

Research on the Impact of Innovation Failure Tolerance on Technological Innovation

Leilei Wang

School of Management, Xi'an Polytechnic University, Xi'an, Shaanxi 710048, China

Abstract: The process of technological innovation is characterized by high risk and high uncertainty. It is urgent to contain the risks of technological innovation and encourage the innovation environment of technological trial and error. Based on the existing research on the tolerance of innovation failure, this paper reveals the four influence paths of the tolerance of innovation failure on technological innovation from the perspective of failure tolerance. The research found that the tolerance of failure through the four paths of technological failure tolerance, market failure tolerance, financing failure tolerance, and policy failure tolerance by each innovation subject has realized an innovation environment that encourages tolerance of error and error and thus promotes technological innovation. Based on this, in view of how to improve the failure tolerance of the innovation subject to promote technological innovation, this paper puts forward countermeasures and suggestions to improve the risk compensation mechanism, establish an innovation consortium, and create an inclusive external environment. It provides a theoretical framework and decision-making reference for building a policy environment and market environment that can tolerate innovation failure and encourage innovation trial and error.

Keywords: Technological innovation, Tolerance of failure, Policy suggestion.

1. Introduction

Technological innovation faces high risks of technological research and development and technology commercialization, and it is urgent to contain failures and encourage an innovative environment of trial and error [1]. The key to creating a good innovation environment is to improve the failure tolerance of innovation subjects to encourage fault tolerance and trial and error, that is, to improve the tolerance of all innovation subjects and even the public to innovation failure. The higher the tolerance of failure in the innovation environment, the greater the probability of successful technological innovation, and the more able to stimulate breakthrough innovation and disruptive innovation. However, the demand characteristics of various innovation subjects for failure tolerance and the theoretical mechanism of failure tolerance to encourage technological innovation are still unclear. Therefore, studying the characteristic dimension of innovation failure tolerance and revealing the impact path of failure tolerance on technological innovation is of great significance to accelerate the transformation of China's regional innovation environment from "low failure tolerance and weak innovation performance" to "high failure tolerance and strong innovation performance".

The existing research on failure tolerance is mainly carried out from three aspects: managers, technology enterprises and financial institutions. From the perspective of managers, Ye Kangtao and other researchers found that the diversity of corporate decision makers' experience can promote enterprise innovation by improving the tolerance of failure[2], Chen Xiude and other researchers found that the failure tolerance of the board of directors can promote enterprise innovation investment, and improving the failure tolerance of the board of directors is conducive to encouraging enterprise executives to make more R&D innovation investment [3]; From the perspective of enterprises, Li Yanxi and other researchers found that the failure tolerance of enterprises can improve the promotion of the "the Belt and Road" initiative on enterprise

innovation efficiency[4]; From the perspective of financial institutions, Dong Jianwei and other researchers found that government-guided fund participation in venture capital funds can improve the failure tolerance of venture capital fund management institutions through loss compensation[5]. However, the existing research has ignored the difference in demand of innovation failure tolerance among innovation subjects, which makes the impact path of innovation failure tolerance on technological innovation unclear. Based on the perspective of failure tolerance, this paper analyzes the demand characteristics of different innovation subjects for failure tolerance, reveals the internal mechanism of innovation failure tolerance on technological innovation, and provides a theoretical framework and decision-making reference for building a policy environment and market environment that tolerates innovation failure and encourages innovation trial and error.

2. Journals Reviewed

The tolerance of failure is the risk bearing capacity and risk repair capacity of each innovation subject to the loss of innovation, which not only determines the size of the trial and error space and commercial exploration space of regional technological innovation, but also determines the quality of regional innovation, especially the possibility of breakthrough innovation and disruptive innovation.

On the one hand, failure tolerance can change entrepreneurs' risk preference, and improving managers' failure tolerance can be used as a special incentive to promote technological innovation[6]. A relaxed and tolerant innovation environment can promote entrepreneurs to change from risk averse to risk averse, and improving managers' tolerance of innovation failure will promote enterprises' independent innovation by changing their risk preference[7]; Managers with high uncertainty tolerance are more likely to implement breakthrough innovation[8]; The higher the tolerance of enterprises to managers' innovation failure, the higher the innovation enthusiasm of managers[9].

On the other hand, failure tolerance is conducive to improving the innovation performance of enterprises. Improving risk tolerance is an important factor in promoting independent innovation of enterprises [10]. Creating an inclusive innovation environment can improve regional innovation performance[11]; Venture capital institutions with high failure tolerance invest in companies with significantly higher innovation output and innovation quality after listing[12]; A high tolerance of entrepreneurs' failure can alleviate the adverse impact of policy uncertainty on enterprise innovation and promote enterprise innovation performance[13].

On the whole, the existing research on innovation failure tolerance is relatively scattered, and the relevant research on the impact mechanism of innovation failure tolerance on technological innovation has not yet been in-depth, and only the simple linear relationship between the two has been discussed. Therefore, this paper aims to clarify the demand characteristics of the failure tolerance of each innovation subject, and clarify the impact path of innovation failure tolerance on technological innovation.

3. Impact Path

The tolerance of innovation failure can be achieved through four ways to promote technological innovation through an innovative environment that encourages fault-tolerance and trial and error: first, to contain the uncertainty of technological trial and error, and to help universities and scientific research institutions carry out original innovation regardless of cost; The second is to contain the uncertainty of business exploration and help science and technology enterprises successfully realize technology commercialization in the process of market development; The third is to contain the uncertainty of the financing process and support financial institutions to provide more powerful financing support for other innovative entities; Fourth, promote the government to introduce inclusive policies to support the technological innovation process.

3.1. Tolerance of technical failure

As the starting point of technological innovation, the improvement of the original innovation ability of universities and scientific research institutes still faces many problems that are difficult to break through. ① The source of funds is single. At present, the research and development funds of universities and scientific research institutions mainly rely on the support of government financial allocations, with narrow access to resources and insufficient investment in scientific research funds. ② Passive scientific research under the professional title system. Under the strategic requirement of "prospering the school through scientific research", the difficulty of scientific research talent assessment has increased[14], "routinization" has become the research norm of scientific researchers, while research projects conducive to original innovation cannot be "routinization". ③ Inadequate support for the intermediate process of original innovation. When scientific researchers finish their projects, they often "take the result as the hero". For projects that fail to complete the expected results within the specified time, they will not only recover the funding, but also have an impact on the next project declaration and discourage the innovation enthusiasm of scientific researchers.

3.2. Tolerance of market failure

How the transformation results of scientific and technological achievements are closely connected with the demand market, that is, how to effectively promote market exploration is still a difficult problem in the technology commercialization stage of scientific and technological enterprises. ① Insufficient support for risk market. Government institutions still have the largest proportion of investment in innovation activities with high risks, and the source of venture capital is narrow, and there is less financial support for enterprises in the seed and start-up stages. ② Path dependence makes it impossible to break through the core technology. After forming the initial technology track, enterprises will continue to strengthen on this locked track due to sunk costs and other reasons, that is, form path dependence[15], which will make enterprises unable to change the technology track in time when encountering external shocks. ③ The procurement of innovative products is insufficient. At present, the essence of government procurement is to promote the clearing of the capacity of innovative products, focusing on the procurement of growth-oriented innovative products, but exploratory innovative products play a more significant role in guiding the technological innovation of science and technology enterprises[16].

3.3. Tolerance of financing failure

The technological innovation of science and technology enterprises needs a large amount of funds and the risk sources in this process are extensive, but the financing problem is difficult to solve effectively, and the enterprises alone cannot carry out effective risk control. Specifically, on the one hand, the support of the banking system for technological innovation is still insufficient. ① Science and technology banks are not professional enough. At present, most science and technology banks are still science and technology branches subordinate to each bank, and they will be limited by performance assessment, risk preference of the head office and other aspects when carrying out business. ② The scope of bank loan mortgage is small, and the traditional physical mortgage guarantee is not friendly to technology enterprises. ③ The types of credit products provided by commercial banks are relatively small, and the products are not targeted enough to meet the financing needs of enterprises. On the other hand, China's science and technology insurance is still in the dilemma of insufficient supply and low demand[17]. ① The types of science and technology insurance products are insufficient to meet the insurance needs of enterprises. ② There are high technical barriers in the technological innovation process of science and technology enterprises, which can not form a complete risk information leakage mechanism, resulting in higher premiums. ③ The existing fiscal policies are seriously homogenized and mainly focus on stimulating the demand side, ignoring the incentives for insurance companies.

3.4. Tolerance of policy failure

In the process of policy formulation, how to improve the rationality of policies and solve the problem of government failure need to consider various factors. ① The participation of innovation subjects is insufficient, and some innovation subjects regard the technology innovation budget mechanism

as an internal problem of the government, which lacks understanding and participation. ② Inadequate budget implementation efficiency and lack of linkage between the upper and lower levels of the government lead to slow budget implementation and difficult to achieve policy objectives. ③ The market supervision model still needs to be improved, and the emergence of new technologies challenges the existing market supervision model, while the optimization of the supervision mechanism with an inclusive and prudent attitude is still in the program commissioning period. In addition, the traditional concept believes that strong policy uncertainty and high degree of ambiguity will lead to a "black box" in the implementation process, which is not conducive to technological innovation. In fact, the degree of fuzziness of the policy cannot fully represent the quality of the policy, and the fuzzy definition of the policy can expand the elastic space of the policy implementation[18].

4. Countermeasures and Suggestions

4.1. Improve the risk compensation mechanism

Establish failure compensation and risk compensation mechanism. First, in order to encourage enterprises to innovate again after the failure of innovation projects, differentiated policy compensation is given to the failed innovation projects. The second is to establish a corresponding supervision mechanism to ensure that subsidies for failed projects are used for re-innovation activities and prevent enterprises from adverse selection. Third, establish a risk compensation mechanism for financial institutions, set up a special fund for risk compensation, share the risks of financial institutions in providing financial support for technological enterprises, and encourage financial institutions to launch diversified financial products that meet the requirements of technological innovation.

4.2. Establish an innovation

Coordinate the mechanism of "revenue sharing and risk sharing" among innovation cooperation entities. First, expand the diversified financing channels of universities and scientific research institutions, encourage universities and scientific research institutions to establish scientific and technological enterprises to raise funds, or seek financial support from enterprises through industry-university-research cooperation, or introduce financial capital and social capital appropriately. The second is to help enterprises make breakthroughs in core technology. On the one hand, science and technology enterprises obtain technical and talent support through industry-university-research cooperation, and on the other hand, obtain financing support through science and technology finance to accelerate breakthroughs in core technology innovation. Third, establish a supporting legal support system for science and technology finance, improve the laws and regulations on equity investment of commercial banks, encourage banks to adopt the investment and loan linkage model, improve the relevant laws and regulations of private equity funds, and guide private capital to participate in technological innovation.

4.3. Create an inclusive environment

Create a scientific research environment driven by scientific and technological talents. First, grant scientific research personnel the autonomy of technical routes, allow

the project leader to adjust the research scheme and technical routes independently, establish a differentiated assessment mechanism, and adopt a flexible assessment mechanism for scientific research personnel engaged in innovative exploratory projects. The second is to increase the process support for innovative projects. During the project implementation, the project establishment department needs to randomly check the support of universities and scientific research institutes for the project from time to time. Third, weaken the impact of the failure of the project conclusion, and exempt the researchers who have fulfilled the obligation of scientific research due diligence but have not yet achieved the expected research objectives. If the innovation project fails, the reasonable paid funds will not be recovered. In addition, with the attitude of "fault tolerance, trial and error", researchers are allowed to appropriately extend the project cycle, apply for increased funding, and encourage researchers to carry out free exploratory innovation.

References

- [1] Guo Chuangtuo The dilemma of legalization of scientific research tolerance system reform and its solution [J] Law Forum, 2020,35 (06): 67-74.
- [2] Ye Kangtao, Li Wanshan, Zhao Qifeng Old horse sees the way: "generalist" executives and enterprise innovation [J] Scientific Research Management, 2021,42 (09): 157-165.
- [3] Chen Xiude, Li Huiyang, Ma Wencong, etc Will board failure tolerance affect enterprise innovation? [J]. Management Review, 2021,33 (08): 90-103.
- [4] Li Yanxi, Li Xiaochong, Shi Jinyan The the Belt and Road Initiative, Risk Tolerance and Enterprise Innovation Efficiency [J] Scientific Research Management, 2020,41 (06): 65-79.
- [5] Dong Jianwei, Wang Han, Shi Guoping The impact of government-guided funds participating in venture capital funds on enterprise innovation [J] Scientific Research, 2018,36 (08): 1474-1486.
- [6] Manso G. Motivating Innovation[J]. The Journal of Finance, 2011,66(5).
- [7] Hu Guoliu, Zhao Yang, Hu Jun D&O insurance, risk tolerance and enterprise independent innovation [J] Managing the World, 2019, 35 (08): 121-135
- [8] Qin Yuanjian, Wang Wenxiang Research on the relationship between uncertainty tolerance, decision-making logic and breakthrough innovation [J] Science and Technology Progress and Countermeasures, 2020,37 (02): 1-9.
- [9] Di Junpeng, Wang Haoyu Tolerance, motivation and behavior choice of enterprise innovation [J] Shanghai Economic Research, 2018 (02): 16-26.
- [10] Ederer F, Manso G. Is Pay for Performance Detrimental to Innovation? [J]. Management Science, 2013,59(07):1496-1513.
- [11] Li Ling, Tao Houyong The impact of inclusive innovation environment on regional innovation performance [J] Science and Technology Progress and Countermeasures, 2018,35 (19): 31-37.
- [12] Tian X, Wang T Y. Tolerance for Failure and Corporate Innovation [J]. Review of Financial Studies, 2014, 27 (01):211-255.
- [13] Yu Wen. Will uncertainty of economic policy hinder enterprise innovation [D]. Wenzhou University, 2020.
- [14] Xie Zhaodan, Yang Yonghuan Research on the innovative ability of young scientific and technological talents in colleges and universities under the "environment - sense of scientific

- research efficiency" [J] Scientific Management Research, 2020,38 (01): 148-152.
- [15] Sun Yukang, Lv Shuang, Cui Dan Regional knowledge base theory and its enlightenment to China's regional innovation [J] Scientific Research, 2022, 40 (02): 366-375.
- [16] Liu Jingfu, Jin Weidong, Liu Yan The driving effect of government procurement on enterprise technological innovation: from the perspective of product heterogeneity [J] Science and Technology Progress and Countermeasures, 2020,37 (05): 10-17.
- [17] Li Yaqing The dilemma of "cold supply and demand" of science and technology insurance and its solution from the perspective of supply-side reform [J] Science and Technology Progress and Countermeasures, 2018,35 (15): 119-125.
- [18] Guo Zhongxing, Zhang Yaling Fuzzy object, flexible space and strategic policy implementation -- take the minimum living allowance policy of N City as an example [J] Learning and Practice, 2022 (01): 88-97.