A Literature Review of the Relationship between Board Characteristics and R&D Expenditure

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Abstract: The board of directors, as the head of the company's governance and critical management, plays a guiding and decisive role in the company’ innovation and development. However, the current research on the relationship between board characteristics and R & D investment has not yet reached a consistent conclusion, so it is necessary to sort out and review the relevant literature. This paper summarizes the research on the relationship between the Board Characteristics and R & D investment in China from such six aspects as the characteristics of the board's structure, power composition, behaviour, incentive, stability, and background. The research in this article indicates that future research can be empirically tested by industry, and there are few related studies on the relationship between board stability and R&D investment, which may be an entry point.

1. Introduction

In the current global environment of business competition, the competitive advantage will weaken over time, and companies must continue to increase R&D investment to develop new technologies and products to update their competitive advantages. However, R&D activities have long-term and uncertain characteristics, which will have negative consequences for the development of enterprises. Therefore, the decision of enterprise R&D investment has attracted extensive attention from the academic and practical circles. Compared with some developed countries, China’s enterprises generally have problems such as insufficient investment in research and development and weak innovation ability. This situation will restrict the implementation of China's innovation-driven development strategy. The survival and growth of an enterprise cannot be separated from the leader's guidance. Therefore, the board of directors has a guiding and decisive role in the innovation and development of the company. The characteristics of the board are the institutional arrangements made on corporate management, which is a division of the board's structure, obligations, powers, and responsibilities to ensure the effectiveness of board governance. Based on this, this article sorts out the correlation between board characteristics and R&D investment from six aspects, and provides some reference opinions for future research directions.

2. Theoretical Basis of the Relevance of Board Characteristics and R&D Investment

The generation of principal-agent relationship has brought about information asymmetry. Shareholders and managers face different risks in business operation, and they also have agency problems when making innovative decisions. On the one hand, the innovation of corporation will face higher market operation risks, and the human resources and material resources invested may become sunk costs. Even if the management makes great efforts for this, the success of innovation activities cannot be guaranteed, and shareholders can diversify their investments to reduce losses. But for managers this failure is a negation of competence and reputation, and this negation is more profound for management. On the other hand, innovation activities have an extended return cycle and high risks. In the short term, shareholders will evaluate management based on the company's performance; it is better to not perform technical innovation. Because shareholders evaluate

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management based on company performance, agents are more likely to choose short-term projects. The problem of agency between shareholders and management is more apparent in innovation activities. How to adequately supervise the agency of enterprises is a problem that the principal-agent theory urgently needs to solve [1]. From this theory, we can see the advantages of the board, and how to improve the efficiency of the Board Governance has become the focus of academic circles.

3. Literature Review on the Relationship between Board Characteristics and R&D Expenditure

Board characteristics refer to variables that can describe the data of the board. The board of directors is an institutional arrangement of the enterprise's internal control system. Its characteristic will affect the formulation of corporate development strategies and the choice of operating decisions. This article sorts out six aspects of the features of the board: structure, power, behaviour, incentive, stability, and background.

3.1 Structural Characteristics of the Board and R&D Expenditure

The number of directors and R&D investment. There are two main conclusions. Empirical research by Xu Wei et al. (2011) and Zhang Junli et al. (2015) found that director board size is significantly promoting the R&D investment. They believe that director board size represents the ability of the company to obtain resources. Resources can be shared between them, which is conducive to make sound investment and financing decisions [2-3].Xiao Liping (2016) and Jia Chunxiang et al. (2019) found that number of directors is significantly negatively related to R&D. They believe that the cost of communication between board members increases with the number of people, which does not enable effective integration of resources. It is not beneficial to R&D investment of company [4-5]. Some scholars believe that there is a more complicated relationship between them. Liu Shengqiang (2010) found that an inverse U type relationship appeared between R&D intensity and the number of boards. It is most appropriate to maintain about eight people [6].

Proportion of independent directors and R&D investment. One view is that independent directors are more independent and can play a useful role in oversight, and provide professional support. Independent directors are more capable of promoting internal directors to make decisions for the long-term development of the enterprise.Hu Quying (2017) research also found that the higher the proportion of independent directors, the more companies focus on technological innovation investment [7].The second is that the success of innovative activities requires not only financial and technical support internally, but also the identification of the right time. Independent directors do not participate in the day-to-day operations, and are unfamiliar with the company's business characteristics and the industry environment. They can’t effectively guide companies to make accurate decisions, so the proportion of independent directors doesn’t increase R&D investment. Sun Zao (2015) and Dong Meisheng (2016) concluded that independent directors don’t play a role in R&D investment decisions [8-9].

3.2 Power Composition Characteristics of the Board and R&D Expenditure

The combination of director and general manager refers to whether the chairman and general manager are separated. One view is that the separation of two positions helps to check and balance power and to a certain extent prevent bad decisions due to overconfidence. And the combination of two situations will weaken the decision-making supervision function of directorate. The CEO will reduce inefficient activities such as research and development for the purpose of reducing risks and maximizing their benefits. Xiao Liping (2016) found that the state of joint board function has a negative correlation with the intensity of R&D investment [4].Li Wei (2018) research found that the combination of the chairman and the general manager has a significant negative impact on technology innovation investment in the tertiary industry [10].Another view is that the combination of two positions is conducive to the unification of the opinions of directors and the operators, reducing conflicts. Developers will have sufficient control to support human and material resources for innovative activities, which will help stimulate research and development activities. Wang Xiaohong (2014) used Xi'an high-tech enterprises as a sample to confirm that a positive impact of the state of joint board function on R&D investment[11].Ren Haiyun (2015)found that the combination of two positions is more conducive to R&D investment in the mature and recession period[12].Huang Qinghua(2017)found that the combination of two posts promoted corporate technological innovation, which not only pushed more R&D investment, but also increased organisational R&D output(reflected in more invention patents), and also improved the efficiency of R&D[13].

3.3 Behavioural Characteristics of the Board and R & D Expenditure

The board of directors is the authority of a joint-stock company. The behaviour of the board is the behaviour of board members in making decisions on matters. Board members make decisions through board meetings. The study mainly describes board behaviour by the number of board meetings. Zhou Wenjing (2019) concluded that the number of board meetings is significantly positively related to R&D efficiency, and the high-frequency sessions send a signal to the outside world: the board of supervisors is more intensive and the company's internal governance is reliable. Therefore, it is easier for the company to obtain external financing, and it will be more inclined to provide more financial support for research and development [14].Wang Siwei et al. (2020) research found that the number of board meetings didn’t significantly promote the R&D expenditure in China's circulation industry, because the board meetings were inferior in quality and inefficient to meet the precise needs [15].

3.4 Board Incentive Characteristics and R&D Expenditure

Related research on corporate governance believes that there is a principal-agent relationship between shareholders and members of the board, and that shareholders give board members rewards that will bring the interests of board members and corporate shareholders closer to each other. The board of directors takes the company's long-term development as the ultimate goal. To improve the company's long-term performance, it will focus on the development of new technologies. Most of the existing researches have concluded that there is a positive correlation between the board's incentive characteristics and R&D investment. Hang Junli (2015) found that share proportion of directors will significantly affect the strength of R&D investment [3].Some scholars have found that there is no correlation between board incentives and R & D investment. Wang Siwei et al. (2020) found that the total salary of the top three directors and the board’s share ratio have no correlation with the R&D expenditure in China's circulation industry. They believe that the effects of salary incentives are limited and will diminish over time [15].

3.5 Board Stability and R&D Expenditure

Board stability refers to the degree of board replacement, including the replacement of board members and the number of board members. R&D activities need to overcome short-term vision and make long-term plan. Board stability can ensure that the company's operating activities conform to the company's long-term plan. So R&D expenditure can be guaranteed. Tang Li et al. (2018) empirically studied the relationship between board stability and innovation input on family business. The results show that company’s level of innovation will increase with the improvement of board stability [16].

3.6 Background Characteristics and R&D Characteristics

The development of R & D activities requires not only financial support, but also breakthroughs in core technologies and a keen sense of business opportunities. These are inseparable from the professional background and social resources possessed by the board members, and the existing research mostly starts with the professional background, political connection and chain background.

The professional background of director members reflects the human resources gathered in them, including work experience, the ability of understanding and dealing with some issues. Export-oriented functions refer to R&D design, marketing, etc. Directors with a professional background of export-oriented functions have rich experience in the technical field, so their predictive ability and response ability are more certain to reduce the uncertainty of R&D activities, so they are more inclined to increase corporate value by R&D activities. Wang Yufeng et al. (2017) found that the proportion of directors with backgrounds in R&D has a significant positive correlation with corporate R&D expenditure, and this positive effect is more significant in less developed regions [17].

Political connections can help enterprises obtain policy resources, such as tax relief, credit support, and government subsidies, which can reduce the obstacles to innovation activities caused by an imperfect institutional environment and encourage enterprises to invest in research and development. Zhu Jian et al. (2019) found that the political connection can effectively promote innovation investment. The resources brought by the political relationship reduce the risk of innovation activities, which increase the company's willingness to invest in innovation [18].Another point of view is that political attachments are the product of an informal system and play a role in resource allocation. The residual control power owned by government officials will give enterprises preferential treatment[19].To obtain benefits, specific interest groups will use a large number of resources for non-productive activities such as rent-seeking [20],and the investment in research and development activities will be reduced accordingly. Sun et al. (2018) found that political linkages will hinder the role of market mechanism in promoting corporate innovation and will result in insufficient investment in corporate innovation. They confirmed “resource curse” effect between political connections and R&D investment [21].

The company's competition in the field of innovation largely depends on the competition for resources. The existence of interlocking directors can more quickly obtain information about the external environment. It help companies identify opportunities and threats in the industry environment, thereby enhancing the effectiveness and motivation of R&D activities. An Ruosen et al. (2016) found that proportion of interlocking directors was significantly positively related to R & D investment [22]. But on the other hand, relying on the chain relationship will weaken the company's ability to perceive changes in the industry environment, and the company needs to invest corresponding resources in maintaining a secure connection, which is not conducive to motivating the company's independent innovation. Fan Jianhong et al. (2015) found that the degree of interlocking directors has a significant correlation with the level of enterprise R & D investment. The deeper the degree of chain embedding, the lower the level of R & D investment [23].

4. Conclusion

To sum up, the research conclusions are different in the structure characteristics, the power characteristics, behaviour characteristics and background characteristics. As for the encouragement characteristics of the board, scholars in China generally believe that there is a significant positive correlation between board incentives and R&D investment. There are relatively few studies on the stability of the board of directors, and existing studies have shown that there is a significant positive correlation between the frequency of board member changes and the level of corporate investment in innovation.

This article believes that the reasons for the disagreement in the academic world may be due to different empirical methods or sample selections. In the study of corporate governance, the effectiveness of any factor must consider not only micro-level factors, but also macro-economic factors. In different industry environments, the effects of certain features should be changed. Therefore, future research can be carried out by industry to conduct comparative studies to find the reasons for the differences. And we have seen that relatively little research has been done on the relationship of stability characteristics on R & D investment, which may be a starting point for future research.

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