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The Value of Knowledge Transfer on the Development of EdTech Ventures

1. Introduction

Universities, research institutes, and tertiary education establishments share the vital role in encouraging original knowledge innovation and technological invention that drive the tendency of economic growth of a country or city while benefiting the wider community. In Hong Kong, universities widely adopted knowledge transfer as the third mission, in addition to teaching and research and development. This third pillar generates an income of over HK\$100 million (approximately USD12.5 million) for the local universities in 2019. University knowledge covering innovation and technology is the major locomotive of economic growth and propels strong productivity gains in society (Lap-chee Tsui *et al.* 2020).

Knowledge transfer between universities and the external community covers the translation of university research outcomes, i.e. innovations and technology, into a real business and daily life applications. The process involves applying university expertise and knowledge to update the operation and services standard of a particular company/industry. The areas range from conventional medicine, machinery, manufacturing, electrics, electronics, material science to the recent wave of cloud computing, biotech and fintech. Education Technology - "EdTech" is another hot topic covering technological inventions and innovations in teaching practices and pedagogies. EdTech companies can gain value from university knowledge in terms of both technological value and educational value.

By nature, EdTech consists of two parts. Firstly, it is the education meaning. It is about the education system, involving students, teachers, schools, educators, classroom equipment, pedagogies and lesson content. Secondly, it is the technology to enable new formats of delivery and reception of education. It is about reform and re-construction of educational communication channels, media and tools. EdTech positively impacts traditional K12 in-school education from kindergarten to high school levels. In addition to the class contents, EdTech creates blended learning platforms and mobile learning platforms for a more efficient, interactive way of teaching and learning. More importantly, it boosts up the market development of community learning and employability platforms (Ramiel, H *et al.*, 2019; IBIS Capital *et al.*, 2019)

EdTech is an expanding market. IBIS Capital's measured the EdTech expenditure valued at USD228 billion in the global market in 2019 and will increase by no less than 15% per year. Meanwhile, the global education expenditure reached USD5 trillion in 2019, eight times the software market and three times the media and entertainment market. However, education was only 2% digitised (IBIS Capital *et al.*, 2019). This means there is a 98% blue ocean for new forms of EdTech, for instance, gamification of learning and edutainment development. An analysis forecast that the digitisation of education is changing fast, projected to grow to USD404 billion by 2025. The impact of COVID-19 can boost up the market with the transformation of education models (Holon IQ, 2021).

There will be an ample space of development for university knowledge to contribute to the EdTech businesses' growth, technologically and educationally. This research will shed light on the field of EdTech, which will discuss how university knowledge transfer helps an EdTech business in the start-up life cycle, and the values created in an EdTech start-up by evidence-based technology invention and intervention innovation of university.

2. Research Problems

As the designated units handling the third mission of universities, knowledge transfer offices are eager to push their researcher's innovations and technologies to the industries. On the other side, EdTech companies are mostly start-ups who need external input to support their passion and visions with technological and educational capabilities. The EdTech industry is facing the situation that the start-up teams are commonly either with subject knowledge of education or hard-core knowledge of technology. Among the top-ranking universities in education in Asia, only 30% are with undergraduate programs in education technology, while 50% are conducting research projects on education technology. Both universities and start-ups need support from each other in EdTech development. There can be synergy. However, are they a match? Furthermore, more importantly, how to match them? Thus, the research questions can be summarised as follows.

1. *How does university knowledge help an EdTech business in the start-up life cycle?*
2. *What are the differences in the effects of university's technology invention and intervention innovation on EdTech start-ups?*

2.1 Significance of the Research Questions

The education technology business is a market of trillion dollars. There were no traditional big names in this market that start-ups are the primary driving force. In these few decades, Israel has become the world's research and development centre for innovation and technology. The country was ranked the most successful showcase of the high-tech development model. It is an event on top of Silicon

Valley (De-Fontenay and Carmell, 2004). The country established the research and development centre cum start-up accelerator for EdTech, called the MindCet, under The Center for Educational Technology. This is a platform fusing researchers, teachers, entrepreneurs and technologists to shape the discursive and interpretive practices of EdTech (Ramiel, H *et al.*, 2019).

Chinese have emphasised the importance of education for thousands of years. There are eight world-class universities in Hong Kong, where hundreds of education research projects plus thousands of cutting-edge technological developments are ongoing every day. Ironically, there is a lack of a research centre with a primary focus on EdTech research and development, let alone a business incubation unit. Innovation and technology are indispensable in upgrading the competitive advantages of a business and industry in a nation, contributing to wealth creation (Kahlil, 2000). The two biggest start-up incubators, the Hong Kong Science Park and the Hong Kong Cyberport, accommodate about two hundred EdTech start-ups. In parallel, sole The Education University of Hong Kong incubates about twenty EdTech ventures each year. However, only a tiny portion of the pool is doing business with a proper combination of evidence-based pedagogical intervention innovations and technological inventions. The Universities have the research results that can benefit the markets and learners, while the start-ups demand innovation capital to boost up their growth and keep pace with the international competition. Effective matching of universities knowledge and start-up ventures is crucial for accelerating the advancement of the industry and building up a significant return on the city's investment in university research and development.

2.2 Research Objectives

The primary objective of this study is to examine the effects of the transfer of university knowledge on building up the business innovation capability of start-ups in the EdTech industry. Universities conduct various types of research and development. Technology invention provides new technology as the media to deliver educational value to the learners. Intervention innovations are learning sciences, including novel pedagogies and new practices that create new educational value to the learners. They can create different values in different aspects of an EdTech start-up. The composition of an EdTech start-up team creates a different profile of knowledge capital. The needs for a technology-based entrepreneur team and those for an education-based team are different. The effects of different types of university knowledge can bring contrasting effects on EdTech start-ups. A model guiding the mix-and-match can practically benefit the EdTech start-ups. This study seeks:

O1: Identify the types of knowledge which universities can transfer to EdTech businesses

O2: Identify the aspects of an EdTech business that university knowledge can advance

O3: Identify the relationship between O1 and O2

O4: How do different types of university knowledge affect the performance of an EdTech business in the start-up life cycle?

O5: What is the framework for effective matching of university knowledge and business needs?

3. Literature Review

3.1 Knowledge Transfer in University

Knowledge transfer is the translation and evolution of innovation and technology from the place of its fundamental research and applied research and development to the marketplace as a product, services or daily routine practice. This diffusion can occur through market transactions, strategic alliances, joint ventures, licensing or else (Grosse 1996). Most universities in Hong Kong set up designated units, which are usually named Knowledge Transfer Offices, to facilitate and foster internal researchers' and scholars' participation in knowledge transfer. Their activities create new values and parameters in the fields of intellectual property, technology development and practical innovations (Beltran-Morales *et al.*, 2020).

Universities and tertiary education institutions have an obligation to transfer their research outcome, innovations, and technologies into a real business and daily life applications. The knowledge transfer offices are platforms designed to bridge the interactions and collaborations between universities, researchers and industries (Brennenraedtset *et al.*, 2006; Sharifiet *et al.*, 2014; O'Reillyet *et al.*, 2019). They help create and nurture help companies be innovative, which the research and development findings of universities. Enhancements of the industry's innovation and technology capabilities and cultivation of creation are the main objective of the knowledge transfer offices.

Nowadays, the universities are more and more deeply committed to the interactions with external partners to commercialise or adopt their research results to accomplish their third mission (Huyghe *et al.*, 2014; Etzkowitz 2003; Rasmussen *et al.*, 2006). They aim to foster the growth of entrepreneurship and economic development. Knowledge transfer is also a channel to boost start-up activities. The eco-system of early-stage investments is yet to mature. Some success stories will help inject a sense of confidence into young people and nurture social attitudes and support towards entrepreneurship (Lap-chee Tsui *et al.*, 2020).

3.2 The EdTech Industry

EdTech means educational technology. It is an integration of two elements, the practical educational pedagogies and the technological inventions. The hundred billion global education technology market is non-stoppable, which is expected to witness a compound annual growth rate of 19.9% from 2021 to 2028. EdTech is not only limited to e-learning materials and smart classroom equipment. It covers interactive displays for replacing blackboard, learning management systems, student record systems, mobile collaboration systems, automatic assessment systems, personalised learning systems, job-talent matching platforms, employability advisory platforms, as well as gamification and edutainment solutions. Advancement in technologies in parallel evolve the advancement of EdTech solutions. Augment Reality, Virtual Reality, Internet of Things, together with the new ABCD "Artificial Intelligence, Blockchain, Cloud Computing and big Data," are reforming the way of teaching and learning. Digital technologies are making access to education cheaper, easier and faster than ever before. Learners are more willing to shift towards electronic books without the boundaries of time and locations. The digitalisation of educational materials also reduced the difficulties in translation, not only on written words but also on those with physical disabilities who can listen to the educational content in an audio format. As of August 2021, the market is enormous that there are 30 EdTech start-up Unicorns with a valuation of USD1 billion or above. (Grand View Research 2021, Markets and Markets 2020, Holon IQ, Aug 2021).

3.3 Performance Measurement of Technology Startups

Start-ups are new progressive ventures which are tracing the quick adaptation to new technologies and marketplace changes. Thanks to the rapid development in innovation and technology, the business environment and various business models undergo a rapid and continuous change. These create a competitive advantage for start-ups compared with traditional large enterprises (Sekliuckiene, *et al* 2018). However, start-ups have to continuously advance themselves to survive and grow along the start-up life cycle. This life cycle of an entrepreneurial business involves several milestones, from idea generation to global expansion (Osnabrugge & Robinson, 2000). That means the development of start-ups start from the ideation, entrepreneur team formation, evaluation of business models and products, prototyping, scaling up, until the establishment of a global market business different. Statistics show that at least six out of ten start-ups end up going bankrupt in their first three to five years of business (Passaro R., *et al* 2020). The ventures need to formulate strategies solutions to tackle the challenge at various stages of the life cycle of start-up development.

The Passaro R., *et al* 2020's start-up business development model classifies the life cycle into four stages: ideation, intention, start-up, and expansion. Ideation is about potential idea generation. It requires the entrepreneur team to be creative in order to discover ideas and identify market

opportunities. The intention stage covers market validation and product prototyping. In the start-up stage, the entrepreneur team establish a new venture to practice its business plan and launch its products. The venture needs to be capable of massive market acquisition and industrialise the products to expand their business to the global market. All the stages required the entrepreneur team's business innovation capability. The innovation capability reflects the performance of a start-up in terms of (i) product innovativeness for problem-solution fit products and the ability to improve and launch a new product to respond to the changes in market and customer needs, (ii) market innovativeness for product/market fit strategies based on its ability in following and understanding the changes in the marketplace environment and innovation, and (iii) scaling up the business as a combination of both product and market innovativeness, which also indicates of their ability to succeed (Sekliuckiene *et al.* 2018).

3.3 Knowledge Capacity of EdTech Startups

Thanks to digitisation, the EdTech industry multiplied with the development of new technologies and expansion of the marketplace that lead to novel learning and teaching in classrooms in schools, lecture theatres in universities, and offices in companies. Education and technology are the dual drivers of businesses. EdTech companies must bring teaching and learning together in the design of their technological products and services. The EdTech developers have to ensure teachers and trainers are involved in securing their proper understanding of pedagogical contents and practices. In parallel, EdTech developers have to play the role of trainers to ensure the educators understand EdTech solutions and the value created to new teaching and learning (Romy *et al.* 2019). EdTech companies have to invest time and resources to develop their understand and information about teaching and learning before the EdTech application can be implemented and fully adopted by the educators (Luckin, R. & Cukurova, M. 2019). On the other hand, they have to develop their technology capability to leverage technologies to create more efficient, effective and individualised modes of education.

3.4 Absorptive Capability

Absorptive capability is a company's capacity to find, capture, fuse, adopt and transform external knowledge into an internal innovation ability. It is the organisational mechanism describing the company's ability in (i) knowledge acquisition and assimilation, called the potential absorptive capability; and (ii) knowledge integration and evolution, called the realised absorptive capability (Zahra *et al.* 2002; Cohen *et al.* 1990). Most of the EdTech start-ups in Hong Kong are supposed to be with their niche knowledge advantage in their domain fields, given that this is the common criteria among the entry requirement of the incubators, for instance the Hong Kong Science Park and the Hong Kong Cyberport, and the universities' entrepreneurship development schemes. However, their

competence or organisational resistance in making changes and capturing, integrating and evaluating new knowledge to advance their businesses will be examined and evaluated. A start-up can begin with great innovation and technology, but the ability to capture new knowledge to fuel their continuous innovation and business advancement. Previous studies suggest measuring the percentage of the company's research and development workforce out of their total workforce as the indicator of their performance in absorptive capability (Leahy *et al.* 2007; Zahra *et al.* 2008).

3.5 Research Gap

Most of the academic studies on measuring knowledge transfer of universities and start-up developments in recent years are related to technological research and inventions. EdTech is unique in that both educational value and technology value is vital to the business. There are rare studies that examined the impact of the transfer of both technology inventions and intervention innovations. This study will fill the puzzle of how technology inventions and intervention innovations empower an EdTech start-up differently. It will also provide guidelines for EdTech start-up to analyse its missing competence and provide insights for future studies about whether EdTech development should be education or technology-driven.

4. Research Model and Hypotheses

Figure 4A shows the conceptual model describing the transfer of university knowledge into knowledge capital of an EdTech start-up and the contribution of the knowledge capital and absorptive capability to the business innovation capability of the EdTech start-up. The previous sector of the literature reviewer explains the model's background. This study will seek to clarify the correlations between university knowledge, knowledge capital, absorptive capability and business innovation capability of an EdTech start-up.

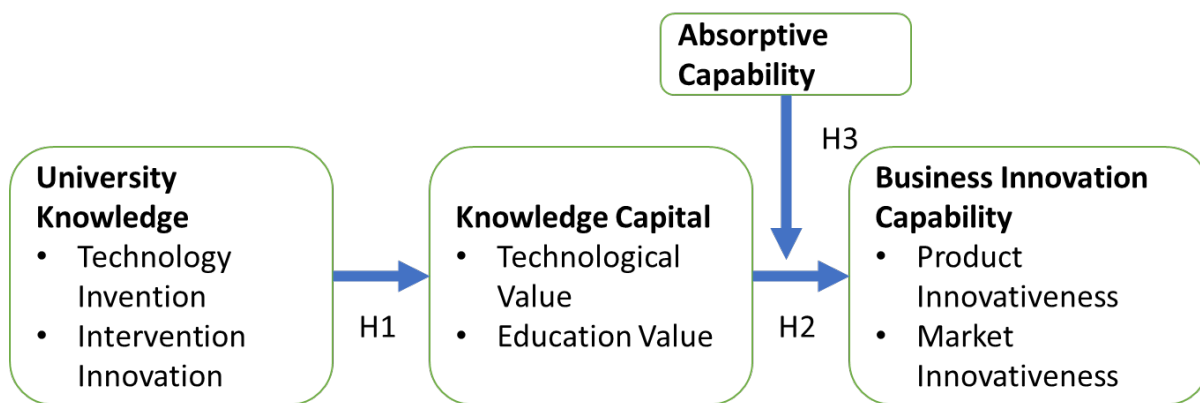


Figure 4A: Conceptual model illustrating the contributions of university knowledge to knowledge capital of an EdTech start-up and how the capital is translated into business innovation capability with the interference of absorptive capability

4.1 University Knowledge and Knowledge Capital

The incubation of EdTech ventures is the attempt to construct a well-balanced construction of integration between the educational world and the technological innovation business field. The integration should involve the consideration of teaching and learning, technology, and business innovations. The discourse of educational practitioners, pedagogical innovators and technological inventors is the priority. The technological innovation start-ups and digital entrepreneurs have become the model for educational changes (Ramiel, H *et al.*, 2019). EdTech entrepreneur teams follow the steps of techno-business to leverage university technology inventions to empower the venture's technology capital. As the same principle, they can also make use of the pedagogical and interventional research in university to advance their education value. Passaro (2020) described that the start-up eco-system has to get the necessary knowledge to support the realisation of their key activities to achieve a successful transition in the start-up life cycle. Knowledge and competence from universities support entrepreneur teams to develop their ideas into practical solutions and commercial products. They are especially crucial in the product prototyping stage. Therefore, university knowledge qualifies the knowledge capital of an EdTech start-up, both technologically and educationally. Based on this reasoning, the following hypothesis is presented.

H1: University knowledge transfer advantage is positively related to a start-up's knowledge capital

With the sub-hypotheses as follows

H1_a: Knowledge transfer of university technology invention is positively related to a start-up's technology value

H1_b: Knowledge transfer of university intervention innovation is positively related to a start-up's education value

4.2 Knowledge Capital and Business Innovation Capability of an EdTech Startup

Knowledge capital is the internal competence and resources of a venture to develop its problem-fit products and market-fit business models. Here studies the link between knowledge capital and the business innovation capability of EdTech start-ups. The utilisation of innovation and technology are closely related to the positive performance of new products and market acquisition of start-ups (Wang et al. 2004). The innovation capability of a venture is about its power to convert internal knowledge and ideas into values in product development, system and implement processes, and its status in the value chain (Lawson et al. 2001; Noke et al. 2010).

The types of business innovation capability concerns this study are the product innovativeness and market innovativeness. Product innovativeness of EdTech business consists of two crucial dimensions: the way of delivery of education with new technology and the content and intervention of education being delivered to learners. Market innovativeness describes the ability for the firm to gain the market sharing in the new marketplace of education digitalisation. Fores *et al.* (2011) pointed out another dimension of innovation capability, called process innovation. This is about the organisational reform in streamlining the internal mechanism and enhancing production and delivery efficiency to the market. Considering the new and small structure, the process innovation in start-ups does not play an indispensable role as in large firms. Therefore, only product innovativeness and market innovativeness are considered in the analysis of the business innovation capability of EdTech start-ups. The hypothesis is as follows.

H2: Knowledge capital advantage is positively related to the business innovation capability of an EdTech start-up

With the sub-hypotheses as follows

H2_a: Technology value is positively related to the product innovativeness of an EdTech start-up

H2_b: Education value is positively related to the product innovativeness of an EdTech start-up

H2_c: Technology value is positively related to the market innovativeness of an EdTech start-up

H2_d: Education value is positively related to the market innovativeness of an EdTech start-up

4.3 Moderating Effects of Absorptive Capability

The primary way for a venture to develop innovation and technology is to set up the internal competence and manpower of research and development. However, start-ups face a highly complex situation thanks to the rapid innovation and technology advancement and the changing needs and expectations of customers. Internal development cannot meet the speed of environmental change. Pisit (2019) indicated that start-ups must seek strategies to create new innovations to gain new competitive advantage. Inter organisational collaboration can boost up the innovation efficiency of start-ups. Even so, a start-up has to establish its internal research and development term to access and adopt the external technology and knowledge. This is about the absorptive capacity. This study will look into the contribution of a sufficient competent research and development team, as the indicator of absorptive capacity, to absorb and configure their knowledge capital acquired from university knowledge into business innovation capability. The hypothesis is presented as follows:

H3: The effect of knowledge capital on business innovation capability of an EdTech start-up is positively moderated by its absorptive capacity

With the sub-hypotheses as follows

H3_a: The effect of technology value on product innovativeness of an EdTech start-up is positively moderated by its absorptive capacity

H3_b: The effect of education value on product innovativeness of an EdTech start-up is positively moderated by its absorptive capacity

H3_c: The effect of technology value on market innovativeness of an EdTech start-up is positively moderated by its absorptive capacity

H3_d: The effect of education value on market innovativeness of an EdTech start-up is positively moderated by its absorptive capacity

5. Research Approach

This study aims to investigate the contribution of university knowledge in business innovation capability via building up the knowledge capital of an EdTech start-up. It adopts a two-step approach: in-depth interview and quantitative survey.

5.1 Research Design

The conceptual research framework is preliminarily designed based on literature and personal expertise in the field. The resulting survey instrument, a questionnaire, will be evaluated with the consultation of industrial practitioners. We will invite five senior practitioners of the EdTech industry to conduct in-depth interviews, which aim to validate the research design and conceptual framework structure. The survey instrument will be refined. The later step will involve a quantitative survey to collect primary research data from EdTech start-ups or new entries to the EdTech industry in Hong Kong. We target to invite 200 companies, which are mostly incubating start-ups in the Hong Kong Science Park, the Hong Kong Cyberport or supported by entrepreneurship development schemes of local universities. So the pool of respondents will have a similar knowledge background. A pre-test will be carried out with 10 EdTech start-ups to check the clarity, appropriateness and reliability of the survey instrument. In the main research, we expect 70 out of the 200 companies will respond the survey. The data collected will be used to test the hypotheses under a quantitative research approach. Managerial and practical implications will be drawn from the results.

The study is cross-sectional research to investigate the correlations between university knowledge and business innovation capability of an EdTech start-up mediated by the knowledge capital and moderated by the absorptive capability. This will provide a holistic view of various variables in a single time point. The business innovation capability is the dependent variable of the conceptual research model. The company level is the unit of analysis.

5.2 Sample, Data Collection and Analysis

The study targets EdTech start-ups in Hong Kong. All the samples must be in the education technology industry and started their business in the field with no longer than five years. The number of full-time employees is not expected to be over 20 people. The figures provided by the Hong Kong Science and Technology Park Corporate and the Hong Kong Cyberport Management Company Limited indicate that there are a total of about 200 EdTech start-ups incubating in their sites. The Education University of Hong Kong is another major incubator of EdTech ventures. They are nurturing about 30 social enterprises each year, half of which are in the EdTech field.

Top management of the EdTech start-ups will be invited as the respondents in the main round of research. They are founders, co-founders, chief executive officers, chief technology officers, chief education officers, research directors and key managers who have solid involvements in the operation, strategic planning and decision making of the ventures. More importantly, they have the obligation in developing new technology and innovation. Mail or Email invitations will be sent to the targeted companies to explain the objective of the study with the path to access the online survey. The research findings will be shared with the respondents, whose identifications will be kept confidential.

The collected data will be analysed with the Statistical Package for the Social Sciences (SPSS) software to assess the reliability and validity of the constructs (Factor loading, Cronbach's α , Composite reliability).

5.3 Measurement Items

The constructs and underlying variables described in the research conceptual model Figure 4A will be measured in the study. The survey instrument will adopt a five-point scale ranging from '1 – Strongly Disagree' to '5 – Strongly Agree'. Table 5A describes the measuring items in detail.

Technological turbulence and market turbulence will be considered as the control variables. They indicate the effects as a result of the change in the market environment and technology eco-system (Wang *et al.* 2004). Data of company size, the position of respondents, the experience of respondents will also be collected as descriptive statistics.

Constructs	Variables	Measurement Items
University Knowledge	Technology Invention	The technology invention is patented The technology invention is supported with research findings
	Intervention Innovation	The intervention innovation is supported with research findings
Knowledge Capital	Technology Value	The start-up is capable of offering specialised technology The start-up is capable of conducting in-house product development
	Education Value	The start-up is with original pedagogies or educational practices

		The start-up is capable of validating the education value of its products
Business Innovation Capability	Product Innovativeness	The start-up is capable of effective integration of tech value and educational value in the product The start-up is capable of diversifying the product portfolio
	Market Innovativeness	The start-up is with good connection with major customers The start-up is with thorough knowledge of different market segments The knowledge supporting the start-up's product is well recognised

Table 5A: Measurement items

6. Conclusion Predication

6.1 Expected Findings

The results will support significant inter-correlations of university knowledge, knowledge capital, business innovation capability and absorptive capability. It will support the main idea that technology transfer can build up value for start-ups and foster development along the life cycle.

We expect the findings will support all the hypotheses. EdTech start-ups will agree that university knowledge can enhance their knowledge capital to support all H1, H1a and H1b. The results of H1a and H1b will vary depending on the composition of the entrepreneur teams. H1a will be more significant for teams with educators as core members, while H1b will be more significant for technology-oriented teams.

The data will also support H2, H2a, H2b, H2c and H2d. Although both technology value and education value will positively affect product innovativeness and market innovativeness, their levels of influence will be different.

The data will support H3, H3a, H3b, H3c and H3d. However, we expect the moderating effect of absorptive capability on technology value is more substantial than on education value. The absorption and reconfiguration of technologies require a highly technical competence than education innovations.

6.2 Implications

We foresee this study will implicate that EdTech start-ups lack either technical competencies or educational competencies, which can be advanced by university knowledge. The low market and

technology visibility and limited internal resources create a product innovation bottleneck for EdTech ventures; meanwhile, the low educational visibility and ambit create a market innovation bottleneck for EdTech ventures. The market lacks neither technical nor educational competencies, but there lack of channels to match each other. This study will provide the framework for EdTech start-ups to self-review their internal limitation and guide them to identify the practical support they should gain by forming knowledge transfer partnerships with universities.

6.3 Limitations

This is a cross-sectional study that will investigate only a snap-shot of the market at a particular time-point. Besides, the respondents' opinions can be subjective, that administration management and technical management can have a different view on product and market strategies.

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