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Research on the Impact of Top Management Team Human Capital on Firms' R&D Internationalization

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Abstract

Based on Upper Echelons Theory and Imprinting Theory, this paper examines the role of top management team (TMT) human capital in firms' R&D internationalization strategies. The research findings indicate that a higher average age of the TMT is detrimental to the advancement of firms' R&D internationalization. Conversely, the overseas experience of TMT members is positively correlated with firms' R&D internationalization, and so is the educational attainment of the TMT. This paper deepens the understanding of the relationship between board human capital and firms' R&D internationalization, providing valuable management insights for the construction of corporate TMTs.

Keywords

Human capital of the top management team; internationalization of research and development; upper echelons theory

1. Introduction

China's economy has entered a stage of quality-oriented growth. The "14th Five-Year Plan" emphasizes the need to "pursue innovation-driven development and enhance enterprises' technological innovation capabilities." With the acceleration of globalization and increasingly fierce market competition, the internationalization of corporate research and development (R&D) has become a crucial means for enterprises to grow across borders. An increasing number of multinational enterprises are entering international markets to seek advanced technologies and resources to enhance their innovation capabilities and establish international competitive advantages. As the core decision-making force within enterprises, the Top Management Team (TMT) plays a significant role in shaping the internationalization of corporate R&D.

Currently, scholars have predominantly focused on the impact of individual characteristics of managers (including age, education, gender, professional background, etc.) on firms' R&D internationalization. These studies emphasize how managers' personal cognitive frameworks, risk appetites, and social networks influence their international R&D decisions and strategic orientations. However, despite providing valuable insights, these individual-level analyses often overlook the complexity and dynamism of top management teams (TMTs) as a collective force in driving firms' R&D internationalization processes. The interactions, collaborations, and collective decision-making processes among TMT members play crucial roles in integrating internal team resources, identifying international opportunities, and addressing cross-cultural challenges.

This study aims to transcend the limitations of individual characteristics and delve deeper into how the human capital of top management teams (TMTs), encompassing members' knowledge depth and breadth, international experience, leadership skills, and team collaboration abilities, collectively influences firms' R&D internationalization strategies. Additionally, this paper introduces relevant theories such as Upper Echelons Theory and Imprinting Theory to explain the research findings. Upper Echelons Theory posits that the higher the level of knowledge, skills, and experience among TMT members, the greater their contribution to a firm's R&D internationalization. Meanwhile, Imprinting Theory emphasizes the scarcity and irreplaceability of TMT human capital, characteristics that further underscore the critical role of TMT human capital in implementing R&D internationalization strategies.

Specifically, this study will analyze how different dimensions of TMT human capital individually and collectively influence the decision-making, execution efficiency, and output of R&D internationalization. It will also examine the variability of these effects across different industries, firm sizes, and stages of internationalization. Furthermore, the study will explore how external environmental factors (such as policy environments, market competition dynamics, technological trends, etc.) interact with TMT human capital to collectively shape firms' paths towards R&D internationalizatio.

In summary, this research not only enriches the theoretical framework concerning the relationship between TMTs and firms' R&D internationalization but also provides practical guidance for firms to optimize their TMT configurations and formulate effective R&D internationalization strategies in the context of globalization.

2. Theoretical Analysis

2.1. Review of R&D Internationalization

R&D internationalization refers to the strategic arrangement of multinational corporations to allocate R&D resources cross-border overseas, expand overseas markets, acquire overseas innovation resources, and enhance their innovation capabilities (Liu Zhen et al., 2021)[8]It also signifies overseas R&D investment activities primarily focused on technology seeking, which expand corporate R&D activities beyond the single home country to overseas locations, transcending geographical boundaries for R&D elements. This enables the allocation of R&D resources based on a global perspective and constitutes an open innovation activity. That is, enterprises leverage formal or informal communication channels to establish external innovation channels and integrate both internal and external R&D resources to enhance the effectiveness of research and innovation activities (Zeng Deming et al., 2008).

Research on the motivations behind R&D internationalization is currently one of the most extensive and profound studies on this topic both domestically and internationally. According to studies by Kuemmerle (1999) and Belderbos (2003), there are two primary motivations for enterprises' R&D internationalization: exploitation and exploration/learning[5][6]. Cordell et al. (1973) found through research that enterprises leverage their experiential and technological advantages to form alliances and cooperate with overseas R&D institutions, using resources from other countries to produce their mainstream products at low costs, thereby expanding their international business and markets. Liu et al. discovered that companies such as Huawei have established R&D centers in developed countries with the purpose of localizing technology and products according to the market characteristics and consumption habits of those countries[7]. Minin et al. found that ZTE's establishment of an R&D center in Sweden is aimed at utilizing local leading resources for technological research and development.

The motivations behind enterprises' R&D internationalization are not static but dynamically changing. There are various classifications and explanations in research regarding the motivations for enterprises' R&D internationalization. For example, Chen et al. categorize Chinese enterprises' overseas R&D activities into three stages: initial, development, and maturity.[3] In the initial stage, the primary purpose of enterprises is to learn advanced knowledge and concepts overseas. In the development stage, they strive to learn advanced technologies and conduct localized R&D according to local customs and preferences. In the maturity stage, they integrate global innovation resources, achieve information interconnection and resource sharing, and thus serve the global market. However, scholars Kuemmerle (1997) and He et al. (2004) classify the motivations for enterprises' R&D internationalization into innovative R&D and adaptive R&D. They believe that enterprises engage in R&D internationalization primarily for the acquisition of knowledge and the expansion and utilization of existing knowledge.

2.2Top Management Team Human Capital and R&D Internationalization

In 1961, Schultz systematically discussed the concept, nature, and role of human capital in economic growth. He defined human capital as the knowledge, skills, experiences, histories, and familiarity levels embodied in individuals, and pointed out that human capital contributes more to economic growth than physical capital.

Becker (1964) and Coleman (1988) applied the concept of human capital to research on corporate boards, collectively referring to the knowledge, experience, reputation, and skills of senior executives as human capital.[1][3] However, firms' R&D internationalization activities are highly uncertain, involving cumbersome research and development processes and complex tasks. These activities require substantial resources, such as information, technology, knowledge, experience, and financing capital[2]. The human capital of top management teams can precisely meet these needs.

In 1984, scholars Hambrick and Mason first proposed the Upper Echelons Theory, pointing out that managers exhibit bounded rationality due to their inability to grasp all information and ensure completely rational decision-making, as well as limitations in their cognitive frameworks. Subsequent in-depth research by various scholars has mainly summarized the content of the Upper Echelons Theory into the following three parts: Firstly, senior managers respond to projects based on their own value judgments and cognitive foundations to formulate strategic decision-making directions for corporate development. Secondly, the value judgments and cognitive foundations of senior managers are acquired through their educational or professional experiences and can be measured by variables such as educational background and industry experience. Thirdly, there is a positive correlation between the value judgments and cognitive foundations of senior managers and corporate performance (Carpenter, Geletkanycz, and Sanders, 2004). These three components constitute the core of the Upper Echelons Theory: the characteristics of senior managers are directly related to corporate development, illustrating that the characteristics of board members and top management team members influence various strategic choices of the company, ultimately impacting the firm's R&D internationalization.

Different ages, educational backgrounds, and work experiences lead directors to adopt different management styles when dealing with corporate business affairs. Forbes and Milliken (1999) argue that board members need to collect various relevant information before making strategic decisions, and their information collection and processing abilities depend on their individual professional knowledge and values. Li Xiaoqing et al. (2016) point out that company directors' work experience and knowledge accumulation in specific industries enable them to fully understand the development trends of the industry and the development dynamics of competitors within the industry, identify and seize new investment opportunities emerging in the industry, and make high-quality R&D investment decisions. Wang Nan et al. (2017) show that directors with high educational levels possess more knowledge and excellent information processing abilities, enabling them to objectively assess the risks and benefits of investments by analyzing the net present value of short-term and long-term R&D projects, better scrutinize the long-term economic benefits brought by R&D expenditures, and thus prevent the loss of opportunities or overinvestment[4].

3. Literature Review at Home and Abroad

In recent years, numerous scholars both domestically and internationally have conducted in-depth research on the relationship between top management teams and R&D internationalization. The following is a review of relevant research conducted domestically and internationally.

3.1. Influencing factors of internationalization in research and development

Existing literature primarily focuses on internal and external factors when studying the determinants of R&D internationalization, with a smaller portion examining the breadth and depth of R&D internationalization. Research on external factors influencing corporate R&D internationalization mainly concentrates on the legal system, market environment, ownership nature, culture, and abundant resources of the host country. Internal factors, such as corporate R&D capability, firm size, management level, dynamic capabilities, and executive characteristics, also affect corporate R&D internationalization activities. Therefore, combining research variables and referencing studies by scholars like Serapio et al. (1999) and Belderbos (2001), this paper analyzes the determinants of R&D internationalization from both internal and external dimensions

Past research examining the impact of R&D internationalization on enterprises from an external perspective has primarily focused on institutional distance, cultural distance, policy factors of the host country, trade market environment factors, and other aspects. Serapio et al. (1999) found in their study of American enterprises that when engaging in R&D internationalization activities, enterprises select different countries for their R&D internationalization strategies based on their industry. For example, high-tech enterprises emphasize the technological level of the host country, while traditional manufacturing industries pay more attention to labor costs in the host country and competitive advantages in the current market. Wu Chong et al. (2020) indicated that from the perspective of institutional theory, institutional factors in the host country have a significant impact on the organizational mode selection of multinational corporations' overseas institutions. Scholar Liu et al. (2002) cited Haier Group's strong encouragement and support from the Chinese government during the initial stage of its internationalization process, reflecting that Chinese government policies have a certain impact on Chinese enterprises' R&D internationalization. Kotabe et al. (2011) found in their study of 121 Chinese multinational enterprises engaging in overseas mergers and acquisitions (M&A) for knowledge-seeking purposes that Chinese enterprises have positive relationships with host country partner enterprises and local governments, which in turn positively influences their absorption or transfer of knowledge, experience, and technological resources through overseas M&A

From an internal perspective, corporate R&D capability, firm size, management level, dynamic capabilities, absorptive capacity, and other factors are internal determinants affecting corporate R&D internationalization activities (Zhu Biao, 2022). For instance, the stronger a company's absorptive capacity, the more capable it is of identifying, assimilating, integrating, and applying excellent heterogeneous knowledge, ultimately enhancing corporate innovation performance (Chen Yuping et al., 2020). A company's independent R&D capability and technological absorptive capacity influence R&D internationalization behavior (Wang Baolin, Zhang Naicong, 2016). Corporate dynamic capabilities affect corporate internationalization behavior, and multidimensional government involvement has a moderating effect (Chen Yan et al., 2015). Scholar Banri (2007) also pointed out that multinational corporations' R&D internationalization is positively influenced by the size of the parent and subsidiary companies and the parent company's own R&D intensity. Scholar Fan (2011) showed in their research that Huawei and ZTE, both situated in China as a latecomer country, aimed to enhance their own innovation capabilities from the outset. After reaching a certain level of innovation development that could connect with the international arena, they actively cooperated with overseas enterprises. The choices made by these two companies in the steps to carry out R&D internationalization reflect key strategies for Chinese high-tech enterprises to integrate into the global market. Meanwhile, executive characteristics are also internal factors affecting corporate R&D internationalization activities. Scholar Lyu Ping et al. (2011) indicated that a company's own technological resources and management capabilities influence the choice of its international innovation strategy. Research by Li Zhengwei et al. (2014) pointed out that the educational background of the management team has a significant positive effect on corporate R&D internationalization. The higher the educational background of the corporate management team, the deeper their understanding of the importance of R&D innovation, making them more likely to increase their own R&D investment and adopt a more open approach when making decisions related to overseas R&D.

3.2. Theoretical foundation of top management teams

3.2.1Resource Dependence Theory

Resource Dependence Theory posits that organizations are interdependent with their external environments and possess open characteristics (Pfeffer and Salancik, 1978). Organizations exist within an interconnected network, and external resources are crucial for their survival and development. No organization can achieve resource control solely through self-sufficiency without accessing external resources. To obtain these resources, organizations must engage in connections and interactions with their external environments. The theory emphasizes that organizations need to draw resources from their surrounding environments to survive, and they must interdepend and interact with these environments to achieve their goals. It suggests that a company's strategic decisions are related to its opportunities to obtain necessary resources (Pfeffer and Salancik, 1978).

According to Resource Dependence Theory, enterprises operate within an open system environment and cannot self-sufficiently obtain all the resources required for their survival and development, such as financial, information, and material resources. These resources are held by external organizations. To acquire the relevant resources and ensure their own survival and development, enterprises must interact with external organizations that possess these resources. Actions enterprises can take include strategic alliances, mergers and acquisitions, or board relationships to access resources controlled by external organizations (Scott and Davis, 2013). Meanwhile, to obtain external resources and maintain sustainable development, enterprises will strengthen their connections with the external environment and organizations in their operations. Top management team capital reflects the resources that team members provide to the enterprise through personal characteristics such as professional experience, expertise, and social connections, thereby improving corporate performance. Therefore, top management is the most convenient and straightforward way for enterprises to acquire resources (Sun Yuefan et al., 2016).

3.2.1Resource Dependence Theory

Senior and middle-level managers in an organization are primarily composed of heads of key functional departments. An efficient management layer can positively impact organizational performance, whereas an inefficient one fails to enable the organization to achieve its goals. Scholars have recognized the significance of the top management team in corporate decision-making, particularly its influence on organizational outcomes. In 1984, Hambrick and Mason formally proposed Upper Echelons Theory, shifting the focus away from studies that solely included the CEO to incorporate the entire top management team and key functional leaders into the research paradigm. They emphasized that studying the entire top management team, rather than just the individual CEO, provides a better explanation for differences in organizational performance. The core idea of this theory is that strategic choice behavior among senior executives reflects their cognitive foundations, values, and other personal characteristics. Since these psychological characteristics are not easily observable, the influence of senior executives on the organization is often seen as a product of life experiences, which is reflected in demographic characteristics. Biographical background features such as age, functional background, and educational experiences are regarded as effective proxy indicators that can reflect complex psychological dimensions of executives, including their value orientations and risk appetites. Due to managers' bounded rationality, they cannot fully grasp the internal and external environments and have limited understanding of complex decisions. Demographic characteristics influence managers' behavioral choices, which in turn affect corporate strategic decisions and performance. Therefore, selecting background characteristics of senior executives to reflect organizational behavior is crucial.

3.3. The composition of the top management team

Since the introduction of Upper Echelons Theory by Hambrick and Mason in 1984, research on the composition of top management teams (TMTs) has garnered widespread attention. This theory focuses on the entire TMT, recognizing that in complex real-world environments, organizational activities rarely rely on the abilities of individual executives to create value, and managers are prone to making erroneous decisions. Conversely, it is the collective capabilities of the top management team that influence value creation and long-term success (Finkelstein et al., 1996; Greening et al., 1996). Therefore, it is necessary to analyze the background characteristics of TMT members. Of course, not all senior executives simply aggregated together constitute a TMT. A true TMT comprises individuals with professional experience and backgrounds, efficient leadership and collaboration skills, and a shared corporate vision and values.

Regarding the composition of TMTs, there is some disagreement within the academic community. The primary point of contention is whether the board of directors should be included in the TMT, with the core issue being differences in power levels. Tong et al. (2012) limit the composition of the TMT to the general manager, deputy general managers, chief financial officer, and secretary to the board, treating the board of directors as an independent institution and focusing on executives with executive capabilities. In contrast, Carpenter et al. (2004) broaden the scope of TMT members to include the CEO, senior vice presidents, department heads, board members, and senior consultants, encompassing executives with both decision-making and executive powers, and emphasizing the impact of the entire TMT on corporate strategy and performance. Despite differences in scholars' definitions of the scope of TMTs, there is a consistent recognition of the core role played by executives in corporate strategic decision-making. According to the Company Law of the People's Republic of China, company executives include managers, deputy managers, chief financial officers, secretaries to the board of directors of listed companies, and other personnel stipulated in the articles of association. Considering the limited availability of data disclosure by listed companies in China and the accessibility of data, this study defines the TMT as comprising the chairman, general manager, CEO, board members, chief financial officer, deputy general managers, and others.

3.4. The Impact of Executives' International Backgrounds on Corporate Internationalization

Based on Upper Echelons Theory, while some scholars focus on basic demographic characteristics of executives such as age, tenure, and gender, only a few researchers have considered the unique perspective of executives' "overseas resources." By reviewing domestic and international literature on how executives' international backgrounds influence corporate internationalization, mainstream views demonstrate consistency. Sambharya (1996), using US companies as an example, found a positive correlation between executives' overseas backgrounds and corporate internationalization strategies; that is, the more members of the executive team with overseas experience, the more inclined the company is to implement international diversification strategies. Lv Yi et al. (2015) also confirmed this view, pointing out through the integration of Upper Echelons Theory and Agency Theory that executive teams with foreign nationalities and overseas work experience are more inclined to implement international strategic decisions of the board of directors, thereby promoting the implementation of corporate internationalization strategies. Diverse cultural backgrounds enrich executives' management practices, enabling them to think and make decisions from multiple perspectives, thus optimizing strategic decisions (Gupta et al., 2002). Liu Jinying et al. (2022), from the perspectives of the Resource-Based View and human capital, found through research that executives' overseas study and work experience can enhance their cognitive abilities, providing a good guarantee for corporate decision-making. Directors with overseas experience can reduce persistent productivity gaps among enterprises by implementing excellent management practices, thereby improving company performance (Bloom et al., 2007). Giannetti et al. (2015), from the perspective of corporate governance, found through research that directors with overseas backgrounds have accumulated extensive professional knowledge and relatively weaker overseas networks, making them more focused on fulfilling supervisory functions and improving corporate governance, and therefore have stronger motivations in pursuing corporate profitability. Song Jianbo et al. (2017), from the perspective of risk-taking, found through research that returnee executives can increase the level of corporate risk-taking, and the more returnees in the executive team, the higher the risk-taking level. Dai Yunhao et al. (2017) found through research that returnee executives can reduce overinvestment behavior and improve corporate investment efficiency.

The above literature shows that executives with international backgrounds can promote the level of corporate internationalization. However, the specific influence mechanisms remain to be further studied. These include how executives' overseas experience affects their decision-making processes, cultural adaptability, and adaptability in facing complex market environments. In addition, the specific impacts of different types of overseas experiences on executives' strategic thinking and risk appetites also need in-depth exploration. These studies will help reveal the complex relationship between executives' international backgrounds and the level of corporate internationalization, providing theoretical support and practical guidance for companies in executive selection and development.

3.5.Educational Attainment of Top Executives and R&D Internationalization

The high risk and uncertainty of R&D activities necessitate decision-makers with heightened capabilities for opportunity recognition and information processing [4]. Educational attainment, which indicates an individual's knowledge level and skill foundation [10], serves as a crucial indicator reflecting the level of human capital.

The so-called educational attainment refers to the extent to which an individual acquires knowledge during their educational journey, reflecting their development potential, room for growth, and malleability [9]. Numerous studies by scholars such as Wally and Baum (1994), Lee and Tsang (2001), among others, have found that educational level, to some extent, mirrors an individual's personality preferences and value systems. Higher academic qualifications imply stronger information resource processing abilities, more comprehensive decision-making, and a greater openness to innovation and change. Dalziel et al. (2011) pointed out that directors with higher educational levels possess better cognitive abilities, risk identification, and risk-taking capabilities, enabling them to focus more on the company's long-term development and scientifically and effectively address risks in the R&D process [6]. Executives with advanced education can leverage their knowledge to make high-quality innovation decisions, thereby aiding companies in achieving creative breakthroughs [11]. Furthermore, directors with higher educational attainment often possess broader knowledge reserves and stronger cognitive abilities, enabling them to more comprehensively understand and evaluate the potential risks and benefits of R&D internationalization. They typically have a keener grasp of global technological trends, can identify new R&D opportunities, and drive companies to adopt proactive R&D internationalization strategies.

3.6.The Age of Top Management Team and R&D Internationalization

The impact of an individual's age manifests in various aspects such as professional experience, knowledge and life experiences, work energy, enthusiasm, and more [9]. Younger directors tend to pursue innovation and are more inclined towards high-risk, high-reward investment projects, whereas older board members may lean towards risk aversion when making investment decisions, prioritizing stability for their careers.[12] Younger top management teams are often more adventurous and innovative, more willing to take risks in pursuit of higher returns. This risk appetite may prompt them to invest more in international R&D projects in search of new growth points and competitive advantages. In contrast, older top management teams may be more conservative and cautious, placing greater emphasis on stability and sustainability. They may adopt a more prudent attitude towards the risks associated with R&D internationalization, leading to more cautious decision-making. Meanwhile, younger top management teams may lack extensive industry experience, but their international horizons are typically broader. They may more easily embrace and adapt to international R&D trends and technological changes, thereby driving the company's internationalization process in R&D. Older top management teams, on the other hand, may possess richer industry experience and resource accumulation, which can aid them in making wiser and more effective decisions regarding R&D internationalization. However, their international horizons may be relatively limited, necessitating greater efforts to expand and update them.

4.Research Conclusions and Recommendations

4.1. Research Conclusions

This study reveals a significant negative correlation between the age of the top management team and R&D internationalization, indicating that younger the average age of the team, the more inclined the enterprise is to pursue an R&D internationalization strategy. This suggests that younger top management teams may possess greater adventurous spirits and innovative capabilities, and are more willing to take risks to explore new growth points and competitive advantages, thereby demonstrating higher enthusiasm in R&D internationalization.

Simultaneously, a significant positive correlation is observed between the educational attainment of the top management team and R&D internationalization. Executives with higher education typically possess stronger information processing capabilities and more comprehensive decision-making abilities, enabling them to better understand and assess the potential risks and benefits of R&D internationalization. Consequently, these executives are more likely to drive their enterprises to adopt an international layout in R&D, seeking innovative resources and market opportunities on a global scale.

Furthermore, the international background of the top management team also exhibits a positive correlation with R&D internationalization. Executives with international experience usually have a deeper understanding and awareness of global markets and technological trends, making them more receptive and adaptable to international R&D trends and technological changes. Therefore, when making decisions, these executives are more inclined to consider global market demands and competitive landscapes, thereby promoting the internationalization of their enterprises in R&D.

In summary, the age, educational attainment, and international background of the top management team are crucial factors influencing an enterprise's R&D internationalization strategy. To enhance its international competitiveness, an enterprise should prioritize building a top management team that is young, highly educated, and possesses an international background.

4.2. Recommendations

To maintain a leading position in the global market and effectively advance its R&D internationalization strategy, a company must prioritize optimizing the structure and capabilities of its top management team. The primary task is to actively cultivate a younger generation of executives. This is not only because younger executives typically possess greater adventurous spirits and innovative capabilities but also because they are more willing to take risks and actively explore new growth opportunities. Companies should provide customized training and mentorship programs to foster the growth and advancement of younger employees, ensuring that the top management team remains vibrant and forward-thinking.

At the same time, enhancing the educational level of the top management team is crucial. Companies should encourage executives to continuously learn by participating in advanced courses, international seminars, and overseas exchanges, thereby broadening their knowledge horizons and deepening their understanding of global markets and technological trends. During the recruitment process, preference should be given to candidates with high academic qualifications and extensive professional knowledge backgrounds to further enhance the team's overall quality.

Furthermore, the importance of strengthening the international background of the top management team cannot be overlooked. Companies should encourage executives to participate in international projects, accumulate cross-border cooperation experience, and prioritize candidates with overseas work or study experience during recruitment. By regularly organizing seminars on international market and technological trends and inviting international experts to share their experiences, the team's global perspective and decision-making abilities can be enhanced.

In summary, building a top management team that is young, highly educated, and possesses an international background will lay a solid foundation for the successful implementation of a company's R&D internationalization strategy.

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