

Research on the Measurement of Technological Innovation Efficiency and its Influencing Factors in the Chengdu-Chongqing Economic Zone

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Abstract: This article constructs an evaluation index system for technological innovation efficiency. Using panel data from 16 cities at the prefecture level and above in the Chengdu-Chongqing Economic Zone from 2013 to 2019, the DEA-BCC model is employed to statically measure the technological innovation efficiency in the region. The Malmquist index method is used to conduct a dynamic analysis of the technological innovation efficiency, and the Tobit regression analysis method is applied with the comprehensive efficiency obtained from the BCC model results as the dependent variable to explore its influencing factors. The study reveals that there are significant differences in the comprehensive efficiency of technological innovation among cities in the Chengdu-Chongqing Economic Zone, with an overall value of 0.818. The slow development of technological innovation in some areas is mainly due to the mismatch between input and output in technological innovation. The intensity of government support and the degree of openness to the outside world has a significant impact on technological innovation efficiency in the Chengdu-Chongqing Economic Zone, while the influence of industrial structure and infrastructure level is not significant.

Keywords: Chengdu-Chongqing Economic Zone; Technological Innovation Efficiency; Influencing Factors.

1. Introduction

account the capabilities of attackers and developers in real-world scenarios. Attackers can poison public datasets, but cannot access the training process, and poisoned datasets need to evade backdoor defense detection to achieve their attack targets. We call this the gray box pattern. In the next subsection, this paper discusses that this model is feasible in real-world scenarios. In addition, to minimize the number of attack samples detected by the defense model, this paper also proposes an adversarial perturbation based on the Gaussian distribution (GN-TUAP) algorithm. The main purpose is to generate backdoor triggers more stably and covertly, effectively evade the detection of defense algorithms, and achieve the effect of model pollution. Our work specifically has the following aspects:

(1) A grey-box testing attack scheme is adopted. This scheme is to simulate a kind of gray box test attack of an image classification model in a real scene, and the attacker Technological innovation holds an important position in social development. It not only reflects the comprehensive strength of a country or region but also has significant impacts on economic growth, social progress, and national competitiveness. The 19th National Congress of the Communist Party of China clearly stated that innovation should be regarded as the core of our country's overall modernization construction and efforts should be made to improve the technological innovation system, further emphasizing the importance of technological innovation.

The Chengdu-Chongqing Economic Zone is an important engine for economic development in Western China. It is home to numerous research institutions and has accumulated a wealth of technological innovation resources and talents. Measuring technological innovation efficiency can reflect a region's capacity and operational ability in allocating technological innovation resources [1]. Scientifically

selecting relevant indicators for technological innovation efficiency, and comprehensively evaluating the technological innovation efficiency and influencing factors in the Chengdu-Chongqing Economic Zone, helps us to gain a comprehensive understanding of its technological innovation status, reveal the problems and bottlenecks in the process of technological innovation, and has positive and significant practical implications for achieving sustainable development in technological innovation and its positive impacts on the economy and society. Additionally, by comparing the technological innovation efficiency of different cities, we can identify successful experiences and innovation models from other cities, promote the exchange and learning of experiences, and strengthen cooperation and collaboration among cities.

2. Literature Review

Existing literature has mainly studied technological innovation efficiency from the following three aspects: (1) Construction of technological innovation level system. For example, Chi and Zhao [2] constructed an evaluation index system for technological innovation with enterprises as the main body using principal component analysis and correlation analysis. Tao [3], on the other hand, used the analytic hierarchy process to construct an evaluation index system for comprehensive technological innovation capacity in cities, with technological innovation as the core. (2) Measurement of technological innovation efficiency based on different input and output indicators. For instance, Wu and Wen [4] measured the technological innovation efficiency in Guangdong Province using three input factors: resources, labor, and capital, and two output factors: direct and indirect outputs of technological innovation. Zhao et al [5], on the other hand, measured the efficiency of technological innovation development in China's provincial regions by considering human resources and resources as input

indicators, and scientific innovation output and high-tech output as output indicators in their evaluation index system. (3) Study on influencing factors of technological innovation efficiency in specific industries or regions. For example, Wu and Chu [6] used Data Envelopment Analysis (DEA) to measure the technological innovation efficiency of 25 listed companies in the construction industry in China and explored its influencing factors. Guo and Fan [7] measured the agricultural technological innovation efficiency in the Yangtze River Economic Belt using the super-efficiency SBM model and analyzed the influencing factors. Chen et al [8] used the DEA model to measure the technological innovation efficiency of 31 provinces in China and analyzed the spatiotemporal heterogeneity of the factors affecting technological innovation. Wang and Huang [9] analyzed the spatiotemporal evolution characteristics of technological innovation efficiency in the Yangtze River Economic Belt using the DEA model and studied the influencing factors of technological innovation efficiency using the Tobit model. Zhou and Zuo [10], focusing on various prefecture-level cities in Hunan Province, measured the technological innovation efficiency of these cities using the DEA method and the Tobit model, and analyzed the influencing factors.

In summary, scholars have mainly focused on the comparative analysis of technological innovation efficiency at the provincial level in China, with less attention given to the differences in technological innovation efficiency among the various prefecture-level cities within the Chengdu-Chongqing Economic Zone. The research content has primarily focused on measuring and analyzing the technological innovation efficiency in regional areas, as well as exploring the influencing factors of technological innovation efficiency. Based on this, this study takes the 16 cities at the prefecture level and above in the Chengdu-Chongqing Economic Zone as the research objects. The DEA-BCC and Malmquist index methods are employed to calculate the static and dynamic efficiency of technological innovation development in the region. Additionally, the Tobit regression analysis method is used to identify the key factors influencing innovation development efficiency. This study aims to provide a basis for objectively understanding the actual situation of technological innovation in the Chengdu-Chongqing Economic Zone, formulating technology policies, and allocating resources. It also aims to assist the Chengdu-Chongqing Economic Zone in enhancing its technological innovation competitiveness.

3. Research Methods, Indicator Selection, and Data Sources

3.1. Research Methods

Data Envelopment Analysis (DEA) is a non-parametric model used to study the efficiency of homogeneous sectors with multiple inputs and outputs. The most representative models of DEA are the Constant Returns to Scale (CCR) model, which assumes constant returns to scale, and the Variable Returns to Scale (BCC) model, which allows for variable returns to scale. The difference between the two lies in the fact that the CCR model only calculates the overall efficiency of decision-making units, while the BCC model takes into account the impact of scale efficiency and decomposes efficiency into three components: Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE). The BCC model with variable returns to

scale is more general in nature. In this study, the BCC model with variable returns to scale is selected to measure the static efficiency of technological innovation in the Chengdu-Chongqing Economic Zone from an input-oriented perspective.

To measure the dynamic changes in technological innovation efficiency in the Chengdu-Chongqing Economic Zone, the Malmquist index method is applied. This study combines the Malmquist index method with the DEA method to establish a non-parametric linear programming model. By constructing the Malmquist index $(x^{t+1}, y^{t+1}, x^t, y^t)$ from period t to $t+1$, the dynamic changes in production efficiency of decision-making units between the two periods are analyzed. The specific mathematical expression is as follows:

$$TFP = M^{t+1}(x^{t+1}, y^{t+1}, x^t, y^t) = (M^t \times M^{t+1})^{\frac{1}{2}} = \left[\frac{D_c^t(x^{t+1}, y^{t+1})}{D_c^t(x^t, y^t)} \times \frac{D_c^{t+1}(x^{t+1}, y^{t+1})}{D_c^{t+1}(x^t, y^t)} \right]^{\frac{1}{2}} \quad (1)$$

$$TFP = EFFCH \times TECH = PECH \times SECH \times TECH \quad (2)$$

Among them, TFP represents Total Factor Productivity, EFFCH represents the index of technical efficiency, TECH represents the index of technological progress, PECH represents the index of pure technical efficiency change, and SECH represents the index of scale efficiency change.

In addition, since the comprehensive efficiency calculated by the DEA-BCC model falls within the range of (0,1), using the traditional OLS model for estimation would result in severe bias and inconsistency. Therefore, in this study, a Tobit regression analysis method based on the DEA-BCC approach is employed, which can effectively address this issue. The model structure of this method is as follows:

$$\begin{aligned} Y_i^* &= X_i \delta + \varepsilon_i \\ y_i &= Y_i^*, \text{ if } Y_i^* > 0 \\ y_i &= 0, \text{ if } Y_i^* \leq 0 \end{aligned}$$

Where Y_i^* is the latent variable, y_i is the dependent variable, X_i is the independent variable. When the latent variable Y_i^* is greater than 0, it can be observed and takes the value y_i . When Y_i^* is less than or equal to 0, it is truncated at 0, and its value is set to 0. δ represents the coefficient vector, and the disturbance term ε_i is independent and follows a normal distribution.

3.2. Indicator Selection

3.2.1. Selection of Innovation Input and Output Indicators

Referring to the research findings of scholars such as Yan [11] and Guo [12], input and output aspects are selected as evaluation indicators for measuring the efficiency of technological innovation in the Chengdu-Chongqing Economic Zone. The specific indicators are as follows:

(1) Innovation Input Indicators: Innovation input consists of human resources input, innovation capital input, and innovation institution input. The measurement indicators for human resources input include full-time equivalent R&D personnel; the indicator for innovation capital input is internal R&D expenditure; the indicator for innovation institution input is the number of research institutions.

(2) Innovation Output Indicators: Innovation output includes technological output and economic output. This study selects the number of patent applications and authorizations and the number of scientific and technological papers published as indicators for measuring technological output. The sales revenue of new products of industrial

enterprises above a certain scale is used as the indicator for measuring new economic output.

3.2.2. Selection of Influencing Factor Indicators

In this study, the comprehensive efficiency value of technological innovation development is taken as the dependent variable, and it is believed that government support, degree of openness, industrial structure, and infrastructure level are the main factors influencing the comprehensive efficiency of technological innovation development. Drawing on the ideas of scholars such as Chen and Fu [13], Hu et al [14], and Cheng et al [15], the measurement indicator for government support is the proportion of research and development expenditure to local fiscal expenditure; the measurement indicator for the degree of openness is the proportion of foreign trade import and export volume to regional GDP; the measurement indicator for industrial structure is the proportion of the tertiary industry to regional GDP; the measurement indicator for infrastructure level is the proportion of total postal and telecommunication services to regional GDP.

3.3. Data Sources

This study uses panel data from 2013 to 2019 on technological innovation in the Chengdu-Chongqing Economic Zone. The data for innovation input-output indicators are sourced from the "Statistical Yearbook of Science and Technology in Sichuan Province" and the "Statistical Yearbook of Chongqing" for the years 2014 to 2020. The data on government support, industrial structure, degree of openness, and infrastructure level are sourced from the "Statistical Yearbook of Sichuan Province" and the "China City Statistical Yearbook" for the years 2014 to 2020.

4. Results and Analysis

4.1. DEA-BCC Static Analysis

DEAP2.1 software used the BCC model to empirically analyze the technological innovation efficiency of 16 prefecture-level and above cities in the Chengdu-Chongqing Economic Zone. The comprehensive assessment results of

technological innovation efficiency in the Chengdu-Chongqing Economic Zone from 2013 to 2019 are shown in Table 1.

There is a significant disparity in the comprehensive efficiency of technological innovation among the prefecture-level cities in the Chengdu-Chongqing Economic Zone during the period from 2013 to 2019, with an overall average efficiency of 0.818. Furthermore, upon further analysis, we can observe that:

(1) The cities of Chongqing and Mianyang demonstrate excellent comprehensive efficiency, both having a score of 1. This indicates that these cities have achieved both pure technical efficiency and scale efficiency of 1, placing them at the efficiency frontier. It suggests that these cities have aligned their investments in technological innovation with their development conditions, effectively allocated and utilized resources, and avoided any mismatch between innovation input and output.

(2) Zigong, Deyang, Neijiang, Leshan, Yibin, Guang'an, Ya'an, and Ziyang have higher technological innovation efficiency than the regional average. Their overall scores show a slight gap from the production frontier, with most of the periods falling on the efficient frontier. It indicates that these regions have achieved a balanced ratio between input and output in technological innovation, but there is still room for improvement. These regions can further enhance their comprehensive efficiency by implementing measures such as improving technology and expanding scale.

(3) Chengdu, Luzhou, Suining, Nanchong, Meishan, and Dazhou have lower technological innovation efficiency than the regional average. It indicates that there is a mismatch between the scale of innovation and the input-output in these regions. The main reason could be inadequate investment, which hinders the development of technological innovation in these cities. These cities must increase investment in technological innovation and expand their scale, considering the current technological level, in order to enhance the overall efficiency of technological innovation.

4.2. Dynamic Analysis of the Malmquist Index

Table 1. Comprehensive Efficiency Results of Technological Innovation in the Chengdu-Chongqing Economic Zone

	2013	2014	2015	2016	2017	2018	2019	Average
Chongqing	1	1	1	1	1	1	1	1
Chengdu	0.812	0.691	0.686	0.743	0.729	0.789	0.847	0.768
Zigong	1	1	0.891	0.761	0.649	0.711	0.765	0.825
Luzhou	0.486	0.503	0.377	0.561	0.567	0.594	0.578	0.524
Deyang	1	0.939	1	0.925	1	1	0.988	0.979
Mianyang	1	1	1	1	1	1	1	1
Suining	0.821	0.621	0.659	0.742	0.815	0.657	0.684	0.714
Neijiang	1	1	1	1	1	0.892	0.887	0.968
Leshan	0.688	0.637	0.778	0.763	0.929	1	1	0.828
Nanchong	0.234	1	0.172	0.427	0.615	0.551	0.658	0.523
Meishan	0.773	0.649	0.527	0.724	0.69	0.674	0.998	0.719
Yibin	0.915	0.848	1	1	1	1	1	0.996
Guang'an	1	1	0.602	1	0.882	0.869	0.49	0.835
Dazhou	0.496	0.549	0.929	0.7	0.561	0.573	0.773	0.654
Ya'an	0.763	1	1	1	1	1	1	0.966
Ziyang	0.804	0.95	1	0.677	1	0.81	0.644	0.841
Average	0.799	0.837	0.789	0.814	0.84	0.82	0.832	0.818

From a time, series perspective, the empirical results of the Malmquist index and its decomposition components for technological innovation efficiency in the Chengdu-Chongqing Economic Zone are shown in Table 2. Overall, the average total factor productivity (TFP) in the Chengdu-Chongqing Economic Zone from 2013 to 2019 is 1.041. The average technical efficiency (TE) is 1.012, and the average technological progress (TP) is 1.029. This indicates that the technological innovation efficiency in the Chengdu-Chongqing Economic Zone increased at an annual growth rate of 4.1% during the period from 2013 to 2019, and the improvement in TFP was mainly driven by technological progress.

From a longitudinal perspective, the Malmquist index for technological innovation efficiency in the Chengdu-Chongqing Economic Zone was 1.159 in 2013-2014, with a TFP growth rate of 15.9%. From 2014 to 2015, the Malmquist index declined to 0.911, mainly due to a decrease in TE, which was caused by a simultaneous decline in pure technical efficiency and scale efficiency. From 2015 to 2018, the Malmquist index remained relatively stable, consistently above 1, with little variation, indicating a continuous improvement in technological innovation efficiency in the Chengdu-Chongqing Economic Zone during that period. However, in 2018-2019, the Malmquist index dropped to 0.905, mainly due to a decrease in the technological progress index. This indicates that during this period, the technological level hindered the improvement of technological innovation efficiency in the Chengdu-Chongqing Economic Zone to some extent.

In terms of the change rate of technical efficiency, pure technical efficiency played a major role in promoting the improvement of technical efficiency in the Chengdu-Chongqing Economic Zone from 2013 to 2019. The changes

in technical efficiency were primarily driven by changes in scale efficiency, which had a significant impact on the variation in technical efficiency. Thus, improving scale efficiency is an important factor in enhancing the technological efficiency in the Chengdu-Chongqing Economic Zone.

Further, we analyzed the dynamic changes in technological innovation efficiency in the Chengdu-Chongqing Economic Zone from a regional perspective. The results are shown in Table 3. From the table, it can be observed that except for Zigong (0.944) and Guang'an (0.871), the other 14 cities in the Chengdu-Chongqing Economic Zone are operating at the efficiency frontier, accounting for a total proportion of 87.5%. This indicates that Zigong and Guang'an are still lagging in terms of development efficiency and need to make significant efforts to improve their technological innovation capabilities. Overall, the technological innovation development efficiency in the Chengdu-Chongqing Economic Zone is continuously improving, and the development status is good.

From the decomposition results of the Malmquist Index in Table 3, we can observe:

(1) Chengdu, Luzhou, Leshan, Nanchong, Meishan, Yibin, Dazhou, and Ya'an, these eight cities have a Malmquist Index greater than 1, and both the technical efficiency index and technological progress index are greater than 1. This means that the improvement in total factor productivity in these cities is influenced by the simultaneous improvement in both technical efficiency and technological progress. The increase in pure technical efficiency and scale efficiency together contribute to the increase in technical efficiency, indicating that technological innovation and the expansion of technological innovation scale have a significant impact on improving the technological innovation efficiency in these cities.

Table 2. Malmquist Index and Its Decomposition Components for Technological Innovation Efficiency in the Chengdu-Chongqing Economic Zone from 2013 to 2019

	EFFC	TECH	PTEC	SEC	TFP (M index)
2013-2014	1.078	1.075	1.04	1.037	1.159
2014-2015	0.892	1.111	0.953	0.936	0.991
2015-2016	1.092	1.018	1.035	1.055	1.111
2016-2017	1.036	0.994	1.031	1.005	1.03
2017-2018	0.977	1.096	0.982	0.995	1.07
2018-2019	1.013	0.893	1.015	0.998	0.905
Average	1.012	1.029	1.009	1.003	1.041

(2) Suining, Neijiang, and Ziyang, these three cities have a Malmquist Index greater than 1, with the technological progress index greater than 1 and the technical efficiency index less than 1. This indicates that the increase in total factor productivity in these three cities comes from technological progress, while technical efficiency hinders the increase in total factor productivity. Different factors affect the technical efficiency index among different cities. The decrease in the technical efficiency index in Neijiang and Ziyang is caused by scale efficiency, while the decrease in the technical efficiency index in Suining is caused by the decrease

in the pure technical efficiency index.

(3) Zigong and Guang'an, these two cities have a Malmquist Index of less than 1, and both the technical efficiency index and technological progress index are less than 1. This indicates that both technical efficiency and technological progress in these two cities hinder the improvement of their total factor productivity. Decomposing the technical efficiency, both pure technical efficiency and scale efficiency are less than 1, indicating that both pure technical efficiency and scale efficiency restrain the improvement of technical efficiency in Zigong and Guang'an.

Table 3. Malmquist Index and its Decomposition for Cities in the Chengdu-Chongqing Economic Zone

	EFFC	TECH	PTEC	SEC	TFP (M index)
Chongqing	1	1.022	1	1	1.022
Chengdu	1.007	1.034	1	1.007	1.041
Zigong	0.956	0.987	0.96	0.996	0.944
Luzhou	1.029	1.018	1.026	1.004	1.047
Deyang	0.998	1.002	0.998	1	1
Mianyang	1	1.022	1	1	1.022
Suining	0.97	1.05	0.966	1.004	1.018
Neijiang	0.98	1.047	1	0.98	1.026
Leshan	1.064	1.021	1.057	1.007	1.087
Nanchong	1.189	1.002	1.164	1.021	1.191
Meishan	1.044	1.027	1.015	1.028	1.072
Yibin	1.015	1.077	1.011	1.004	1.093
Guangan	0.888	0.981	0.932	0.953	0.871
Dazhou	1.077	1.002	1.029	1.047	1.08
Ya'an	1.046	1.065	1	1.046	1.114
Ziyang	0.964	1.106	1	0.964	1.066
Average	1.012	1.029	1.009	1.003	1.041

(4) Deyang city has a Malmquist Index of 1, and the improvements and reductions in both technical efficiency and technological progress offset each other. This indicates that the development and utilization of technological innovation resources in Deyang City reached an equilibrium state during the period from 2013 to 2019.

4.3. Factors Analysis of Technological Innovation Efficiency in the Chengdu-Chongqing Economic Zone

Next, we explore the factors influencing technological innovation efficiency in different regions of the Chengdu-Chongqing Economic Zone using the Tobit model based on the BEA-BCC model. The dependent variable Y in the regression model represents the comprehensive efficiency of technological innovation in various cities of the Chengdu-Chongqing Economic Zone during the period 2013-2019, as calculated by the BCC model. The main factors (independent variables) affecting their technological innovation efficiency are government support, degree of openness, industrial structure, and infrastructure level.

The empirical results of the factors influencing technological innovation efficiency in different regions of the Chengdu-Chongqing Economic Zone are shown in Table 4. From the results, we can observe the following:

(1) The regression coefficient of government support is significant at the 5% level and positively correlated. This indicates that the greater the government's investment in technological innovation activities, the higher the technological innovation efficiency in the region. Technological innovation often requires substantial research and development expenses, and government funding support can help research institutions and companies bear a portion of the R&D costs, lowering the innovation threshold. It also indirectly encourages more institutions and companies to participate in technological innovation activities. Relevant literature also suggests that the government plays a guiding, supporting, and facilitating role in technological innovation activities [16], and a significant portion of the funding for

technological innovation activities comes from government investment.

(2) The regression coefficient of the degree of openness is significant at the 10% level and positively correlated. This indicates that the higher the level of openness in the region, the higher the technological innovation efficiency. Technological innovation often requires various specialized knowledge and technologies, and through exchanges and cooperation with research institutions, academia, and companies in other countries and regions, knowledge, technology, and best practices can be shared, promoting the progress of technological innovation. At the same time, openness to the outside world can provide broader sources of funding and market opportunities for technological innovation, attracting more investment and technology companies to enter the Chengdu-Chongqing market, providing more financial support and business opportunities for technological innovation, expanding sales channels for products and services, and promoting the industrialization and commercialization of innovative outcomes.

(3) The regression coefficients of industrial structure and infrastructure level are both insignificant and negatively correlated. This indicates that the higher the industrial structure and infrastructure level, the lower the technological innovation efficiency. The negative impact of industrial structure on technological innovation efficiency may be due to the dominance of the tertiary industry, which is generally service-oriented. In some areas, an excessively high proportion of the tertiary industry may weaken other factors that support technological innovation, resulting in lower innovation inputs and limiting the resources and funding support for technological innovation, thus negatively affecting technological innovation efficiency. The negative impact of the infrastructure level may be due to the substantial financial support required for technological innovation in terms of manpower, materials, and funds. Except for Chengdu and Chongqing, which are new first-tier cities, most of the other cities in the Chengdu-Chongqing Economic Zone are fourth and fifth-tier cities with insufficient infrastructure development. This may result in insufficient innovation

capacity, limiting the level and efficiency of technological innovation in the region and hampering the full utilization and realization of innovation potential.

Table 4. Tobit Regression Analysis Results

y	Coefficient	Std .err
cons	0.920***	0.119
Government support level	0.806**	0.358
Industrial structure	-0.457	0.325
Degree of openness to the outside world	0.883*	0.535
Level of infrastructure	-0.0628	2.978

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

5. Conclusion and Recommendations

This study employed the DEAP2.1 software and BCC model to statically measure the technological innovation efficiency of 16 prefecture-level and above cities in the Chengdu-Chongqing Economic Zone between 2013 and 2019. The results showed significant variations in comprehensive efficiency among the cities, with an overall comprehensive efficiency value of 0.818, indicating that the region was generally inefficient in terms of DEA. Furthermore, the dynamic changes in technological innovation efficiency in the Chengdu-Chongqing Economic Zone were investigated using the Malmquist index. The research findings revealed that the overall average total factor productivity in the region during 2013-2019 was 1.041, indicating an increasing trend in technological innovation efficiency. From the perspective of the rate of change in technical efficiency, pure technical efficiency played a positive role in promoting the improvement of technical efficiency. Regarding the total factor productivity of each city, 87.5% of the cities in the Chengdu-Chongqing Economic Zone had technological innovation efficiency at the frontier level, and the changes in total factor productivity among the cities were relatively small, indicating stable technical efficiency. Lastly, through Tobit regression analysis, it was found that government support and openness to the outside world had a significant positive impact on technological innovation efficiency in the Chengdu-Chongqing Economic Zone, while the impact of industrial structure and infrastructure level on technological innovation efficiency was not significant.

Based on the above research findings, the following four recommendations are proposed:

(1) Increase funding and policy support to promote industry-academia-research collaboration projects. Local governments and relevant institutions should increase financial resources and policy support to provide more research and development funding and support for technological innovation projects. This will stimulate innovation vitality, promote the activity and commercialization of technological innovation, and enhance technological innovation efficiency. Additionally, local governments should actively promote industry-academia-research collaboration to foster cooperation and exchange between research institutions, universities, and enterprises.

(2) Establish a platform for international technological innovation exchange and actively attract talent. The Chengdu-Chongqing Economic Zone should establish a platform for technological innovation exchange, offering services such as

information exchange and technological cooperation, to strengthen collaboration and exchange in technological innovation with other countries and regions. Furthermore, by opening channels for international talent mobility, more outstanding scientific and technological talents, as well as high-skilled professionals, should be attracted to work and innovate in the Chengdu-Chongqing Economic Zone, further enhancing the international competitiveness of technological innovation.

(3) Promote the optimization and upgrading of industrial structure to increase technological innovation potential and efficiency. By adjusting the industrial structure, the development of high-tech industries and innovative enterprises should be promoted to enhance the potential and efficiency of technological innovation. Encouraging and supporting the development of industries with high technological content and high added value, particularly those closely related to technological innovation, will continually strengthen the cultivation and improvement of independent innovation capabilities.

(4) Strengthen infrastructure construction to provide a supportive environment for technological innovation. The development and improvement of infrastructure, including the construction and enhancement of research institutions, laboratories, and science and technology parks, can provide a favorable environment for scientists and innovative enterprises, thereby promoting the progress and commercialization of technological innovation.

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