Organization innovation practices, talent management and research and development effectiveness: Basis for talent driven innovation framework

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Abstract

A strong employee productivity rests on three key pillars: organization innovation practices, talent management, and research and development effectiveness. This study aims to test the relationship between innovation practices, talent management, and R&D effectiveness of technology companies and develop a talent driven innovation framework. It adopted a descriptive design method with 436 employees from various technology companies as participants of the study. A self-structured survey questionnaire was used to conduct the study and the result was tabulated and analyzed using SPSS v.28. The study revealed that technology companies have good organizational innovation practices such as user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation as agreed by the respondents. The respondents have good evaluation on talent management in terms of skills training, skill matching, talent acquisition, and growth incentives. Research and development activities are effective in terms of output, resource utilization efficiency, and risk control as agreed by the respondents. Highly significant relationships exist between innovation practices, talent management, and R&D effectiveness in technology companies. A talent driven innovation framework for technology companies was developed.

Keywords: organizational innovation, talent management, R&D effectiveness, technological development strategy, innovation practices

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1. Introduction

In an era of globalization and rapid technological advancement, tech companies face unprecedented market competition pressures and development opportunities. Organizations can develop strategies to enhance employee productivity and thrive in this dynamic environment by recognizing both the challenges and opportunities presented by globalization and technological advancement. A strong employee productivity rests on three key pillars: organization innovation practices, talent management, and research and design(R&D) effectiveness.

Organizational innovation practices involve not only new product development but also comprehensive innovations in processes, services, management practices, and even business models. Xu (2023) emphasizes the role of capital market innovation in empowering the real economy, while Sun et. al.,(2024) analyze the logic and path of new quality productivity from the perspective of an innovation-driven development strategy. Talent management is a crucial support for organizational innovation, essential for stimulating employees' innovation potential and enhancing organizational performance. Chen et. al.,(2021) conducted an empirical analysis of provincial panel data from mainland China, exploring the relationship between science and technology human resources, science and technology associations, and technological innovation performance, revealing the important role of human resources in technological innovation. Additionally, Zheng (2020), explored the challenges faced by private enterprises during strategic expansion and proposed strategies such as increasing R&D investment, optimizing resource utilization, and improving risk control mechanisms to enhance capabilities and reduce risks. A company's R&D capability depends not only on the amount of R&D investment but also on the effective utilization of R&D resources and the effective control of innovation risks.

As market competition intensifies, companies must continuously innovate to adapt to ever-changing market demands. However, implementing innovation is not easy and requires in-depth exploration and practice in talent management, R&D investment, and organizational culture. Innovation is the core driver of economic development and has strategic significance for building a modern economic system and achieving high-quality development of the real economy. The importance of organizational innovation has been widely recognized in current academic research and industrial practice. This concept is seen as a core driving force for companies to adapt to rapidly changing market environments and technological advancements. With the intensification of global competition and the acceleration of technological innovation, organizational innovation is not only related to the survival of enterprises but also is key to their long-term development. However, despite the widespread recognition of the importance of organizational innovation, academic discussions on how to effectively implement it remain very active. However, despite the relatively rich literature on organizational innovation and talent management, existing research often fails to fully explore how these factors interact to enhance employee productivity. In particular, there has been little in-depth research and analysis on the specific impact of R&D management practices on employee productivity. This leads to certain challenges and gaps when constructing a talent driven innovation framework that integrates organizational innovation, talent management, and R&D effectiveness.

This study aims to fill these gaps by providing a comprehensive analytical framework to explore the following questions: how organizational innovation practices, talent management strategies, and R&D management practices interact, and how they jointly influence the improvement of employee productivity. Existing research predominantly focuses on the macro level of innovation, with insufficient analysis of the specific impacts at the micro level, such as user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation, particularly in the context of technology companies. Additionally, while the importance of talent management is widely recognized, research on its multi-dimensional

assessment, including skills training, skills matching, talent acquisition, and growth incentives, remains inadequate. Similarly, evaluation mechanisms for R&D effectiveness often concentrate on R&D output, with insufficient attention given to other critical dimensions such as resource utilization efficiency and risk control.

Objectives of the Study - This study aimed to test the relationship between innovation practices, talent management, and R&D effectiveness of technology companies and develop a talent driven innovation framework. Specifically, this study aimed to identify organizational innovation practices, such as user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation. It also described the talent management in terms of skills training, skill matching, talent acquisition, and growth incentives. Furthermore, the study evaluated R&D effectiveness in terms of output, resource utilization efficiency, and risk control. The research also examined the significant relationships between innovation practices, talent management, and R&D effectiveness in technology companies and developed a talent driven innovation framework.

2. Methods

Research Design - This study adopted a descriptive design method as the primary research approach because descriptive design focuses on describing, analyzing, and explaining phenomena or social phenomena. The study conducts comprehensive and in-depth investigations into key aspects of innovation practices, talent management, and R&D effectiveness in technology companies by developing detailed questionnaires.

Participants of the Study - The participants in this study are employees from various technology companies, with a total of 436 questionnaires distributed. These employees come from different departments and levels, possessing rich practical experience and professional knowledge, thus their responses will have wide representativeness and diversity. When selecting participants, this study fully considers factors such as the size of technology companies, industry status, and geographical distribution, ensuring the broadness and representativeness of the sample. During the data collection process, this study will strictly adhere to ethical standards to ensure the privacy and rights of participants are protected. All participants will voluntarily participate in this study after fully understanding the research purpose and methods, and they have the right to withdraw from the study at any time. Additionally, to ensure the accuracy and reliability of the data, the study will conduct strict scrutiny and screening of the questionnaires, as well as clean and organize the collected data. The participants in this study encompass technology companies of different scales and types, ensuring the representativeness and diversity of the sample. Sample selection is based on multiple dimensions such as the company's industry status, innovation capabilities, talent management practices, and R&D effectiveness, ensuring the wide applicability of the research results.

Data Gathering Instruments - To effectively collect and analyze data on organizational innovation practices, talent management, and R&D effectiveness in technology companies, this study employs a structured questionnaire as the data collection tool. This tool primarily includes a detailed questionnaire designed to systematically record, measure, and interpret the key variables needed for the research. The questionnaire is closely aligned with the research objectives and the various aspects that need to be evaluated, ensuring data comprehensiveness and relevance. It is divided into several main sections, each designed with corresponding questions and scales for different research areas.

Innovation Practices Section: This section contains questions about user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation. The questions aim to understand the company's specific practices, level of investment, and effectiveness in these innovation practices.

Talent Management Section: Focused on skills training, skill matching, talent acquisition, and growth incentives, this section includes questions to understand the company's strategies and effectiveness in talent management. The questions encompass both objective management measures and employees' subjective perceptions and evaluations of these measures.

R&D Effectiveness Section: This section primarily addresses R&D output, resource utilization efficiency, and risk control. By including questions on specific R&D project data, resource investment, and risk control measures, it collects information on the company's effectiveness in R&D activities. To ensure data accuracy and reliability, the questions in the questionnaire use a Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The Likert scale is mainly used to measure employees' perceptions and evaluations of innovation practices, talent management, and R&D effectiveness, as well as these internal practices within the company.

Data Gathering Procedure - The data collection process first involves a thorough analysis of the current research status regarding managerial cognition, organizational learning capability, and innovation practices to identify gaps in the research and formulate research questions. Subsequently, based on the literature related to the research variables, a questionnaire was designed and the questionnaire results were analyzed. Before collecting data, experts validated the questionnaire content. Following this, a pilot survey was conducted to determine the consistency of the three variable indicators. The data from the pilot survey were used to test its reliability. After the reliability test, the researchers obtained permission from organizational leaders to collect data through methods such as email and online platforms.

Ethical Considerations - The ethical considerations of this study primarily include ensuring the confidentiality and anonymity of the respondents. Participation in the survey will be entirely voluntary, and respondents will be explicitly informed of the purpose of the study, with an assurance that their responses will be used solely for research purposes. Data will be securely stored, and only aggregated results will be reported, ensuring that individual responses cannot be traced back to specific participants. These measures are crucial for maintaining ethical standards in the research and ensuring the integrity of the study.

Data Analysis - The collected data in this study were comprehensively analyzed using SPSS 28 statistical software. Initially, a descriptive statistical method was employed to provide an overview of the data, laying the foundation for understanding the general trends and patterns in innovation practices, talent management, and R&D effectiveness within technology companies. To assess the impact of organizational innovation practices (such as user-driven innovation, technology-oriented innovation, market-oriented innovation, rapid iterative innovation) on R&D effectiveness, Spearman's rho correlation analysis was utilized. This method allowed us to explore relationships between variables that are not normally distributed, without being limited by linear relationships. In the realm of talent management, we focused on aspects such as skills training, skill matching, talent acquisition, and growth incentives. To evaluate how these practices influence employee productivity and R&D effectiveness, we also employed Spearman's rho correlation analysis. When evaluating R&D effectiveness, factors such as R&D output, resource utilization efficiency, and risk control were considered. To delve into the relationships between these indicators and how they are influenced by innovation practices and talent management, we again used Spearman's rho correlation analysis. To test the significant relationships between innovation practices, talent management, and R&D effectiveness within technology companies and confirm the study's hypotheses, we used the Shapiro-Wilk test to assess the normality of each variable. The test results indicated that all variables had p-values less than 0.05, indicating a non-normal distribution of the dataset. Therefore, Spearman's rho was employed as part of the non-parametric testing to determine significant relationships between variables. All analyses were conducted using SPSS version 28.

3. Results and discussion

Table 1 illustrates the impact of different innovation practices on technology companies. The table shows an overall weighted average of 3.03, falling within the "Agree" range, indicating a general consensus among respondents that innovative practices in technology companies have a positive impact. This finding is crucial for understanding how innovation practices drive growth and competitiveness in technology companies.

Table 1

Summary Table on the Impact of Innovation Practices of Technology Companies

Key Result Areas	Composite Mean	VI	Rank
User-driven Innovation	2.93	Agree	4
Technology-oriented Innovation	3.07	Agree	1.5
Market-oriented Innovation	3.07	Agree	1.5
Rapid Iteration Innovation	3.05	Agree	3
Grand Composite Mean	3.03	Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Both technology-oriented and market-oriented innovation practices achieved the highest weighted average (3.07), tying for first place. This indicates that technology companies have achieved significant success in both these areas of innovation. The reason may lie in technology-oriented innovation helping companies maintain a technological edge, while market-oriented innovation ensures products and services meet customer needs. This dual-oriented innovation practice is crucial for the success of technology companies.

In recent years, more research has supported this point. Technology companies need to simultaneously focus on technological development and market demand to achieve sustained growth. Digital transformation plays a positive role in strengthening the effects of expanding market demand and reducing market concentration on enhancing technological innovation performance. Heterogeneity analysis further revealed that digital transformation has a more significant effect on reducing market concentration and improving technological innovation performance in state-owned enterprises, mature enterprises, central and western regions, and regions with lower levels of marketization. In a rapidly changing business environment, technological advancement and market uncertainty pose challenges to innovation for companies. Wang (2024) explored the impact of technological volatility and market volatility on enterprise innovation performance, emphasizing the need for companies to understand and adapt to both types of volatility and find a balance between them to achieve sustainable competitive advantages and growth.

User-driven (2.93) and rapid iterative (3.05) innovation practices closely follow, indicating their significance for technology companies as well. User-driven innovation ensures companies optimize products based on customer feedback, while rapid iteration helps companies respond quickly to market changes. This flexibility and adaptability are particularly crucial for technology companies.

Although user-driven innovation practices scored high, their weighted average is slightly lower compared to technology-oriented and market-oriented innovation. This may be because technology companies often prioritize technological and market factors while overlooking the importance of user feedback. However, as customer demands become increasingly diverse and personalized, user-driven innovation practices will become more critical. Neglecting user feedback can lead to a disconnect between product innovation and the market, affecting product competitiveness. Additionally, user-driven innovation practices help companies better understand customer needs, leading to the development of products that better meet market demands. Peng et al. (2021) proposed a data-driven modeling approach that, under user-driven demand, effectively characterizes complex response characteristics and optimizes pricing strategies, providing a new perspective for the power grid technology field. Zhao et al. (2022) focused on furniture product design, emphasizing design methods driven by user needs to meet personalized and humanized requirements through integrating various theories and methods. Huang et al. (2023) proposed an approach from the perspective of publishing knowledge services, advocating user-driven approaches to promote the development of personalized products through optimizing platform functionality and services, enhancing user experience and value delivery.

Table 2 provides an overview of four key dimensions of talent management in companies: skills training, skills matching, talent acquisition and growth incentives, along with their respective weighted average scores. The overall weighted average is 3.00, indicating a general agreement among respondents regarding current talent management practices. This finding is crucial for understanding the current status of talent management in

companies, identifying potential areas for improvement, and predicting impact on organizational performance.

Table 2

Summary Table on Talent Management

Key Result Areas	Composite Mean	VI	Rank
Skills Training	3.11	Agree	1
Skills Matching	2.96	Agree	3
Talent Introduction	3.00	Agree	2
Growth Incentives	2.91	Agree	4
Grand Composite Mean	3.00	Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Among the four key outcome areas, skills training has the highest weighted average score of 3.11, indicating that respondents generally consider skills training to be the most important aspect of current talent management. This may be related to the emphasis on skill enhancement and continuous learning in recent years. Skills training has a significant positive impact on employee satisfaction, performance, and organizational competitiveness. Therefore, companies may view skills training as a key means to improve employee capabilities and organizational performance. Chen (2024) emphasized in their study the important role of employee skills training in promoting innovation performance, stating that companies optimize their human capital structure through training to adapt to the era of innovation-driven development, thereby enhancing their competitiveness. Zhang (2021) also showed in their study that training plays an important role in driving skill iteration and updating, contributing to promoting the innovation activities of companies.

Following closely are talent acquisition (3.00) and skills matching (2.96), both of which are also recognized by respondents. Talent acquisition is seen as an important way to enhance organizational vitality and innovation capabilities, while skills matching helps optimize human resource allocation and improve work efficiency. Sun (2023) research indicated that compared to talent acquisition policies focused on quantity, government's structured talent acquisition policies are more conducive to enterprise innovation and can build a "reverse aggregation" talent structure within cities (industries), which is one of the important mechanisms for government to promote enterprise innovation. Du et. al.,(2023), from the perspective of universities, discussed the importance of building an innovative talent team for universities to maintain competitive advantages and achieve development, emphasizing that universities can optimize their teaching staff and improve education levels by strengthening the introduction of innovative talents, thereby promoting comprehensive development of education innovation and research capabilities. Li et al. (2023) explored the impact of structured talent acquisition policies on regional technological innovation capabilities from the perspective of regional technological development. Based on panel data from 15 new first-tier cities, the study established a model based on structured talent acquisition policies, talent density, and regional technological innovation capabilities, finding that structured talent acquisition policies significantly promote regional technological innovation capabilities, especially when there are more universities, the improvement effect is more pronounced.

In contrast, growth incentives have the lowest weighted average score of 2.91. This may reflect the current inadequacy of companies in incentive mechanism design, failing to fully stimulate employee enthusiasm and innovation potential. Li (2023) deeply explored the driving mechanism of high-quality development in China's manufacturing industry based on talent factors in their doctoral dissertation. The study pointed out that in the knowledge economy era, new factors such as talents have become the source of innovation and development, and talent-driven is the key driving mechanism for economic development. Building a dynamic, empowering, and driving talent factor system is an important way to achieve high-quality development in the manufacturing industry. The dynamic, empowering, and driving characteristics of the talent factor system collectively constitute the driving mechanism for high-quality development in the manufacturing industry, and effective growth incentives are crucial for employees' career development, job satisfaction, and loyalty. Therefore, companies need to re-examine and improve their growth incentive mechanisms.

Table 3 is a summary table about R&D effectiveness, aiming to summarize key result areas in R&D activities and evaluate the performance of these areas through Composite Mean and respondent viewpoints (VI). The table shows an overall composite mean of 3.00, indicating a general agreement among respondents regarding the effectiveness of R&D activities. This finding is crucial for guiding future R&D strategy development and resource allocation.

Table 3

Summary Table on R&D Effectiveness

Key Result Areas	Composite Mean	VI	Rank
R&D Outputs	2.93	Agree	3
Resource Utilization Efficiency	3.08	Agree	1
Risk Control	2.99	Agree	2
Grand Composite Mean	3.00	Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Firstly, worth noting is the indicator "Resource Utilization Efficiency," with a weighted average of 3.08, ranking first among all indicators. This indicates widespread recognition of the efficiency of resource utilization in R&D activities. This may be due to the introduction of modern management concepts and technologies such as Lean R&D and Agile Development, which help optimize resource allocation and improve R&D efficiency. Yin et. al.,(2024) explored these factors and their intrinsic relationship with corporate innovation performance from the perspectives of government support and IT resources, using Root Theory analysis method with Xi Liquor Company as an example. The study found that government R&D subsidies and tax incentives promote corporate innovation performance, with R&D subsidies showing a more significant effect. Additionally, the company's IT infrastructure, data information, and personnel, among other IT resources, positively impact corporate innovation performance. Government support and IT resources as the foundation of corporate resources contribute to digital innovation in areas like technology application, business model transformation, and data utilization, thereby enhancing corporate innovation performance.

Wei et. al.,(2024) empirically analyzed the impact of digital finance on corporate innovation performance using panel data from Chinese listed companies on the Shanghai and Shenzhen stock exchanges from 2011 to 2021. They examined the transmission effect of financial resource allocation efficiency. The results showed that the development of digital finance enhances corporate innovation performance and plays an important role through improving financial resource allocation efficiency. Further research found a significant threshold effect of digital finance and financial resource allocation efficiency on corporate innovation performance, with this positive impact increasing with higher threshold values. Heterogeneity tests also indicated a more significant promoting effect in non-state-owned enterprises. Zhou et. al.,(2024) conducted an empirical study on 221 user entrepreneurial enterprises embedded in mass innovation spaces by constructing a matching model of resource innovation capability, entrepreneurial mode, and innovation performance. The results showed that resource acquisition innovation capability helps user entrepreneurs choose collaborative entrepreneurial modes and improve survival performance; resource utilization innovation capability helps choose autonomous entrepreneurial modes and promote growth performance. Furthermore, entrepreneurial mode plays a partial mediating role in the relationship between resource innovation capability and entrepreneurial performance, and the dual network embedding of mass innovation spaces has a positive moderating effect on these relationships.

Secondly, the second and third-ranking indicators are "Risk Control" (2.99) and "R&D Output" (2.93), respectively. The proximity of the weighted averages of these indicators suggests that risk management and R&D output are both important considerations in the R&D process. The importance of risk control lies in its ability to reduce the risk of project failure and safeguard investment returns; R&D output is directly related to the final value of R&D activities.

Wang et. al.,(2022) pointed out in their study that effective risk management significantly improves the success rate of small and medium-sized enterprises in the R&D stage of innovative drug projects. They believe

that the core goal of risk management is to ensure the long-term stable operation of enterprises by minimizing or accepting various risks that affect enterprises, thereby providing security for the sustainable development of enterprises.

Lastly, it is worth noting that while all indicators' weighted averages reached the "Agree" level, there was no "Strongly Agree" evaluation. This may indicate room for improvement in R&D activities. Future research can further explore how to improve the overall effectiveness of R&D activities through process optimization, introduction of new technologies, or improvement of management strategies.

Table 4

Relationship Between Innovation Practices and Talent Management

Variables	rho	p-value	Interpretation
User-driven Innovation			
Skills Training	0.575**	< .001	Highly Significant
Skills Matching	0.435**	< .001	Highly Significant
Talent Introduction	0.420**	< .001	Highly Significant
Growth Incentives	0.321**	< .001	Highly Significant
Technology-oriented Innovation			
Skills Training	0.519**	< .001	Highly Significant
Skills Matching	0.391**	< .001	Highly Significant
Talent Introduction	0.387**	< .001	Highly Significant
Growth Incentives	0.352**	< .001	Highly Significant
Market-oriented Innovation			
Skills Training	0.515**	< .001	Highly Significant
Skills Matching	0.387**	< .001	Highly Significant
Talent Introduction	0.392**	< .001	Highly Significant
Growth Incentives	0.357**	< .001	Highly Significant
Rapid Iteration Innovation			
Skills Training	0.539**	< .001	Highly Significant
Skills Matching	0.411**	< .001	Highly Significant
Talent Introduction	0.367**	< .001	Highly Significant
Growth Incentives	0.372**	< .001	Highly Significant

**. Correlation is significant at the 0.01 level

Through a detailed analysis of the data provided in Table 4, it will reveal how different innovation practices impact an organization's talent management strategy. Based on the data shown in Table 4, the correlation between sub-variables of innovation practices and talent management has been quantified using rho values. Specifically, user-driven innovation shows a rho value of 0.575 in terms of skills training, indicating a strong positive correlation between the two. Skill matching and talent acquisition also exhibit significant positive correlations, with rho values of 0.435 and 0.420, respectively. Growth incentives and talent management have a rho value of 0.321, indicating a relatively weaker but still positive correlation. Both technology-oriented innovation and market-oriented innovation also display similar positive correlation patterns across talent management sub-variables. Rapid iterative innovation also shows positive correlations across various aspects of talent management, with a rho value of 0.539 for skills training, indicating a strong correlation.

All sub-variables show correlations with p-values less than 0.01, which is considered highly significant in statistics. This result indicates strong statistical evidence for the correlation between different innovation practices and talent management, ruling out the possibility of randomness. Different innovation practices all have a significant positive impact on talent management. These results suggest that innovation practices are not only means for organizations to pursue technological advancement and market competitiveness but also crucial factors in optimizing talent management strategies and enhancing talent effectiveness. The sub-variables of innovation practices, including user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation, all exhibit positive correlations with key aspects of talent management—skills training, skill matching, talent acquisition, and growth incentives. These results suggest that organizations, when implementing innovation practices, should consider how to attract, develop, and motivate

talent through different innovation practices, thereby improving the overall effectiveness of talent management. Luo (2020) pointed out in their study that innovation practices not only drive the transformation of auditing work from traditional error correction to performance management but also promote the sustainable and healthy development of railway economics. Additionally, the role of talent management in innovation practices is crucial. Deng (2022) discussed in their paper the importance of talent incentives in stimulating innovation capabilities and initiative, highlighting its key role in promoting orderly activities and providing momentum for social and economic development.

Table 5

Relationship Between Innovation Practices and R & D Effectiveness

Variables	rho	p-value	Interpretation
User-driven Innovation			
R&D Outputs	0.246**	< .001	Highly Significant
Resource Utilization Efficiency	0.341**	< .001	Highly Significant
Risk Control	0.574**	< .001	Highly Significant
Technology-oriented Innovation			
R&D Outputs	0.269**	< .001	Highly Significant
Resource Utilization Efficiency	0.311**	< .001	Highly Significant
Risk Control	0.496**	< .001	Highly Significant
Market-oriented Innovation			
R&D Outputs	0.262**	< .001	Highly Significant
Resource Utilization Efficiency	0.361**	< .001	Highly Significant
Risk Control	0.581**	< .001	Highly Significant
Rapid Iteration Innovation			
R&D Outputs	0.291**	< .001	Highly Significant
Resource Utilization Efficiency	0.285**	< .001	Highly Significant
Risk Control	0.548**	< .001	Highly Significant

**. Correlation is significant at the 0.01 level

The data in Table 5 displays the strength of correlation between sub-variables of innovation practices and R&D effectiveness through rho values. Specifically, the rho value between user-driven innovation and R&D output is 0.246, indicating a positive correlation, albeit relatively weak. The correlation between technology-oriented innovation and R&D output is slightly higher, with a rho value of 0.269. Market-oriented innovation and rapid iterative innovation show moderate positive correlations with R&D output, with rho values of 0.262 and 0.291, respectively. In terms of resource utilization efficiency and risk control, each sub-variable of innovation practices also demonstrates significant positive correlations, with risk control showing the strongest correlation, ranging from 0.574 to 0.581.

All sub-variables show correlations with p-values less than 0.01, which is considered highly significant in statistics. This result indicates strong statistical evidence for the correlation between different innovation practices and R&D effectiveness, ruling out the possibility of randomness. Innovation practices all have a significant positive impact on R&D effectiveness. Particularly, risk control shows very significant correlations with various sub-variables of innovation practices, which may imply that effective risk management is crucial for enhancing the efficiency and output of R&D activities within innovation practices.

The sub-variables of innovation practices, including user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation, all exhibit positive correlations with three key indicators of R&D effectiveness—R&D output, resource utilization efficiency, and risk control. These results suggest that organizations, when implementing innovation practices, should consider how to optimize the output and efficiency of their R&D teams through different innovation strategies. These findings align with existing literature, emphasizing the role of innovation practices in enhancing R&D effectiveness.

Shen (2023) proposed that through knowledge management, enterprises can efficiently integrate information resources, develop latent value, and promote corporate culture construction and innovation activities. Additionally, Zhou (2019) in their doctoral dissertation extensively explored the significantly positive impact of

knowledge management on enterprise technological innovation performance, pointing out that improving infrastructure, building platforms, and establishing incentive mechanisms can effectively enhance technological innovation performance. Shen (2023) further emphasized the importance of innovative knowledge management in enterprises, stating that it plays a crucial role in driving innovative archival work in companies. Meanwhile, Xiong (2020) also noted that library knowledge management plays a crucial role in modern library management, with its innovative strategies having positive implications for theoretical development, content creation, and personnel services in libraries.

Table 6

Relationship Between Talent Management and R & D Effectiveness

Variables	rho	p-value	Interpretation
Skills Training			
R&D Outputs	0.264**	< .001	Highly Significant
Resource Utilization Efficiency	0.319**	< .001	Highly Significant
Risk Control	0.534**	< .001	Highly Significant
Skills Matching			
R&D Outputs	0.325**	< .001	Highly Significant
Resource Utilization Efficiency	0.399**	< .001	Highly Significant
Risk Control	0.424**	< .001	Highly Significant
Talent Introduction			
R&D Outputs	0.322**	< .001	Highly Significant
Resource Utilization Efficiency	0.377**	< .001	Highly Significant
Risk Control	0.403**	< .001	Highly Significant
Growth Incentives			
R&D Outputs	0.724**	< .001	Highly Significant
Resource Utilization Efficiency	0.314**	< .001	Highly Significant
Risk Control	0.340**	< .001	Highly Significant

**. Correlation is significant at the 0.01 level

Table 6 aims to delve into the interaction and statistical significance between talent management and R&D effectiveness. Through a meticulous analysis of the relevant data, it reveals the specific impact of each sub-variable of talent management on R&D effectiveness. The data displays the strength of relationship between each sub-variable of talent management and R&D effectiveness through rho values. Specifically, the rho value between skill training and R&D output is 0.264, indicating a positive correlation, albeit relatively weak. The rho value for resource utilization efficiency is 0.319, while the rho value for risk control is as high as 0.534, indicating a more significant positive correlation with R&D output. The rho values for skill matching, talent introduction, and growth incentives with R&D output are 0.325, 0.322, and 0.724, respectively, showing from moderate to extremely strong positive correlations. All sub-variables show correlations with p-values less than 0.01, which is considered highly significant in statistics. This result indicates strong statistical evidence for the correlation between various aspects of talent management and R&D effectiveness, ruling out the possibility of randomness.

Overall, various aspects of talent management have a significant positive impact on R&D effectiveness. Particularly, the correlation between growth incentives and R&D output is particularly prominent, implying that the design of incentive mechanisms in talent management practices is crucial for stimulating the innovation potential of R&D teams and improving output efficiency. The sub-variables of talent management, including skill training, skill matching, talent introduction, and growth incentives, all exhibit positive correlations with three key indicators of R&D effectiveness R&D output, resource utilization efficiency, and risk control. These results suggest that through effective talent management strategies, organizations can optimize the skills and incentive mechanisms of their R&D teams, thereby enhancing the efficiency and output of R&D activities.

These findings align with existing literature, emphasizing the role of talent management in enhancing R&D effectiveness. Zhou (2022) pointed out in their research that the application of informatization concepts and technological methods has a significant effect on optimizing talent management and scientific research and

development. Additionally, Song et al. (2019) explored new methods for agile full-process R&D teams in a VUCA environment from the perspective of employee efficiency perception. They emphasized that by optimizing the environment of employee efficiency perception, promoting individual leadership and the development of self-organized teams, as well as achieving self-integration of R&D personnel's values and attitudes at the project level, can effectively promote the agile transformation of R&D teams, thereby enhancing R&D effectiveness.

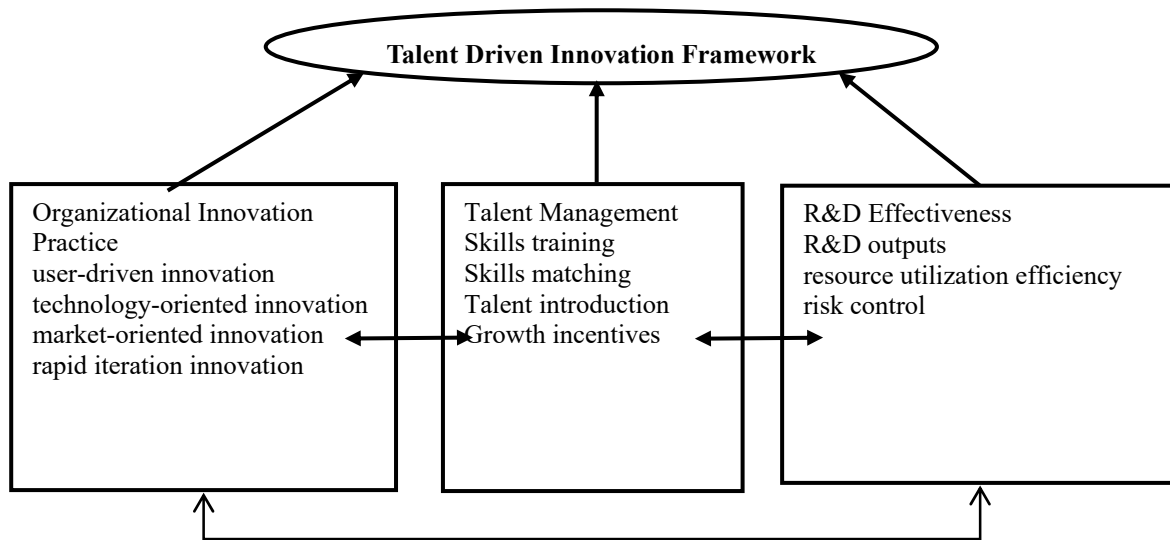**Proposed Talent Driven Innovation Framework**

Figure 1. Proposed Talent Driven Innovation Framework

In this study, a framework aimed at enhancing productivity among employees in technology companies has been established. This framework centers around organizational innovation practices, talent management, and R&D effectiveness. The goal is to identify and assess the impact of innovative practices in these companies, such as user-driven, technology-oriented, market-oriented, and rapid iterative innovations. Additionally, the framework aims to evaluate talent management practices from the perspectives of skill training, skill matching, talent introduction, and growth incentives, as well as assess R&D effectiveness from the angles of output, resource utilization efficiency, and risk management.

The proposed framework seeks to determine significant relationships among organizational innovation practices, talent management, and R&D effectiveness in technology companies. By integrating these three key components, a comprehensive strategy for improving employee productivity can be developed. Based on the research, it is anticipated that implementing user-driven innovation strategies will promote a deeper understanding of customer needs, leading to the development of products and services that better meet market demands. Technology-oriented innovations are expected to drive technological advancements and enhance the company's competitive advantage. Market-oriented strategies aim to identify and seize market opportunities, while rapid iterative innovation ensures continuous improvement of products and services.

In the field of talent management, the framework recognizes the importance of skilled and motivated employees in effectively executing innovation strategies. Therefore, it emphasizes the importance of skill training to ensure employees have the necessary expertise, skill matching to allocate the right talent to the right tasks, talent introduction to bring in new perspectives and ideas, and growth incentives to inspire continuous development and contribution from employees. Regarding R&D effectiveness, the framework aims to optimize the R&D process, ensure efficient resource utilization, manage risks effectively, and ultimately achieve high-quality output.

The framework proposed by integrating these three dimensions—organizational innovation practices, talent

management, and R&D effectiveness—provides a strategic roadmap for technology companies to enhance employee productivity, drive innovation, and achieve sustainable growth. The proposed talent driven innovation framework offers technology companies a comprehensive approach to enhance employees' innovation capabilities, manage talent resources, and optimize R&D activities. By implementing this framework, organizations can better unleash the potential of their employees, improve productivity, and maintain a leading position in the competitive technology industry.

4. Conclusions and recommendations

Based on the findings of the study, the researcher came up with the following conclusions. The technology companies have good organizational innovation practices such as user-driven innovation, technology-oriented innovation, market-oriented innovation, and rapid iterative innovation as agreed by the respondents. The respondents have good evaluation on talent management in terms of skills training, skill matching, talent acquisition, and growth incentives. Research and development activities are effective in terms of output, resource utilization efficiency, and risk control as agreed by the respondents. Highly significant relationships exist between innovation practices, talent management, and R&D effectiveness in technology companies. A talent driven innovation framework is developed for technology companies.

Enterprises may establish a dedicated department or team for organizational innovation and talent management. The top management may establish a well-rounded R&D effectiveness evaluation system and closely integrate it with employee incentive mechanisms. The human resource department may promote cross-departmental collaboration between innovation practices and talent management. The proposed framework maybe consider for utilization to improve employee productivity in technology companies. Future researchers may conduct regarding employee productivity such as agility, autonomy or digital literacy.

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