A talent cultivation approach for improving the future technology management capability of college students

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Abstract: It is of great theoretical and practical significance to promote students' active integration into technological innovation, stimulate their innovative spirit, and shape their innovative qualities, enable them to possess innovation capabilities and innovative thinking, laying a solid theoretical foundation for their future entry into enterprises, broaden employment opportunities and better become the innovative talents that society urgently needs. At present, college students lack an understanding of the principles of technological innovation, and in the future, they will lack the ability to solve application problems in the decision-making process of innovation strategies when entering the industrial sector. To this end, this paper proposes a talent cultivation approach for improving the future technology management capability of college students from the perspective of tech mining. In the technology management course, students are taught the principles, processes, and functions of tech mining, and are exposed to real-world industry problems through scenario simulations. By playing different roles in the tech mining process, students enhance their innovative awareness and practical problem-solving abilities, which will help them develop greater management potential in their future careers.

1. Introduction

Improving college students' future technology management capabilities holds significant value. Strengthening technology management capabilities makes students more competitive in the future job market. In addition, students with strong technology management capabilities are better equipped to drive technological advancements, foster innovation, and contribute to the overall growth of their respective industries. Besides, effective technology management capabilities enable students to work collaboratively in multidisciplinary teams, enhancing communication and cooperation among teams. As students develop their technology management capabilities, they are more likely to take on leadership roles in their future careers, guiding and mentoring others to achieve common goals.

There are several challenges and obstacles in cultivating technology management capabilities

among college students. Some universities place too much emphasis on theoretical knowledge while neglecting practical applications, making it difficult for students to apply their learning in real-world situations. The technology management curriculum in certain universities may not be comprehensive, focusing only on specific aspects and leaving students with gaps in their overall skillset. Traditional teaching methods like lectures and discussions may not sufficiently engage students or unleash their full potential, thus hindering the development of technology management capabilities. A lack of industry-university collaboration and real-world project opportunities can prevent students from honing their technology management capabilities in actual working environments. Some students may not fully understand the importance of technology management capabilities, which can lead to a lack of motivation to proactively learn and develop these capabilities.

Taking into account the aforementioned challenges and obstacles, this study proposes a cultivation approach for enhancing students' technological innovation management capabilities based on "tech mining" theory. In this model, we consider the curriculum optimization, diversifying teaching methods using "role-play scenario" and strengthening collaboration among students.

This paper is structured as follows. Section 2 will introduce technology management and tech mining theory. Section 3 will discuss how to apply tech mining to enhance the cultivation of students' technology management capabilities in our proposed approach. Finally, we will present our conclusions and discussions.

2. Literature review

2.1. Technology Management Capability

Technology Management is a multidisciplinary field that involves the integration of technical, business, and human aspects to ensure that technology contributes effectively to organizational goals[1]. Cetindamar et al. (2009) employs a Venn diagram to show that technology management has relationship with both innovation management and knowledge management[2]. One common definition is that technology management as the "planning, directing, control and coordination of the development and implementation of technological capabilities[3].

Technology management Capability can be defined as the potential or ability of a person or a firm to effectively manage technological resources and processes to achieve strategic goals. Technology management capability may include but is not limited to: (1) Observing, identifying, and assessing competing technologies to fulfill a certain market need; (2) Select the most relevant technologies from the feasible options to help the organization build a sustainable, possibly long-lasting competitive advantage; (3) Get access to the knowledge base required for the technologies selected, be it through internal development, R&D partnership and acquisitions; (4) Manage research activities; (5) Subsequent implementation and improvement of product and process technologies integrated with the organization's portfolio; (6) Pick out former technologies, progressively or suddenly rendered obsolete by new technologies[4].

2.2. Tech mining

Content analysis and text mining are ancestries of tech mining. Tech mining applies text mining tools to science and technology information, informed by an understanding of technological innovation processes. We distinguish tech mining from data mining and text mining by its reliance on science and technology domain knowledge to inform its practice[5]. There are several related concepts: "tech miners" are technology watchers mainly detect what is happening now and what is likely to happen in the future with regard to some particular technologies, by foreseeing

opportunities, tech miners can help make better plans and decisions, thereby gaining significant competitive advantage. "Tech mining users" can be strategic planners, R&D managers and funders, researchers, inventors and project managers, new product developers and designers, process managers, product managers, product service managers, marketing experts, IP managers and specialists[5].

Tech mining aims at solving technology management issues and concerns including[5]: (1) R&D portfolio selection; (2) R&D project initiation; (3)Engineering project initiation; (4) New product development; (5) New market development; (6) Mergers; (7) Acquisitions of intellectual property; (8) Exploiting one's own intellectual assets;(9) Collaboration in technology development; (10) Identifying and assessing competing organizations; (11) Tracking and forecasting emerging or breakthrough technologies; (12) Strategic technology planning; (13) Technology roadmapping.

From the aforementioned research, it can be seen that tech mining has strong relationship with technology management capabilities. For a college student, if he can master the tech mining skills, he can increase his technology management capabilities. In turn, he plays a positive role in promoting the firm's competitive advantage at the future job market.

3. Tech mining approach for College students' technology management capabilities

This paper stands at the background of offering technology management courses for engineering students, incorporating tech mining theory into the curriculum. Students form collaboration teams centered around technology management issues and engage in role-playing simulations. Students assume different roles and exchange them after a round of solving problems, allowing each student to consider technology management issues from multiple perspectives and roles. The final practical solutions are generated with the team using empirical sources and multiple tools. This approach not only enhances students' teamwork skills but also get access to practical technology management issues, thereby improving their technology management capabilities.

Figure 1 shows there are 6 roles participated in this framework, they are tech miners, tech mining users, tech experts, decision-makers, managers and researchers. Some roles can emerge in different situations, for example, researchers (including inventors and R&D staff) can emerge as casual tech miners. Table 1 lists some practical problems from which students can choose. Besides, the course teachers can bring entrepreneurs into the classroom, presenting students with real-word problems. A good tech mining case exploits multiple information sources with multiple tools. Tech expert is mainly in charge of the quality of empirical database and the final solutions. The empirical sources range from fundamental research to commercial application. Students can download patents from Derwent Innovation database, S&T publications from Web of Knowledge database.

Table 1: Practical Problems

No.	Questions
1	What emerging technologies merit our ongoing attention?
2	What facets of this technology development are especially hot?
3	What are the likely development pathways for this technology?
4	What societal and market needs do this technology and its applications address?
5	What is changing in the competitive environment?
6	Does this technology offer strong commercialization prospects?
7	What are the strengths and gaps within our own organization?
8	Who might be prospects to license our IP?

In this approach, tech mining process is an iterative process. Students learn a little more about the practical problem at each step under their investigation and collaboration. Managers and decision-makers in this approach pay attention to how others transfer the knowledge into their decision-making process. This is the most important part to make sure the tech mining results

meaningful.

Finally, students in their teams should document the whole tech mining process, note how many rounds they take, who plays which roles, what sources they use, what tech mining actions they take, and they also should draft a file report on the solutions, note the reactions of managers and decision-makers.
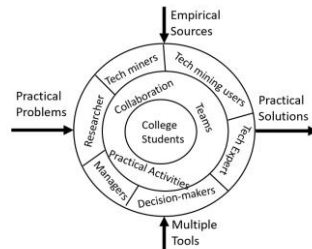
Figure 1: Tech mining model in the technology management courses

4. Discussions and Conclusions

The impact of tech mining on the improvement of technology management capabilities can be seen from several perspectives. Tech mining can identify emerging technologies, trends and opportunities, which allow managers make better-informed decisions about investment, research and development priorities. Tech mining can help understand the technological landscape, help them identify potential partners, collaborators or competitors. Tech mining enables managers to anticipate potential disruptions, allowing them to develop strategies to mitigate risks and capitalize on opportunities.

This paper considers the practical issues and needs in the talent cultivation and technological management capabilities in current universities, introduces tech mining theory into the technology innovation management course, and proposes a university talent technology management capability improvement approach based on tech mining. This approach is based on the roles involved in the entire process of tech mining, allowing students to start from real problems faced by enterprises, create an actual industry scenario, and have students select different roles in the tech mining process to address real issues and collaboratively provide solutions. In this process, students update their roles, repeatedly iterate and optimize existing solutions, and eventually terminate the scenario with a feasible research plan under control, while documenting the entire process.

Acknowledgement

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