UDC 33

Influencing factors and suggestions for digital platform innovation: Using the TOE Framework and the PLS-SEM Model

Zhai Yanyan

Postgraduate student,
Belarusian State University,
220030, 4, Independence ave., Minsk, Republic of Belarus;
e-mail: yannzoie12@gmail.com

Abstract

This study summarizes the factors of digital platform innovation based on the TOE framework, selects case data of 175 digital platform innovations in China, and uses reliability and validity to test the quality of the data. On this basis, this study also constructs a PLS-SEM model to analyse the weight of each influencing factor on digital platform innovation, as well as the fitting effect and predictive ability of the model. The results show that proactiveness, innovativeness, environmental munificence, complexity and technological skills have a significant positive impact on digital platform innovation, and the path coefficients decrease in turn. The model has a good fitting effect and predictive ability. Based on the analysis of the model, recommendations were developed to optimize the process of implementing innovations for each factor.

For citation

Zhai Yanyan (2025) Influencing factors and suggestions for digital platform innovation: Using the TOE Framework and the PLS-SEM Model. *Ekonomika: vchera, segodnya, zavtra* [Economics: Yesterday, Today and Tomorrow], 15 (3A), pp. 521-532.

Keywords

Digital platform; innovation; factors; TOE; PLS-SEM model; optimization.

Introduction

Digital platform innovation is a business-model innovation activity that involves building service platforms and integrating resources [He, Pu, Pan, 2021]. It occupies a crucial position in economic development. Data from 2019 shows that 7 of the top 8 enterprises in the world in terms of market value are platform enterprises [United Nations, 2024]. Governments from various countries have recently committed to developing digital platforms to stimulate the digital development of enterprises. The Belarusian government has formulated the "Digital Development of Belarus" development policy and actively promoted the application of digital platforms in the field of public facilities [Ministry of Communications and Informatization of Belarus, 2023]. Russia has formulated the "Digital Economy of the Russian Federation" to support the development of digital platforms [Government of Russia, 2025]. The Chinese government has formulated the "Plan for the Overall Layout of Building a Digital China" policy to actively promote the high-quality development of digital platforms [State Council of China, 2025]. Digital platforms have become a hot spot for competition among countries and a major trend in corporate development.

Digital platform innovation has changed the pattern of economic competition and provided new opportunities in the digital economy. However, some enterprises still maintain a wait-and-see attitude towards digital platform innovation, and the progress of innovation is still constrained. This is mainly due to the mechanisms of digital platform innovation not being clear. This study will examine digital platform enterprises as case studies to identify the factors influencing digital platform innovation and propose corresponding strategies.

Theoretical basis

To study the mechanism of digital platform innovation, it is necessary to clarify its influencing factors. Previous literature on the influencing factors of digital platform innovation includes political factors [Anwar, Shah, 2018], industry environment [Su, Zhang, Ma, 2019], user participation [Lian, Song, 2023], platform owners [Eaton, 2012], market orientation [Yang, Wei, Shi, Zhao, 2020], strategic flexibility [Miroshnychenko, Strobl, Matzler, De Massis, 2020], etc. The study of digital platform innovation factors has become a hot topic. However, the research theory shows obvious fragmentation.

Tornatzky Louis and Mitchell Fleische proposed the TOE (technology-organization-environment) framework [Tornatzky, Fleischer, Chakrabarti, 1990]. The theory grouped innovation factors into three dimensions of consideration: technological, organizational, and environmental. Since the TOE framework is not strictly limited to specific factors, the application has a large elastic space and is widely used. For instance, researchers used it to explore e-government assimilation mechanisms. This study improved the TOE framework and conducted an in-depth exploration of the innovation mechanism of digital platforms from three dimensions: technology, entrepreneurial orientation, and environment.

Technology: Technology is considered a key element of digital platform innovation. Gatignon and Xuereb believe that the application of new technologies brings new value creation and value delivery to the business [Gatignon, Xuereb, 1997]. Scholars focus on acquiring technological skills when evaluating technological factors. This study draws its evaluation scale from the research conducted by César Camisón and Ana Villar-López and Chinese scholars Wu Xiaoyun and Zhang Xinyan [Camisón, Villar-López, 2011, Wu, Zhang, 2015]. We will describe it from three perspectives: technology investment, technology acquisition capability, and technology application capability. Technology investment refers to the platform's large investment in technology. For instance, the platform may invest in independent research and development or purchase technology. Technology acquisition capability means that enterprises can create a series of related technologies through purchase, independent research and development (R&D), or cooperative R&D. Technology application capability refers to the ability of an enterprise to master or absorb new technologies.

Entrepreneurial Orientation: Digital platform innovation necessitates entrepreneurial orientation within the organization. Miller defined entrepreneurial orientation from three dimensions: innovativeness, risk-taking, and proactiveness [Miller, 2011]. In addition, Lumpkin and Dess pointed out that these three dimensions are independent frameworks [Lumpkin, Dess, 1996]. Therefore, this study selected this framework, which can provide a more accurate interpretation of entrepreneurial orientation. The evaluation scale for innovativeness in entrepreneurial orientation primarily utilizes items from Norman Vella, Bettis, Hitt, and Zhang Huanyong [Bettis, Hitt, 1995, Bettis, Hitt, 1995, Zhang, 2007]. Innovativeness reflects the organization's ideas and trends for new methods, new problems, new services, and new products. Risk-taking refers to Norman Vella, Srivastava, Fahey and Christensen, Zhang Huanyong, and Liu Yu [Vella, 2001, Zhang, 2007, Srivastava, Fahey, Christensen, 2001]. Risk-taking refers to an organization’s willingness to take risks, its risk avoidance strategies, and its ability to explore risks. Proactiveness refers to Giraud, Voss, Moorman, Hu Wangbin, and Zhang Yuli [Giraud Voss, Vos, Moorman, 2005, Hu, Zhang, 2012]. Proactiveness refers to an organization's ability to constantly explore new marketing methods, lead strategies, and quickly respond to competitive activities.

Environment

The environment influences digital platform innovation in multiple dimensions. Dess and Beard proposed to divide environmental characteristics into three dimensions: environmental munificence, environmental complexity, and environmental dynamism [Dess, Beard, 1984]. The munificence of the environment reflects the extent to which it supports digital platform enterprises. Environmental munificence refers to the research of Wei Zelong, Guo Hai, and Shen Rui [Guo, Shen, 2012, Wei, Wang, Song, Zhang, 2017]. The content includes the abundance of profit-making opportunities in the market, the strength of government support, the difficulty of obtaining capital, and the difficulty of obtaining production factors such as talents and raw materials. Environmental dynamism refers to the frequency and unpredictability of environmental changes. Environmental dynamism in this study refers to Newkirk, Lederer, and Wei et al. [Wei, Wang, Song, Zhang, 2017, Newkirk, Lederer, 2006]. The four main items of environmental dynamics are the speed of product and service change in the industry, the speed of technological change in the industry, the predictability of customer demand change, and the predictability of competitors' action strategies [Newkirk, Lederer, 2006]. Environmental complexity refers to the scope and variability of the industry's or organization's activities. The environmental complexity evaluation scale is based on the items proposed by Chen et al. [Chen, Wang, Nevo, Jin, Wang, Chow, 2014]. It focuses on consumer buying habits, the nature of competition, and the diversity of product lines.

Digital Platform Innovation

The digital platform innovation evaluation scale is based on the scale of Zott and Amit and also draws on the scale adapted by Chinese scholars Pang Changwei, Hu Baoliang, and Tian Jian [Zott, 2008, Hu, 2012, Pang, Li, Duan, 2015, Tian, Xu, 2020]. The adaptation also takes into account the characteristics of Chinese digital platforms. Lastly, we select six indicators to evaluate the digital platform innovation. The evaluation items are new transaction parties; connecting the platform with all parties in novel ways; new ways to profit; intellectual property and patented technologies playing an important role between the platform and business partners; transactions being faster and more efficient; and costs being reduced.

Therefore, this study incorporates seven factors—namely, technological skills, innovativeness, risk-taking, proactiveness, munificence, complexity, and dynamics— into the TOE framework and establishes an evaluation scale to evaluate them and digital platform innovation.

Research design

Research methods. This study uses the partial least squares structural equation modeling (PLS-SEM) method to look into the factors and effects of digital platform innovation. PLS-SEM is based on variance analysis and uses partial least squares regression to estimate the path model. Recently, researchers have applied this method in many fields, such as in economics, markets, and strategy.

The use of PLS-SEM has the following advantages: First, this method requires a smaller sample size. Second, the method's assumptions about the distribution of data are not as strict as those of traditional regression methods, and the data does not need to suit the normal distribution. This is because PLS-SEM uses a non-parametric method. PLS-SEM gradually explains the variance by extracting components, avoiding overall reliance on the covariance matrix. In addition, the statistical significance test of PLS-SEM usually adopts the bootstrap method. As a non-parametric resampling technique, the bootstrap method maximizes the explanatory power of the independent variable on the dependent variable through iterative calculation. It does not require the assumption of the data distribution form, further reducing the requirements for the distribution of the data. Third, PLS-SEM can do predictive analysis, which can help the model figure out what the important variables are and how they relate to each other. This can also provide a basis for theoretical construction. Therefore, using the PLS-SEM model is the best choice.

Evaluation indicators and data sources: The data of this study mainly come from the China Management Case Sharing Center. This database is based on firsthand cases authorized by enterprises, and each case has a detailed description of the entire innovation activity. Many scholars have used this database as a data source for research, and it has strong reliability [Su, 2020]. This study selected 175 enterprises cases of digital platform innovation from the database as samples.

According to the previous discussion, there are seven conditional variables that affect digital platform innovation. This study uses a five-level Likert item to measure and convert qualitative data into quantitative results before PLS-SEM analysis. The rule is: strongly disagree is marked as 1, and strongly agree is marked as 5.

This study uses Munoz and Cohen's expert scoring approach, randomly dividing 175 cases into three groups of 58, 58, and 59, respectively, to reduce subjective errors. Two PhD students and one entrepreneur in the platform enterprise field selected two groups of cases for scoring, ensuring that at least two experts jointly scored each group of cases.

To further ensure the consistency of case scoring, this study used the Kappa coefficient for testing. As shown in Table 1, the Kappa coefficient between Group A and Group B is 0.8, the Kappa coefficient between Group A and Group C is 0.9, and the Kappa coefficient between Group B and Group C is 0.9. Given that all three are greater than 0.7, this indicates a strong consistency level in the scoring [Munoz, Bangdiwala, 1997].

Using the average method, the average score of the two members on the same case is calculated as the original score of the case.

Table 1 - Kappa of groups

Group	Number of valid cases	Kappa value	Asymptotic significance
A&B	1682	0.8	.012
A&C	1711	0.9	.010
B&C	1682	0.9	.009

Reliability and Validity Test: The reliability test of the model is carried out by internal consistency tests. The internal consistency test is measured by Cronbach's alpha coefficient. Generally, Cronbach's alpha coefficient is larger than 0.7, which means good reliability and it is greater than 0.8, which means very high reliability [Tavakol, 2011].

For the validity test, we often judge it using factor loading, average variance extracted (AVE), and composite reliability (CR). The higher the factor loading of each evaluation variable, the better the convergent validity of the evaluation model. The value of factor loading and the AVE value should be larger than 0.5 in general [Cheung, 2017]. The higher the AVE value, the better the convergent validity. If the CR value exceeds 0.7, it means that the composite reliability test has passed.

Table 2 - Reliability and validity tests

Variable	Items	Factor loading	Cronbach's alpha	CR	AVE
Technological Skills(TS)	TS1	0.935	0.932	0.937	0.832
	TS2	0.952			
	TS3	0.939			
Innovativeness (OI)	OI1	0.948	0.944	0.944	0.849
	OI2	0.941			
	OI3	0.956			
Risk-taking (OR)	OR1	0.796	0.812	0.816	0.603
	OR2	0.889			
	OR3	0.880			
Proactiveness (OP)	OP1	0.871	0.869	0.871	0.692
	OP2	0.889			
	OP3	0.912			
Munificence (EM)	EM1	0.628	0.818	0.829	0.558
	EM2	0.856			
	EM3	0.868			
	EM4	0.865			
Dynamism (ED)	ED1	0.860	0.912	0.914	0.726
	ED2	0.907			
	ED3	0.895			
	ED4	0.901			
Complexity (EC)	EC1	0.869	0.818	0.829	0.558
	EC2	0.901			
	EC3	0.903			
Digital Platform Innovation (DPI)	DPI1	0.836	0.863	0.868	0.526
	DPI2	0.773			
	DPI3	0.774			
	DPI4	0.828			
	DPI5	0.742			
	DPI6	0.698			

In table 2, the smallest Cronbach's alpha value is 0.812, which is greater than 0.8. This proves that it has a very high reliability and meets the requirements of the study. In the validity test, the lowest value of factor loading is 0.628, and the lowest value of AVE is 0.526, and the lowest value of CR is 0.816, both of which are higher than the critical value, indicating that the model has good convergent validity.

Result analysis

Structural model verification: We used SmartPLS software to evaluate the fitting effect of the structural model and verify the research hypotheses. The coefficient of determination (R^2), which measures the degree of explanation of factors, is used to make sure that the model fits. R^2 has three critical values of 0.19, 0.33, and 0.67, and the explanatory power is getting stronger following the number [Chin, 1998]. We also adopt cross-validated redundancy (Q^2) to test the predictive relevance of the model. If Q^2 is larger than 0, it means the predictive relevance of the model meets the standard. And the larger the Q^2, the stronger the predictive power [38]. The goodness of fit (GOF) decides the overall prediction effect of the structural equation model. When GOF exceeds 0.36, the model has a high degree of prediction [39]. The effect size (f^2) is obtained by calculating the impact of an exogenous variable on the R^2 value of the endogenous variable after deleting it. The effect size is used to measure the impact of exogenous variables on endogenous variables. If f^2 is greater than 0.02, the factor affects utility [40]. If the model passes the above tests, it proves that the factors can well explain digital platform innovation, and the model fit is good.

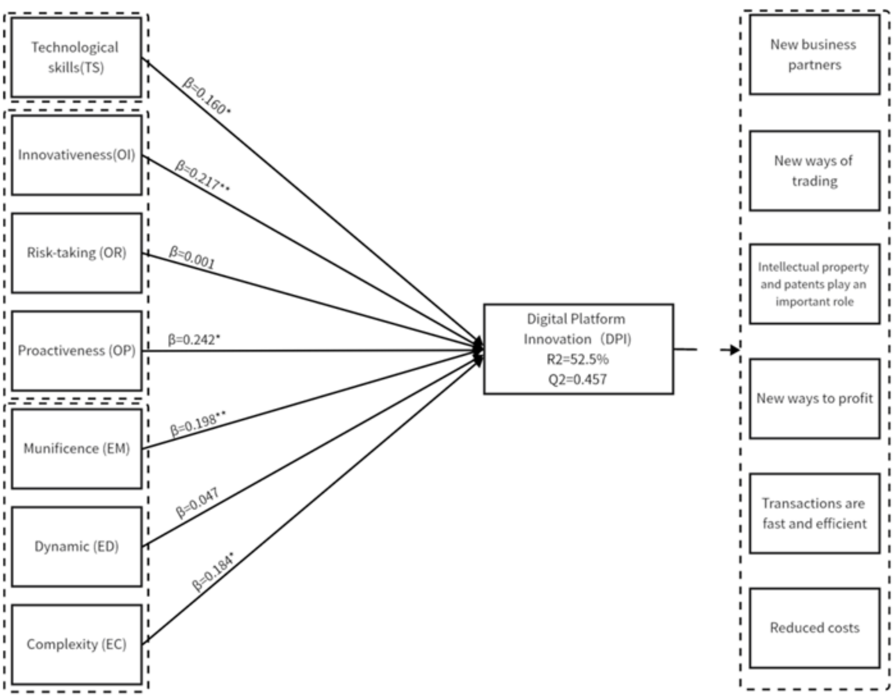

Figure 3- Structural model

As shown in Figure 3, the R^2 value is 52.5%, which means that technology, entrepreneurial orientation, and environment can explain 52.5% of the variation in digital platform innovation. This indicates that the explanatory power of the model is above the medium level. The study indicates that the Q^2 value is 0.457, which is far more than 0, so the model has good predictive relevance. In this study, the GOF of 0.6 is greater than 0.36, indicating that the model fits very well. It is worth noting that according to the data in Table 4, except for the entrepreneur's risk-taking and the dynamics of the environment, the effect sizes of other variables are all greater than 0.02. This shows that only these two factors may not have a direct impact on digital platform innovation. The comprehensive analysis of all indicators indicates that the model meets all test criteria, which is conducive to subsequent hypothesis testing analysis.

Analysis of influencing factors: This study uses the path coefficient value to find out how strong the direct link is between the model's variables when looking at the factors that affect them. The nature of the path coefficient is similar to the regression coefficient in regression analysis, which is a standardized regression weight.

To further verify the significance of the path coefficient, this study uses the bootstrapping algorithm. Setting the sampling number to 5000 times yields the path coefficient's significance test results. The current studies believe that the path coefficient's absolute value is greater than 0.1, and the p-value is significant at the 0.05 level, which certifies that the influence in the model is established.

Table 4 - PLS-SEM model path coefficient and significance test results

	Path coefficient(β)	f^2	Sample mean	Standard deviation	T value	P value
EC ->DPI	0.184	0.046	0.175	0.073	2.505	0.012
ED ->DPI	0.047	0.004	0.049	0.060	0.785	0.433
EM ->DPI	0.198	0.057	0.203	0.074	2.654	0.008
OI -> DPI	0.217	0.072	0.212	0.068	3.184	0.001
OP -> DPI	0.242	0.058	0.240	0.076	3.179	0.001
OR ->DPI	0.001	0.000	0.005	0.061	0.009	0.993
TS -> DPI	0.160	0.038	0.166	0.078	2.046	0.041

The empirical results in Table 4 show that technology skills, innovativeness, proactiveness, munificence, and complexity all have significant positive effects on digital platform innovation. Although risk-taking as a defense mechanism reduces risk, it has no direct impact on digital platform innovation. Environmental dynamism involves more stakeholders, and it may need to cooperate with other conditions to play a role.

Suggestions on optimizing factors affecting digital platform innovation

The conclusions of this study make it possible to formulate some applicable suggestions in the field of digital platform innovation.

Proactiveness, as the most important influencing factor, has a path coefficient of 0.242. Entrepreneurs can adopt three specific strategies to enhance proactiveness. 1. Enterprises can establish a market forecasting system to receive more comprehensive, cutting-edge development information and identify new market opportunities. 2. Based on new market opportunities, enterprises continue to develop new products, services, and marketing models to convert opportunity identification into real market value. 3. By establishing a user, technology, and experience database, enterprises can help reduce the cost of acquiring users in subsequent development and provide more experience and technological support.

The path coefficient of high innovativeness is 0.217. Improving innovativeness strategies involves three main points. First, enterprises need to select leaders with high innovativeness by focusing on the achievements of senior and middle-level innovators. This approach forms the foundation for enhancing innovativeness. Second, enterprises can encourage entrepreneurs to regularly participate in innovation and other related forums or training activities to increase the learning and exchange opportunities for entrepreneurs within and outside the industry. Such activity will not only help improve entrepreneurs' innovation awareness but also help entrepreneurs interpret government innovation policies. Third, enterprises need to cultivate corporate innovation culture by promoting innovation theories and setting up innovation funds, continuously enhance employees' recognition of organizational innovation, and infiltrate innovation culture into the grassroots. This can not only improve the overall innovation environment within the enterprise but also promote the implementation of innovation measures.

The path coefficient of environmental munificence is 0.198. The government is responsible for improving environmental munificence. It can implement the following measures: 1. The government needs to formulate favorable policies to reduce the cost of digital platform innovations. 2. The government can assist platform enterprises in establishing a platform ecosystem around factors such as funds, talents, and technology. Through the establishment of a platform ecosystem, attract related enterprises in the supply chain, service chain, logistics chain, and financial chain to join the platform. This approach can strengthen communication and cooperation with other stakeholders in the ecosystem, further establishing deeper mutual trust and reciprocal relationships, promoting the inflow of relevant resources and knowledge, providing more convenience for platform enterprises to obtain resources, and thus promoting digital platform innovation.

The path coefficient of environmental complexity is 0.184. Strategies to enhance it need to be considered on both the government and enterprise sides. First, the government provides effective legal protection for fair competition by establishing and improving laws and regulations for supervising platform competition and anti-monopoly competition. Secondly, through refined user operations, enterprises can ensure the in-depth relationship with users, improve the precision and diversity of products, services, and marketing models, and ultimately achieve user retention and conversion.

The path coefficient of technological skills is 0.16. We need to establish a complete technological skills improvement system in three parts: technological investment, research and development, and application. 1. R&D investment is the basis of technological innovation, which continues to strengthen R&D investment. 2. In the technological research and development stage, we should focus on R&D cooperation and establish an integrated R&D mechanism for industry, academia, and research. Platform enterprises can strengthen cooperation with external scientific research forces, such as universities, scientific research institutions, and cross-border technology enterprises, to introduce advanced technologies and talents. 3. During the technology application stage, the efficiency of digital platform innovation should be improved by increasing the technology conversion rate and the cross-border application capabilities of technology.

Conclusion

The results of the empirical study show that proactiveness, innovativeness, environmental munificence, environmental complexity, and technological skills all have a positive impact on digital platform innovation. Furthermore, the model demonstrates strong predictive relevance and well-fitting. Based on the factors above, this study suggests that the government and enterprises should make factor optimization plans that are specific to each innovation factor. Such plans will make it easier for digital platform innovation to happen.

References

1.He Y.Q., Pu Z.J., Pan J.Y. (2021) Key influencing factors of platform innovation: a multi-case study based on grounded theory. *Lan zhou xue kan*, (01), pp. 36-48.

2.*United nations* (2024). Available at: https://unctad.org/system/files/official-document/der2019_overview_ch.pdf.[Accessed 24/06/24].

3.*The Ministry of Communications and Informatization of the Republic of Belarus* (2023) Available at: https://www.mpt.gov.by/sites/default/files/prezentaciya_obshchaya_gosprogramma_.pdf. [Accessed 19/10/23].

4.*Government of Russia* (2025) Available at: http://static.government.ru/media/files/9gFM4FHj4PsB79I5v7yLVuPgu4bvR7M0.pdf. [Accessed 04/03/25]

5.*The state council the people's republic of China* (2025) Available at: https://www.gov.cn/zhengce/2023-02/27/content_5743484.htm [Accessed 08/03/25].

6. Anwar M., Ali Shah S. Z. (2018) Managerial Networking and Business Model Innovation: Empirical Study of New Ventures in an Emerging Economy. *Journal of Small Business & Entrepreneurship*. 32(3), pp. 265-286.

7.Su J., Zhang S., Ma, H. (2019) Entrepreneurial orientation, environmental characteristics, and business model innovation: a configurational approach. *Innovation*, 22(4), pp. 399-421.

8.Lian Y., Song M. (2023) A Double Case Study on the Influencing Factors of Enterprise Platformalization Transformation and Innovation. *Science & Technology Progress and Policy*, 40(03), pp. 83-92.

9.Eaton, B. D. (2012). *The dynamics of digital platform innovation: Unfolding the paradox of control and generativity in Apple's iOS*. London: London School of Economics and Political Science.

10.Yang D., Wei Z., Shi H., Zhao J. (2020) Market orientation, strategic flexibility and business model innovation. *Journal of Business & Industrial Marketing*, 35(4), pp. 771-784.

11.Miroshnychenko I., Strobl A., Matzler K., De Massis A. (2020) Absorptive capacity, strategic flexibility, and business model innovation: Empirical evidence from Italian SMEs. *Journal of Business Research.* 130, pp. 670-682.

12.Tornatzky L.G., Fleischer M., Chakrabarti A.K. (1990) *The processes of technological innovation*. Lexington Books.

13.Gatignon H., Xuereb J.M. (1997) Strategic orientation of the firm and new product performance. *Journal of Marketing Research*. 34(1), pp. 77-90.

14.Camisón C., Villar-López A. (2011) On How Firms Located in an Industrial District Profit from Knowledge Spillovers: Adoption of an Organic Structure and Innovation Capabilities. *British Journal of Management*. 23(3), pp. 361-382.

15.Wu X., & Zhang X. (2015) Enterprise Capability, Technology Innovation, Value Network Cooperation Innovation and Firm Performance. Journal of Management Science, 28(06), pp.12-26.

16.Miller, D. (2011) Miller (1983) Revisited: A Reflection on EO Research and Some Suggestions for the Future. *Entrepreneurship Theory and Practice*. 35(5), pp. 873-894.

17.Lumpkin G.T., Dess G.G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review*. 21(1), pp. 135-172.

18.Bettis R.A., Hitt M.A. (1995). The new competitive landscape. *Strategic Management Journal*. 1195, pp. 7-19.

19.Vella, N. (2001). *Entrepreneurial attributes in Malta*. Netherlands. Maastricht School of Management.

20.Zhang, H. (2007). *Research on the relationship between entrepreneurial ability and enterprise growth.* Shanghai, Fudan University.

21.Srivastava R.K., Fahey L., Christensen H.K. (2001) The resource-based view and marketing: The role of market-based assets in gaining competitive advantage. *Journal of Management*. 27(6), pp. 777-802.

22.Giraud Voss Z., Vos, G.B., Moorman C. (2005) An empirical examination of the complex relationships between entrepreneurial orientation and stakeholder support. *European Journal of Marketing*. 39(9/10), pp. 1132-1150.

23.HU W.B., Zhang Y.L. (2012) Measuring and Functions of New Venture's Entrepreneurial Orientation: An Empirical Study in China. *Management Review.* 24(03), pp.40-48+57.

24.Dess, G. G., & Beard, D. W. (1984) Dimensions of organizational task environments. *Administrative Science Quarterly.* pp. 52-73.

25.Guo H., Shen R. (2012) Environmental Munificence, Environmental Uncertainty,and Business Model Innovation. *Research on Economics and Management*(10), pp.97-104.

26.Wei Z., Wang S., Song X., Zhang L. (2017) Strategic Cognition, External Environment, and Business Model Novelty. *Science of Science and Management of S.& T.*, 38(12), pp.109-123.

27.Newkirk H.E., Lederer A.L. (2006) The effectiveness of strategic information systems planning under environmental uncertainty. *Information & Management*, 43(4), pp. 481-501.

28.Chen Y., Wang Y., Nevo S., Jin J., Wang L., ChowW. S. (2014) IT capability and organizational performance: the roles of business process agility and environmental factors. *European Journal of Information Systems*. 23(3), pp. 326-342.

29.Zott, C. (2008) The fit between product market strategy and business model: Implications for firm performance. *Strategic management journal*.29(1), pp. 1-26.

30.Hu B.l. (2012) Business model innovation, technological innovation and firm performance: an empirical study of Listed companies on the GEM. *Science & technology progress and policy*, 29(03), pp. 95-100.

31.Pang C.W., Li Y, Duan G. (2015) Integrative capability and firm performance: the mediating effect of business model innovation. *Journal of management science*, 28 (05), pp. 31-41. doi: CNKI:SUN:JCJJ.0.2015-05-003.
32.Tian J., Xu J.B. (2020) Research on the driving factors of business model innovation. *Studies in Science of Science*, 38(05), pp. 949-960.
33.Su, J. (2020) Entrepreneurial orientation, environmental characteristics, and business model innovation: a configurational approach.*Innovation.22*(04), pp. 399-421.
34.Munoz, S. R., & Bangdiwala, S. I. (1997). Interpretation of Kappa and B statistics measures of agreement. *Journal of Applied Statistics*. 24(1), pp. 105-112.
35.Tavakol, M. (2011) Making sense of Cronbach's alpha. *International journal of medical education*. 27(2), pp. 53-55.
36.Cheung, G.W. (2017) Current approaches for assessing convergent and discriminant validity with SEM: Issues and solutions. *Academy of management proceedings*.2017(1), pp. 12706.
37.Chin, W.W. (1998) The Partial Least Squares Approach to Structural Equation Modeling. *Advances in Hospitality and Lsure*. 8(2), pp. 295-336.
38.Stone, M. (1974) Cross-validation and multinomial prediction.*Biometrika*. 61(3), pp. 509-515.
39.Wetzels M., Odekerken-Schröder G., Van Oppen C. (2009) Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS quarterly*. 33(1), pp. 177-195.
40.Purwanto A., Sudargini Y. (2021) Partial least squares structural squation modeling (PLS-SEM) analysis for social and management research: a literature review. *Journal of Industrial Engineering & Management Research*, 2(4), pp. 114-123.

Исследование факторов влияния на инновации в области цифровых платформ на основе методики TOE и модели PLS-SEM

Чжай Яньянь

Аспирант,
Белорусский государственный университет,
220030, Республика Беларусь, Минск,
просп. Независимости, 4;
e-mail: yannzoie12@gmail.com

Аннотация

В данном исследовании обобщаются факторы инноваций в области цифровых платформ на основе методики TOE. Отобраны тематические данные по 175 вариантам внедрения инноваций цифровых платформ в Китае, использованы индикаторы надежности и достоверности для проверки качества данных. На основе статистических данных построена модель PLS-SEM для анализа веса каждого фактора, влияющего на инновации в цифровой платформе, а также соответствующего эффекта и прогностической способности модели. Результаты показывают, что проактивность, инновационность, бережное отношение к окружающей среде, уровень комплексности и технологические навыки оказывают значительное положительное влияние на инновации в цифровой платформе снижая коэффициенты пути. Получена модель хорошего качества с высокой прогностической способностью. На основе анализа модели разработаны рекомендации для оптимизации процесса внедрения инноваций по каждому фактору.

Для цитирования в научных исследованиях

Чжай Яньянь. Influencing factors and suggestions for digital platform innovation: Using the TOE Framework and the PLS-SEM Model // Экономика: вчера, сегодня, завтра. 2025. Том 15. № 3А. С. 521-532.

Ключевые слова

Цифровая платформа; инновации; факторы; TOE; модель PLS-SEM; оптимизация.

Библиография

1.He Y.Q., Pu Z.J., Pan J.Y. (2021) Key influencing factors of platform innovation: a multi-case study based on grounded theory. *Lan zhou xue kan,* (01), pp. 36-48.

2.*United nations* (2024). Available at: https://unctad.org/system/files/official-document/der2019_overview_ch.pdf.[Accessed 24/06/24].

3.*The Ministry of Communications and Informatization of the Republic of Belarus* (2023) Available at: https://www.mpt.gov.by/sites/default/files/prezentaciya_obshchaya_gosprogramma_.pdf. [Accessed 19/10/23].

4.*Government of Russia* (2025) Available at: http://static.government.ru/media/files/9gFM4FHj4PsB79I5v7yLVuPgu4bvR7M0.pdf. [Accessed 04/03/25]

5.*The state council the people's republic of China* (2025) Available at: https://www.gov.cn/zhengce/2023-02/27/content_5743484.htm [Accessed 08/03/25].

6. Anwar M., Ali Shah S. Z. (2018) Managerial Networking and Business Model Innovation: Empirical Study of New Ventures in an Emerging Economy. *Journal of Small Business & Entrepreneurship*. 32(3), pp. 265-286.

7.Su J., Zhang S., Ma, H. (2019) Entrepreneurial orientation, environmental characteristics, and business model innovation: a configurational approach. *Innovation*, 22(4), pp. 399-421.

8.Lian Y., Song M. (2023) A Double Case Study on the Influencing Factors of Enterprise Platformalization Transformation and Innovation. *Science & Technology Progress and Policy*, 40(03), pp. 83-92.

9.Eaton, B. D. (2012). *The dynamics of digital platform innovation: Unfolding the paradox of control and generativity in Apple's iOS*. London: London School of Economics and Political Science.

10.Yang D., Wei Z., Shi H., Zhao J. (2020) Market orientation, strategic flexibility and business model innovation. *Journal of Business & Industrial Marketing*, 35(4), pp. 771-784.

11.Miroshnychenko I., Strobl A., Matzler K., De Massis A. (2020) Absorptive capacity, strategic flexibility, and business model innovation: Empirical evidence from Italian SMEs. *Journal of Business Research.* 130, pp. 670-682.

12.Tornatzky L.G., Fleischer M., Chakrabarti A.K. (1990) *The processes of technological innovation*. Lexington Books.

13.Gatignon H., Xuereb J.M. (1997) Strategic orientation of the firm and new product performance. *Journal of Marketing Research*. 34(1), pp. 77-90.

14.Camisón C., Villar-López A. (2011) On How Firms Located in an Industrial District Profit from Knowledge Spillovers: Adoption of an Organic Structure and Innovation Capabilities. *British Journal of Management*. 23(3), pp. 361-382.

15.Wu X., & Zhang X. (2015) Enterprise Capability, Technology Innovation, Value Network Cooperation Innovation and Firm Performance. Journal of Management Science, 28(06), pp.12-26.

16.Miller, D. (2011) Miller (1983) Revisited: A Reflection on EO Research and Some Suggestions for the Future. *Entrepreneurship Theory and Practice*. 35(5), pp. 873-894.

17.Lumpkin G.T., Dess G.G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review*. 21(1), pp. 135-172.

18.Bettis R.A., Hitt M.A. (1995). The new competitive landscape. *Strategic Management Journal*. 1195, pp. 7-19.

19.Vella, N. (2001). *Entrepreneurial attributes in Malta*. Netherlands. Maastricht School of Management.

20.Zhang, H. (2007). *Research on the relationship between entrepreneurial ability and enterprise growth.* Shanghai, Fudan University.

21.Srivastava R.K., Fahey L., Christensen H.K. (2001) The resource-based view and marketing: The role of market-based assets in gaining competitive advantage. *Journal of Management*. 27(6), pp. 777-802.

22.Giraud Voss Z., Vos, G.B., Moorman C. (2005) An empirical examination of the complex relationships between entrepreneurial orientation and stakeholder support. *European Journal of Marketing*. 39(9/10), pp. 1132-1150.

23.HU W.B., Zhang Y.L. (2012) Measuring and Functions of New Venture's Entrepreneurial Orientation: An Empirical Study in China. *Management Review.* 24(03), pp.40-48+57.

24.Dess, G. G., & Beard, D. W. (1984) Dimensions of organizational task environments. *Administrative Science Quarterly.* pp. 52-73.

25.Guo H., Shen R. (2012) Environmental Munificence, Environmental Uncertainty,and Business Model Innovation. *Research on Economics and Management*(10), pp.97-104.

26.Wei Z., Wang S., Song X., Zhang L. (2017) Strategic Cognition, External Environment, and Business Model Novelty. *Science of Science and Management of S.& T.*, 38(12), pp.109-123.

27.Newkirk H.E., Lederer A.L. (2006) The effectiveness of strategic information systems planning under environmental uncertainty. *Information & Management*, 43(4), pp. 481-501.

28.Chen Y., Wang Y., Nevo S., Jin J., Wang L., ChowW. S. (2014) IT capability and organizational performance: the roles

of business process agility and environmental factors. *European Journal of Information Systems*. 23(3), pp. 326-342.
29. Zott, C. (2008) The fit between product market strategy and business model: Implications for firm performance. *Strategic management journal*.29(1), pp. 1-26.
30. Hu B.l. (2012) Business model innovation, technological innovation and firm performance: an empirical study of Listed companies on the GEM. *Science & technology progress and policy*, 29(03), pp. 95-100.
31. Pang C.W., Li Y, Duan G. (2015) Integrative capability and firm performance: the mediating effect of business model innovation. *Journal of management science*, 28 (05), pp. 31-41. doi: CNKI:SUN:JCJJ.0.2015-05-003.
32. Tian J., Xu J.B. (2020) Research on the driving factors of business model innovation. *Studies in Science of Science*, 38(05), pp. 949-960.
33. Su, J. (2020) Entrepreneurial orientation, environmental characteristics, and business model innovation: a configurational approach.*Innovation.22*(04), pp. 399-421.
34. Munoz, S. R., & Bangdiwala, S. I. (1997). Interpretation of Kappa and B statistics measures of agreement. *Journal of Applied Statistics*. 24(1), pp. 105-112.
35. Tavakol, M. (2011) Making sense of Cronbach's alpha. *International journal of medical education*. 27(2), pp. 53-55.
36. Cheung, G.W. (2017) Current approaches for assessing convergent and discriminant validity with SEM: Issues and solutions. *Academy of management proceedings*.2017(1), pp. 12706.
37. Chin, W.W. (1998) The Partial Least Squares Approach to Structural Equation Modeling. *Advances in Hospitality and Lsure*. 8(2), pp. 295-336.
38. Stone, M. (1974) Cross-validation and multinomial prediction.*Biometrika*. 61(3), pp. 509-515.
39. Wetzels M., Odekerken-Schröder G., Van Oppen C. (2009) Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS quarterly*. 33(1), pp. 177-195.
40. Purwanto A., Sudargini Y. (2021) Partial least squares structural squation modeling (PLS-SEM) analysis for social and management research: a literature review. *Journal of Industrial Engineering & Management Research*, 2(4), pp. 114-123.