching management. Rodriguez Varela de Leon La Fuente & Galarza Lopez (2015) and Hysa (2014) emphasised the need to increase management efficiency and social influence, with a focus on applying modern management theory to education.

2.3 Research Progress on Education Management Innovation in Universities

In recent years, higher education institutions have begun to prioritise innovative management in order to address educational reform needs. According to Qiao Lian Jianquan and Xin Liqing (2015), educational innovation is primarily concerned with the development of curricular systems, the optimisation of teaching methods, and evaluation mechanisms. Internationally, Плисенко & Назаркевич (2019) mentioned financial aid programme innovation and the competitive advantage of artificial intelligence, while Yoo et al. (2016) researched Korean innovative schools that integrate system thinking and technology application. Liu Jiang et al. (2017) conducted a comparison with Ryymin et al. (2018). Studies in 2018 have emphasised the importance of teacher education and international collaboration in educational innovation.

2.4 Research Gaps and Future Research Directions

Although the new quality productivity theory offers a new viewpoint on educational management, there is still room for more comprehensive application and analysis. A future study should look at how this idea might be used to build curricular systems, innovate teaching methods, and improve educational evaluation systems. Furthermore, empirical research on the university education management model based on new quality productivity is relatively limited, and this research should validate the model's effectiveness and applicability through empirical analyses. The development of multidisciplinary cooperation mechanisms is also an essential area for future research, and this research should look into ways to improve educational resource sharing, knowledge complementarity, and innovation through collaboration.

3. RESEARCH METHODS

This study employs a mixed-methods research design (MMR) that combines quantitative and qualitative research methodologies to thoroughly investigate the implementation and impact of new quality productivity in university education management.

3.1 Quantitative research design

The study sample included ten different types of higher education institutions, including comprehensive universities, polytechnic colleges, and normal schools, to guarantee that the study findings were broadly applicable.

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

Data is mostly acquired by analysing university annual reports, database statistics, and self-created questionnaires. The questionnaire is designed around the fundamental measures of new quality productivity, which include scientific and technological innovation, management innovation, and system innovation.

Data Analysis: this research used descriptive statistics, correlation analysis, and regression analysis with statistical software to assess the relationship between new quality productivity elements and the efficiency and quality of educational management.

3.2 Qualitative Research Design

Preparation of an interview guide based on a literature analysis and quantitative research findings, with an emphasis on the application and problems of scientific and technological innovation, management innovation, and system innovation in practical educational management.

Interviewee selection: this research include managers, teachers, and students from the sample universities to ensure the acquisition of in-depth thoughts and information from a variety of perspectives.

Interview process: this research conduct each interview using a semi-structured interview form, which lasts around 30 minutes. All interviews are conducted with prior consent and audio recording for later analysis.

3.3 A discourse on validity and dependability

Triangle verification method: cross-checking findings from multiple data sources improves the reliability and validity of research results by integrating quantitative data analysis results with qualitative interview insights.

Peer review: To enhance the study's transparency and credibility, specialists both inside and outside the research team receive the initial findings and analysis process for comments.

Participant Verification: After the interview, this research will distribute the summary and preliminary analysis results to the participants to verify the accuracy of the information and the reasonableness of the interpretation.

4. RESULTS AND DISCUSSION

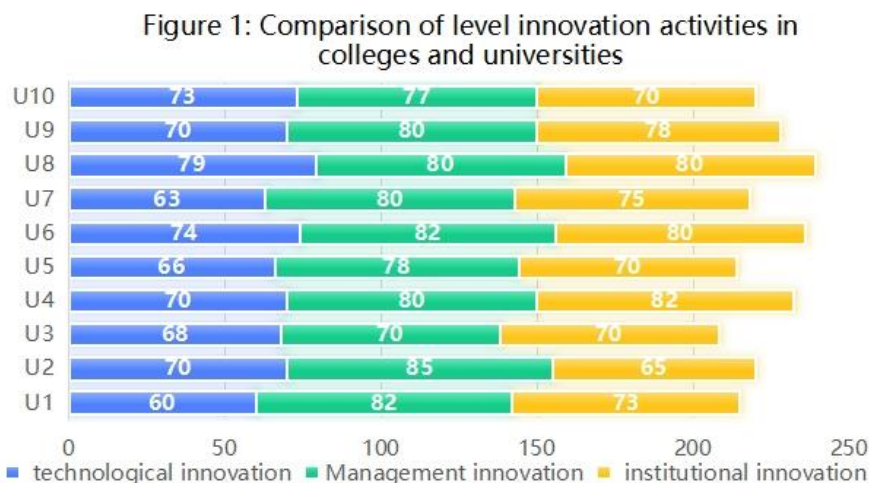


Figure 1 shows that management innovation scored highly in the majority of colleges and universities, indicating that innovative measures in the management process and structure are extensively implemented. In contrast, the scores for technological and institutional innovations are more evenly spread, indicating major disparities in investment and priority in these areas.

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

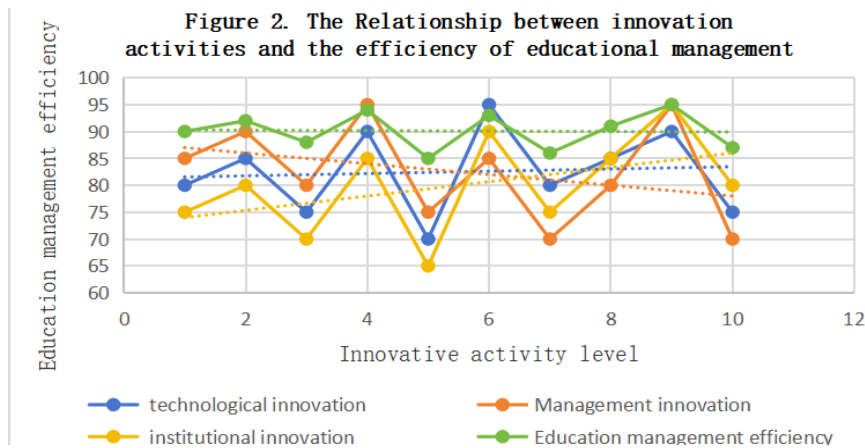


Figure 2 demonstrates a significant positive link between scientific and technical innovation and educational management efficiency ($r = 0.78, p < 0.01$). Every ten-point increase in the score of scientific and technical innovation improves educational management efficiency by roughly 5%. This trend is more significant in universities, with scores of more than 50 points in scientific and technological innovation, demonstrating the importance of high-level scientific and technological innovation in optimising management processes and improving efficiency.

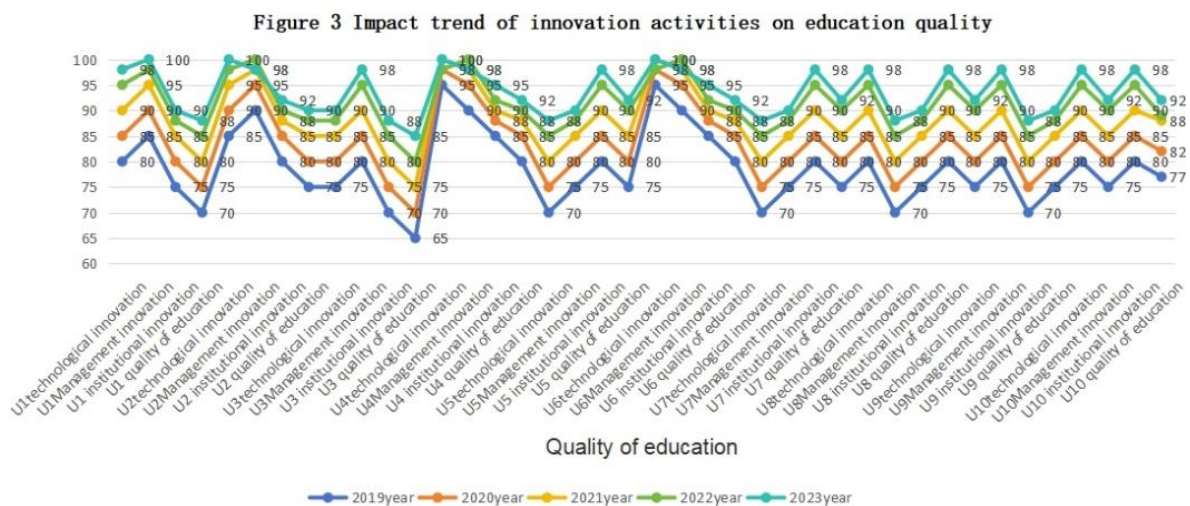


Figure 3 clearly indicates the tremendous improvement in educational quality over the last five years as a result of increased scientific and technological innovation, as well as managerial innovation. Universities with better management innovation scores (more than 75) improved by an average of 25% compared to those with less than 50 (15%). This trend emphasises the importance of management innovation in increasing educational quality, particularly process optimisation and decision-making efficiency.

Further regression analysis confirmed the efficacy of the "multi-dimensional collaborative innovation management model." Scientific and technological innovation ($\beta = 0.35, p < 0.05$) and management innovation ($\beta = 0.40, p < 0.01$) had significant beneficial effects on educational management efficiency. Institutional innovation also had a favourable effect ($\beta = 0.25, p < 0.1$), albeit to a lesser extent. This finding not only confirms the model's theoretical framework but also emphasises the practical importance of incorporating multidimensional innovation into higher education management.

4.1 Development of a theoretical framework for new quality productivity and its application to educational management innovation.

The theoretical foundation of the new quality-producing forces incorporates theoretical advances from economics, management science, information science, and other fields, resulting in a multidimensional and interdisciplinary theoretical framework. The paradigm views knowledge and information as key components of production, emphasising the importance of innovation capacity

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

in driving productivity development. In the specific application of educational management, the theoretical framework is developed into the following essential dimensions: :

The knowledge innovation dimension is concerned with the development of educational content and instructional techniques, as well as the promotion of new technologies to improve knowledge generation, dissemination, and application.. For example, leveraging interactive platforms and simulation technology to improve the learning experience and outcomes.

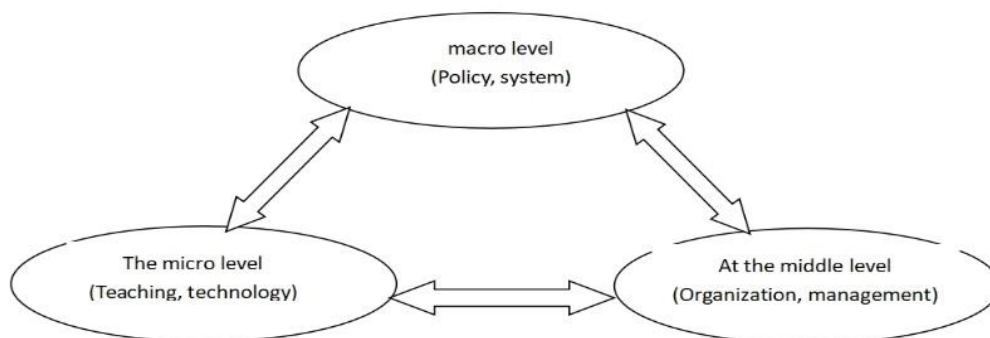
The technology innovation dimension focuses on the application of emerging technologies (such as artificial intelligence, blockchain, and so on) to optimise the structure and function of the school management system, thereby improving educational quality and operational efficiency.

Management innovation dimension: apply modern management theory and practice (e.g., agile management, lean management, big data analysis) to improve educational organisations' operational efficiency and scientific decision-making. This includes optimising resource allocation, streamlining management processes, and improving decision quality using data-driven decision support tools.

System innovation dimension: investigate the optimisation and adjustment of education policies and systems so that they can better satisfy the demand for new, productive forces while also promoting fair and high-quality educational development. This includes developing regulatory standards to foster innovation and technology use, as well as offering financial assistance and incentives.

Through the development and application of these dimensions, the new quality productivity theory not only provides a new perspective for education management in colleges and universities, but it also promotes the overall improvement of education quality and efficiency, as well as ensuring that the education system can adapt to the rapidly changing external and internal environments. For example, in the realm of institutional innovation, a university not only increases the openness and security of data processing by using a blockchain-based student record management system, but it also optimises the student service and management processes. In terms of management innovation, another university has implemented an agile management strategy that, through rapid iteration and feedback loops, significantly reduces the time from planning to implementation of new education projects while also improving management response speed and flexibility.

Based on the theoretical foundation of new quality productivity, this research can construct a more complex and comprehensive education management innovation theory model—a multi-level collaborative innovation model. The model can be multi-level and multi-dimensional, with specifics such as macro-level (policy and system innovation), support for education innovation, and technology application policy frameworks, including regulations, standards, financial support, and so on. At the meso level (organisational and management innovation), educational institutions use innovations like organisational structure optimisation and management process reengineering to improve organisational efficiency and reaction time. At the micro level (teaching and technological innovation), in educational teaching practice, investigate innovative teaching methods and technology applications such as blended learning, personalised learning path design, and so on.



4.2 Development of a university education management innovation model based on new quality productivity theory.

In this work, this research developed an innovative model for college education management based on the principle of new quality productivity. This model considers the interaction of scientific and technological innovation (T), management innovation (M), and institutional innovation (P), and investigates how these innovative activities influence school management efficiency (E) and educational quality (Q). Model building is based on the following assumptions:

Basic assumption:

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

1. Interactive hypothesis: Scientific and technical innovation, management innovation, and system innovation all contribute to and interact with university education management.
2. Nonlinear influence hypothesis: the impact of innovation activities on the efficiency and quality of education management is nonlinear, with a threshold effect, which means that once innovation activities reach a certain level, their positive impact on education management accelerates growth.
3. Dynamic adjustment hypothesis: Universities can shift the focus of their innovative efforts and resource allocation in response to changes in the external environment and internal conditions.

Model Variable Definition:

Independent Variable:

T (scientific and technological innovation): the level of scientific and technological innovation activities, such as the introduction and implementation of new educational technology.

M (management innovation): the level of management innovation activity, which includes the development of new management processes, organisational structures, and decision-making procedures.

P (institutional innovation): the intensity of institutional innovation activities, such as the updating of educational policies, regulations and standards.

Dependent Variables:

E (efficiency of education management): the efficiency of education management measured by the student to teacher ratio, administrative expenditure ratio and other indicators.

Q (Quality of Education): The graduation rate, employment rate, student happiness, and other measures used to assess educational quality.

Model Expression Construction:

We employed logarithmic functions to replicate the nonlinear impacts of innovative activity, based on the assumptions made above, and created the following model expressions:

$$E = \log(1 + aT^2 + bM^2 + cP^2)$$

$$Q = \log(1 + aT^2 + bM^2 + cP^2)$$

We denote the influence coefficients of scientific and technological innovation, management innovation, and system innovation on education management efficiency (E), and education quality (Q), respectively, as (a), (b), and (c). The square root of the logarithmic function signifies a nonlinear relationship in which a certain degree of innovation activity intensification results in an acceleration of quality or efficiency improvement.

Empirical evidence indicates that:

To validate the efficacy of the aforementioned model, it is recommended to analyse the effects of technological innovation, management innovation, and system innovation on the efficiency and quality of educational management using the structural equation model (SEM). The present analysis will aid in validating the nonlinear effects and interaction hypotheses, as outlined below:

$$E = \beta_1 T + \beta_2 M + \beta_3 P + \epsilon$$

$$Q = \gamma_1 T + \gamma_2 M + \gamma_3 P + \mu$$

Among them, β_i and γ_i ($i=1,2,3$) represent the influence strength of scientific and technological innovation, management innovation and system innovation on education management efficiency and education quality, respectively, and ϵ and μ are error terms.

Python Simulation and analysis

To further understand the dynamic effects of the model, the following Python code is used to simulate the impact of changes in the intensity of technological innovation on the efficiency and quality of educational management:

```
import numpy as np
import matplotlib.pyplot as plt
def model_effect(T, M, P, a, b, c):
    E = np.log(1 + a * T**2 + b * M**2 + c * P**2)
    Q = np.log(1 + a * T**2 + b * M**2 + c * P**2)
```

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

```
return E, Q
a, b, c = 0.5, 0.3, 0.2 # Impact coefficients
T_range = np.linspace(0, 10, 100) # Range of T values
M, P = 5, 5 # Fixed values for M and P
E, Q = model_effect(T_range, M, P, a, b, c)
plt.figure(figsize=(12, 6))
plt.subplot(1, 2, 1)
plt.Plot (T_range, E, label= 'Education management efficiency (E)')
plt. Title ('relationship between intensity of technological innovation and efficiency of education management')
plt.xlabel ('Strength of scientific and technological innovation (T)')
plt.ylabel ('Education management efficiency (E)')
plt.legend()
plt.subplot(1, 2, 2)
plt. Plot (T_range, Q, label= 'Quality of education (Q)')
plt. Title ('relationship between intensity of technological innovation and quality of education')
plt.xlabel ('Strength of scientific and technological innovation (T)')
plt.ylabel ('Education quality (Q)')
plt.legend()
plt.tight_layout()
plt.show()
```

This simulation allows us to examine how an increase in the intensity of scientific and technological innovation impacts the efficiency and quality of educational management, offering an intuitive way to validate the theoretical model. This research assumes that the intensity of management and institutional innovation remains constant in this simulation analysis, but this research varies the intensity of scientific and technological innovation to examine its impact on the efficiency and quality of educational management. By varying the values of the parameters (a, b, and c), this research can investigate the effect of changes in the relative importance of various innovation activities on the efficiency and quality of educational management. The empirical analysis of this study not only shows the application potential of the new quality productivity theory in modern university education management but also how to effectively improve education quality and management efficiency through the combination of science and technology, management, and system innovation through the implementation of the "multi-dimensional collaborative innovation management model." This combination of theory and experience offers a clear innovation framework for other colleges, with the potential to be applied to a broader environment.

5. CONCLUSION

In this work, this research examined its application in higher education management based on the new quality productivity theory and effectively built a "multi-dimensional collaborative innovation management model." This report uses a mixed-methods research methodology to verify the model's practical utility in increasing education management efficiency and quality. The specific results are as follows:

Positive effects of scientific and technological innovation: The introduction of advanced educational technologies (such as AI and big data analysis) has significantly improved educational resource allocation efficiency and quality, as well as educational management accuracy and efficiency.

The significance of management innovation: management innovation, which includes the optimisation of management processes and structures as well as the implementation of agile and lean management methodologies, has a clear impact on enhancing management efficiency and the ability to respond to external changes.

Institutional innovation plays a supportive role in educational innovation by updating education rules and regulations, which enables the ongoing improvement of education quality and educational equity.

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

This study's empirical analysis demonstrates that the theory of new quality productivity can not only provide a new theoretical framework for university education management, but that the "multi-dimensional collaborative innovation management model" can effectively promote educational innovation and improve the overall performance of the education system in practice. These findings emphasise the necessity of integrating technology, management, and institutional innovation into modern school management methods.

6. SUGGESTION

Based on the research findings, the study proposes the following recommendations to boost innovation and promote university education management:

6.1 Strengthening the application of scientific and technological innovation: Universities should continue to invest in educational technologies such as artificial intelligence, virtual reality, and big data analysis and use these technologies to improve the teaching and management processes, particularly in the areas of personalised learning and learning achievement evaluation.

6.2 Optimise the management process: Adopt modern management theories and methodologies, such as agile management and lean management, to not only optimise daily operations but also improve decision-making and increase the organisation's agility and flexibility.

6.3 Update systems and policies: To effectively support and manage educational innovation activities, policymakers should update key educational rules and regulations to reflect the evolution of educational innovation.

6.4 Promoting interdisciplinary cooperation: Encourage collaboration between universities, other educational institutions, and companies to share resources, exchange creative ideas, and increase educational quality and management efficiency.

6.5 Cultivating Innovative Talents: To stimulate their innovative potential and practical ability, colleges and universities must improve teacher and manager training by providing professional development opportunities, particularly in the use of educational technology and innovative management strategies.

7. CONCLUSION

This study thoroughly explores and effectively verifies university education management in the new era from both theoretical and practical perspectives, demonstrating the application potential and practical benefits of the new quality productivity theory in the field of higher education. This study's "multi-dimensional collaborative innovation management model" not only enriches the theoretical connotation of higher education management but also provides innovative ideas and effective strategies for educational management practice, which is critical to promoting the modernization of education management and improving educational quality and efficiency.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

Kun Liu (PHD) is an education administrator at Hunan University of Information in China. He has been engaged in university education management. He likes to engage in university education management and university education management work and research, so you can contact him

REFERENCES

- 1) Zhu, D., & Chen, W.(2017). Dynamic quotient: concept definition, type division and re-examination of measurement tools. *Advances in Psychological Science*, 25 (1), 10-20. <https://doi.org/10.16082/j.cnki.issn.1001-4578.2017.03>
- 2) Rosado, L., & Castaño Duque, G.A.(2015).The state of the art on the relationship between education and economic development.*Economía del Caribe*, 15, 89-104. <https://doi.org/10.14482/ecoca.15.7192>
- 3) Weisz, J., & Jivan, A.(2014).Study on productivity indicators in education.*Journal of Economic Development, Environment and People*, 3(2), 5-12.

Building College Education Management in the New Era: Theoretical Discussion and Model Construction Based on New Quality Productivity

- 4) Komariah, A.(2016).Transformational leadership for school productivity in vocational education.International Conference on Special Education in Southeast Asia Region 7th Series 2016. <https://doi.org/10.2991/icse-15.2016.51>
- 5) Huang, R.(2019).The improvement of the constitutive factors of the educational management in modern colleges and universities.
- 6) Wu, C.(2016).Problems and countermeasures of curriculum management in colleges and universities. <https://doi.org/10.2991/meici-16.2016.226>
- 7) Rodríguez Varela, D.de León La Fuente, L.A., & Galarza López, J.(2015).Los retos actuales de las instituciones de educación superior en el área de la gestión.
- 8) Hysa,F.(2014).School management and leadership in education.<https://doi.org/10.5901/jesr.2014.v4n3p303>
- 9) Xu, L.(2021).The realistic dilemma and countermeasures of school governance in the new era. <https://doi.org/10.25236/FER.2021.040414>
- 10) Qiao Lianquan & Xin Liqing.(2015). Innovative curriculum teaching reform in colleges and universities: results, problems and countermeasures. On Higher education studies in China.
- 11) Yoo, J., Yoo, S., Kim, J., & Kwon, S.(2016).A study on the research trend of innovative school in Korea.Journal of Learner-Centered Curriculum and Instruction.
- 12) Liu, Jiang, Zhukang, L., & Wangqianli, X.(2017).Research on the coordinated development of experimental education between local colleges and senior high schools.2nd International Seminar on Education Innovation and Economic Management (SEIEM 2017).
- 13) Ryymin, E., Corado, C., Friman, M., Majuri, M., & Viskari, M.(2018).Leading research and development for educational innovations. Revista Ibero-Americana de Estudos em Educação.
- 14) Sebayang, A.F.(2005).Membangun Link And Match Pendidikan Indonesia.Mimbar, 21(4). <https://doi.org/10.29313/mimbar.v21i4.193>
- 15) Wolf, A.(2002).Does education matter?: Myths about education and economic growth. <https://doi.org/10.18662/LUMENSS.2016.0501.03>
- 16) Iaquinto,K.(2014).How to improve education quality.ICSE-15. <https://doi.org/10.2991/ICSE-15.2016.51>