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Strategies and possible directions to improve Technology Scouting in China

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Strategies and possible directions to improve

Technology Scouting in China[1]

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[1] This paper is based on a diploma thesis, which was accomplished by Mirjam Riesemann in 2007 during a stay in China.

Abstract

This paper examines how theoretical and cultural dimensions in China challenge the use of the generic Open-Market Innovation model by companies in general and one sample Company in China in particular. To carry this analysis out, several interviews with venture technologists and innovators of a company in China were conducted and results are concluded out of business case studies. The outcome of these analyses shows that an Open-Market Innovation Company in China is constrained to a certain degree by political and cultural challenges. Nonetheless, the importance of the Chinese market makes a strong argument for developing an effective business model for China. Therefore, this article concludes that the focus going forward must be on seeking opportunities to improve Technology Scouting in China.

Abstract

Die Tendenz, vermehrt auch Innovationen außerhalb der eigenen Firma zu finden, steigt. Dieser Artikel beschreibt Probleme und Herausforderungen des „Open-Market Innovation“ Modells in China. Die Ursachen wie auch Probleme wurden mit Hilfe verschiedener Analysemethoden ermittelt, wofür Führungskräfte des Innovationsmanagements aus einem multinationalen Konzern in China befragt wurden. Das Resultat belegt, dass ein Open-Market Innovation Modell in China sehr viel schwieriger durchzuführen ist verglichen zu westlichen Ländern. Nichts desto trotz ist der chinesische Markt ein wichtiger Weltmarkt, der Potential für Verbesserungen bereitstellt und für dieses Modell spricht. Kritische Erfolgsfaktoren zeigen Möglichkeiten auf, mit denen Technology Scouting in China erleichtert werden kann.

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Table of Abbreviations

CI	Closed Innovation
IDV	Individualism
IEEE	Institute of Electrical and Electronics Engineers
IP	Intellectual Property
IPR	Intellectual Property Right
KM	Knowledge Management
LTO	Long-term orientation
MAS	Masculinity
NCA	National Copyright Administration
OECD	Organization for Economic Co-operation and Development
OI	Open Innovation
OMI	Open-Market Innovation
OMIC	Open-Market Innovation Company
PDI	Power distance index
PEST	Political, economical, social, technological
R&D	Research and Development
SIPO	State Intellectual Property Office
SOE	State-Owned Enterprises
SWOT	Strengths, weaknesses, opportunities, threats
TRIPS	Trade Related aspects of Intellectual Property rights
UAI	Uncertainty avoidance index
WTO	World Trade Organization

1 The Open Innovation Approach

Closed Innovation (CI) was predominant during most of the twentieth century. Internal Research and Development (R&D) departments developed innovative ideas and products and kept these inside the company. Under this approach, information was not gathered outside of the company's own R&D laboratories. In recent times, the Open-Market Innovation (OMI) approach has been considered and implemented by a growing number of companies.[2]

"OMI is defined as an approach that brings the benefits of free trade to the flow of new ideas."[3]

In contrast to the traditional model of CI, Henry Chesbrough, assistant professor at Harvard Business School, shaped the new innovation model of Open Innovation (OI).[4] Following Chesbrough's approach, two theories (Gassmann/ Enkel) have had particular influence on the OI process. Both of them possess a variety of tools to increase innovativeness and to allow benefits to arise through the creation of alliances with third parties. Their conclusions were drawn from an empirical study of 124 companies. This chapter introduces the basic models with focus on opportunities to apply outside innovations to the own company.

1.1 Open Innovation

1.1.1 Definition: Open Innovation

The current market is trending towards the use of an increasing availability of venture capital, a growing number of strategic innovation alliances and rising innovation exchanges including accessible innovation databases.[5] More frequently companies need to react to sudden market shifts and other changes in the market. A fast and effective solution to deal with such shifts may be the concept of OI.

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[2] See Rigby/ Zook (2002), p. 1.
[3] Bain & Company (Internet, 2006).
[4] See Quick MBA (Internet, 2007).
[5] See ibid., p. 3.

"Open Innovation means that the company needs to open up its solid boundaries to let valuable knowledge flow in from the outside in order to create opportunities for co-operative innovation processes with partners, customers and/or suppliers."[6]

Replacing the CI principles with more modern, adaptable concepts based on knowledge- and idea exchange with third parties supposedly increases strategic flexibility.[7] As mentioned above, there are different tools and ways of increasing the speed and benefits of innovation.

1.1.2 Advantages and Applications

Given the technology trends mentioned, importing new ideas into a company is an effective way to multiply a company's number of innovations.[8] Furthermore, OI can improve the cost, quality and speed with which innovations are put in place.[9]

"By opening up the solid boundaries innovation will be able to move more easily between external environment and the company's internal innovation process."[10]

The definition by Oliver Gassmann and Ellen Enkel in section 1.1.1. not only describes an open paradigm, but it also suggests the possibilities for reaching out for external ideas. Companies ought to focus on the integration of customers, suppliers and partners in order to use their knowledge and capabilities to best effect. There are different vehicles for implementing an OI approach including licensing, joint ventures, strategic alliances or partnerships with universities.[11] With these initiatives an Open- Market Innovation Company (OMIC) can work together with recent graduates, start-ups or garage inventors and benefit from their innovations. As with industries which favour a CI model (nuclear reactors or aircraft engines), there are also industries which suit the specific conditions offered by an OI approach. Mentionable are the computer and movie industries. There are also industries which are operating a hybrid OI-CI model, taking elements from both

[6] Gassmann/ Enkel (2004), p. 2.
[7] See Rigby/ Zook (2002), p. 2.
[8] See ibid.
[9] See ibid.
[10] Gassmann/ Enkel (2004), p. 2.
[11] See Chesbrough (2002), p. xxvii - xxviii.

approaches. Examples include the automotive, biotechnology and health care industries.[12]

1.2 Inside-out/ Outside-in Process

Further to Chesbrough's OI paradigm, Gassmann and Enkel divided OI into three core processes: inside-out, outside-in and a coupled process. The external search for innovations is just one part of the OI model (outside-in) and the transfer of ideas to the outside environment by selling intellectual property and ideas not used inside the company is the other (inside-out).[13] The combination of the inside-out and outside-in process is known as the coupled process, which is practiced in cooperation with other companies.[14]

For many companies, it is important to choose one primary, core process to successfully follow an OI-strategy. This strategy must be in accordance with the characteristics and capabilities of that company.

1.2.1 Advantages and Application of Outside-in

The outside-in process is based on the premise that external knowledge is gathered through the integration of partners, customers or clients.[15] The integration of suppliers, who are valuable sources of knowledge, can provide operational benefits such as early identification of technical problems, strategic benefits such as improved utilisation of internal resources, reduced technical and financial risks and a shorter time to market for new products. Aiming to reduce R&D expenses through new ideas and improved processes, some companies offer incentives to suppliers in order to increase the exchange of ideas.[16] Besides the integration of customers and suppliers, a further possibility to gain external knowledge is from a link to regional innovation clusters. This offers the ability to obtain Intellectual Property (IP) -licensed patents and technological knowledge.[17] To do this, companies establish networks with universities and set up technology offices with the goal of looking out for new trends and novel technical knowledge. This is also to find and establish contacts with potential partners. The discovery of new

[12] See ibid., p. xxvii - xxviii.
[13] See Gassmann/ Enkel (2004), p. 12.
[14] See ibid., p. 12.
[15] See ibid., p. 8.
[16] See ibid.

ideas and technologies can also be achieved by external knowledge sourcing and through developing listening posts to innovation clusters, applying innovations across industries, buying IP and investing in global knowledge creation.[18] According to a survey on OI carried out by Bain & Company, in which 200 senior executives were asked about tools to increase innovativeness, the highest-rated technique was external technology searches.[19]

1.3 Technology Scouting

Technology Scouting (TS) is a strategy how companies can source competencies externally within the outside-in method.[20] TS support companies in gathering knowledge by monitoring relevant technological approaches, developments and trends.

> "Technology Scouting is defined as a systematic approach by companies whereby they assign part of their staff or employ external consultants to gather information in the field of Science and Technology and to help facilitate or execute technology sourcing."[21]

TS can be separated in two different areas. Firstly, TS identifies technological approaches in Science and Technology which could be of potential use for the company. This can either be done in a directed manner (technology monitoring), by searching in specific technological fields, or undirected (technology scanning), by searching for new technological opportunities in 'white' spaces not yet covered by the company's scope.[22] Secondly, TS supports companies in sourcing new technologies.[23] However, TS assumes that explicit knowledge is able to obtain.

1.3.1 Advantages and Application

External TS has two important advantages: On one hand, TS can support companies in identifying market trends at an earlier stage and therefore lowers the time lag between

[17] See ibid.
[18] See ibid., p. 7.
[19] See Rigby/ Zook (2002), p. 2.
[20] See ibid.
[21] See ibid., p. 5.
[22] See ibid., p. 4.
[23] See ibid.

advances in technology and their detection.[24] On the other hand, TS assumes that technology scouts have informal networks. These networks provide a strong base for sourcing technologies from the outside market.[25] Therefore, the goal of TS is to screen opportunities and threats arising from technology developments and to identify at an early stage technological solutions to face these challenges.[26] The application of TS is increasingly important in areas undergoing rapid technological change, and where companies are not able to identify the needed technological capabilities or the potential sources of technological knowledge.[27] The organization of TS is contingent upon geographical and technological expertise. Companies can either take advantage of investing in geographical units or a company can organize scouting units de-centrally.[28]

1.3.2 Critical Success Factors of Technology Scouting

As explained, TS is one way how to organize the OI approach. Two elements are crucial for a successful project outcome: Firstly, the goal of the scouting activity has to be defined. This implies that the process has to be tailored and directed in anticipation of the final usage and requirements of the information being sought. This goal demonstrates that it is of up most importance to fully brief the technology scouts at the beginning of the scouting activity. Secondly, a working incentive system, which takes into account all players involved in the process, should be developed. The company has to make sure that a win-win situation can be created for all participants involved.[29] Joint research projects are an example of this mutual exchange of benefits.[30]

[24] See ibid., p. 2.
[25] See ibid.
[26] See Rohrbeck (2007), p. 5.
[27] See ibid., p. 3.
[28] See Lang (1999), p. 4.
[29] See ibid.
[30] See ibid., p. 3.

2 The Chinese Market from an Innovation perspective – demonstrated by the PEST-analysis

Within today's world of fast moving business and short product lifecycles, a company's strategy must engender a sharp focus on the forces which influence the company's economic success. As this article focuses on the OI model challenged by cultural principles of China, a PEST analysis will be highly relevant to introduce and develop ideas around environmental characteristics.

"PEST-analysis is the acronym for 'Political, Economic, Social, and Technological analysis' and illustrates a framework of macro-environmental aspects used in environmental sensing."[31]

The constituent factors of the PEST-analysis provide an effective method of analysis to assist with generating a successful market approach. Through this analysis, it is shown that any company must have a high level awareness of its economic surroundings. This analysis should shed light on the following:

- Political: Does the IPR-System allow an OMIC in China.
- Economic: How have economical conditions changed in recent times.
- Social: In what ways do the Chinese behave differently when compared with other Western countries, and what are the key features of the education system in China which influence their social behaviour.
- Technological: Whether the Chinese market is suited to the implementation of an OMI approach.

[31] See CI-Home (Internet, 2007).

2.1 Political: Intellectual Property Rights

Internationally, the issues around the protection of Intellectual Property Rights (IPR) have received much attention in the last few years.

> "The Intellectual Property system is a basic legal system that promotes mankind's economic development, social progress, scientific and technological innovation, and cultural prosperity."[32]

Although China has strengthened its legal framework and adjusted its IPR laws and regulations to comply with the requirements of the Word Trade Organization (WTO), China continues to face problems with piracy and copyright. According to the copyright industry association, the piracy rate in China is one of the highest in the world. Unsurprisingly then, a report in a Chinese newspaper claimed that 20% of all consumer products in the Chinese market are products of counterfeit.[33]

The IPR protection system in China was established relatively late, the late 1970s in fact, but has developed rapidly in the last 30 years. A system of laws and regulations has been built up and this covers a range of areas. Since the 1980s the regulations have improved to cover a wider range of laws and IPR protection, including "Trademark Law of the People's Republic of China," "Copyright Law of the People's Republic of China," "Regulations on the Protection of Computer Software," "Regulations on the Protection of Layout Designs of Integrated Circuits," "Regulations on the Collective Management of Copyright," and so on.[34] Due to these developments around the implementation of regulations, the IPR system has improved, but unfortunately does still not satisfy the requirements of international IPR standards.

In spite of China's adherence to several international agreements for protecting IP (such as the WIPO, Berne and Paris Convention, etc.), a company must also register its patents and trademarks at the appropriate Chinese agencies.

The following overview of Chinese regulations for IPR may help to understand the process better:

[32] See China Daily (Internet, 2005).

Patent: China introduced the first Patent Law in 1984. This has been revised twice (1992 and 2000) to improve the scope of protection for patents. In contrast to the United States, where a first-to-invent system operates, China follows a first-to-file system.[35] "First-to-file" means that a patent is granted to whoever is able to register their patent to the files first, even though this person may not necessarily be the original inventor. This system is consistent with most parts of the world including the system in the European Union. On the other hand the "First-to-invent" system, which operates in the United States, can generate difficulties with proving who actually had developed the invention first.[36] In the "First-to-invent" system, an inventor gets the patent first even if he or she filed the application after another patent was filed, but for a later invention. As a member of the Patent Cooperation Treaty Group since 1994, China must carry out international patent searches and preliminary examinations of patent applications.[37] However, this is very difficult in China and the inefficiency of this process makes it difficult to warrant in practice. Instead, in the attempt to reduce violation and piracy, patent agents are hired to identify patent fraud all over the country. Furthermore, China's State IP Office (SIPO) in Beijing files the patents, while provincial and municipal offices are responsible for the administrative enforcement of the patents.[38]

Trademark: China's first trademark law was adopted in 1982 and has been improved in 1993 and 2001.[39] The actual trademark law was introduced in October 2001; this took effect in September 2002. This new trademark law was adjusted to be in line with the 'Trade Related Aspects of Intellectual Property Rights' (TRIPS) – an international agreement administered by the WTO – and includes collective marks, certification marks and three-dimensional symbols.[40] Since joining the Madrid Protocol in 1989, Chinese companies are bound to register trademarks which have originated in China with the other Madrid Protocol member countries. Reciprocally, foreign companies who want to distribute their products in China have to register their marks or logos with the Chinese

[33] See ibid.
[34] See ibid.
[35] See US embassy in China (Internet, 2007).
[36] See ibid.
[37] See ibid.
[38] See ibid.
[39] See ibid.
[40] See ibid.

trademark office. In contrast with regulations for patents, Chinese and foreign companies are allowed to register trademarks directly without the use of an agent.[41]

Copyright: The copyright law of China was established in 1990, amended in October 2001 and came into force in September 2002. Unlike patent and trademark protection, copyrighted work does not need to have a registration. This results in a lower protection for the owners of the copyright. Therefore, copyright owners may wish to consider registering their copyright ownership at China's National Copyright Administration (NCA) in order to establish evidence of their ownership.[42]

In 1998, China established the SIPO in order to coordinate China's IPR by merging the patent, trademark and copyright offices into one institution. The SIPO is now responsible for granting patents (national office), registering semiconductor layout designs (national office) and enforcing patents (local SIPOs).[43] Moreover, SIPO coordinates national and foreign-related IPR issues involving copyrights, trademarks and patents. In order to regulate and enforce IP rules, a two-track infringement system exists: one is an administrative track where the IP holders can file a complaint themselves, and the other is a judicial track where complaints are filed through the court system. However, jurisdiction of IP protection is limited through the number of agencies and offices carrying this work out.[44] These offices are typically responsible for only one area or just one IP-related law. Hence geographical limitations come into play as a cross-jurisdictional enforcement procedure is necessary to reduce counterfeit activities.

2.2 Economic: Actual Conditions in China

China is one of the fastest growing markets in the world. Since the country joined the WTO in 2001, China has rapidly become a global economic force. While doubling its global share of manufacturing output, China has also helped to create a commodity-market boom and has accumulated $1 trillion USD of foreign-exchange reserves.[45] In the past two decades, China's average economic growth was 9.5% per year.[46] The impact of this

[41] See ibid.
[42] See ibid.
[43] See ibid.
[44] See ibid.
[45] See Economist (Internet, 2007).
[46] See OECD (2005), p. 1.

has been a contribution to higher personal incomes and therefore a significant reduction in poverty.[47]

"The size of the economy, when measured at market prices, now exceeds that of a number of major European economies and may be exceeded by only three OECD member countries in five years' time."[48]

Underlying this rapid growth has been a profound change in policy and law which focus on bringing the forces in the Chinese market in line with international market forces. While price control systems were abolished in 2000, the government introduced a new company law that permitted private individuals to own limited liability corporations.[49] Furthermore, the government has enforced several competition laws in order to unify the internal market while the business environment has been developed by direct foreign investment, the reduction of trading tariffs and the abolishment of a state export trading monopoly.[50]

As already mentioned, an important step towards an open economy for the Chinese government was its entry into the WTO in 2001. This membership enabled the standardization of several laws and regulations, and also the prospect of further tariff reductions.

Fundamental changes were also made in the construction sector in 2004, where the role of the non-state sector in supporting economic activity was stressed, and private property was protected against random seizure.[51] Further regulation changes in 2005 increasingly supported privately-owned companies and the ensuing result is a powerful private sector in the economy.[52] In addition, the government introduced reforms for state-owned companies which had dominated the economy in the early 1990s. State-owned Enterprises (SOE) have been transformed to resemble private corporations and the result has been a reduction by half in the number of SOE's in the last five years.[53] All of these changes show how the government has made large strides in the reorientation of its economy

[47] See ibid., p. 7.
[48] See ibid., p. 2.
[49] See ibid.
[50] See ibid.
[51] See ibid.
[52] See ibid.
[53] See ibid.

towards a free market, and one in which the privately owned sector is playing a key role. Nonetheless, while business development in China has greatly improved, there is still plenty of potential for further modernizing the business framework, and key for this present discussion, for the better enforcement of IPR laws.

2.3 Social: Cultural Characteristics

Business strategies always have to consider which cultural characteristics have a special hold in any country where operations are undertaken.[54] A national culture can be shown best by identifying which values people hold. Cultural values explain what people believe and how they behave in different situations.[55] Furthermore, cultural values establish the norms or standards by which everything in a society is judged, although it is concurrently acknowledged that not all members of a cultural group will hold exactly the same values. In fact, many great differences in political, social and economic realm exist between Mainland China and other places dominated by Chinese culture (e.g. Hong Kong, Taiwan). Nonetheless, it is possible to identify values that are commonly held across Chinese culture.

2.3.1 Model of Geert Hofstede

Geert Hofstede is an influential Dutch writer on the subject of interactions between national cultures and organizational cultures. Hofstede demonstrated that there are national and regional cultural groupings that affect the behaviour of organizations. To better understand how people react in given situations, it is useful to understand Hofstede's analysis. His analysis was supported by IBM, which collected a large amount of data between 1967 and 1973 based on employee values. The model should not be used as a true representation of the national culture but can give a good insight into generally accepted values. Hofstede formulated the following five dimensions from his study of national influences which affect people's behaviour.

Power Distance Index (PDI): This dimension shows how much the less powerful members of an organization (like a company or a family) accept the inequalities of power distribu-

[54] See Deutsches Institut fuer Betriebswirtschaft GmbH (2003), p. 15
[55] See Hofstede/ Hofstede (2005), p. 2.

tion.[56] According to Hofstede, the PDI explains about dependences in relationships in a country. Power and inequality are fundamental factors in any society, but some societies are more unequal than others.[57]

Individualism (IDV): Its opposite, collectivism, shows the degree to which individuals are integrated into groups.[58] In individualist countries people are expected more to look after themselves and one's own immediate family. Moreover, the characteristic of relationships is more voluntary and are fostered carefully.[59] Instead, in collectivist there is no need to make specific friendships. People are integrated more in groups, cohesive 'in-groups' by families or group memberships, where members are protected by virtue of their belonging in the group.[60]

Masculinity (MAS): Together with its opposite, femininity, these concepts refer to the distribution of values along gender lines in a country.[61] The IBM studies, published between 1990 and 2002, showed that women's values differ less amongst a societal group than men's values. Therefore, in 'feminine' countries, women carry the same values as men. On the other hand, in the 'masculine' countries, they are somewhat forceful and competitive.[62]

Uncertainty Avoidance Index (UAI): Explains a society's tolerance for uncertainty and doubt in certain situations.[63] This index can also be expressed in people's search for truth. It explains how people in different countries deal with uncertainty and whether they feel comfortable or uncomfortable in unstructured situations. Cultures that want to avoid uncertainty have stricter laws and rules, safety and security measures, and tend to be very religious. People in certainty avoidance countries' are generally more outwardly emotional, are motivated by inner energy, and demonstrate flexibility and tolerance. Such cultures try to have as few rules as possible. On a philosophical and religious level they are more open-minded and accept that many different values flow side by side.[64]

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[56] See Hofstede (Internet, 2007).
[57] See Hofstede/ Hofstede (2005), p. 45.
[58] See Hofstede (Internet, 2007).
[59] See Hofstede/ Hofstede (2005), p. 80.
[60] See ibid.
[61] See ibid., p. 117.
[62] See Hofstede (Internet, 2007).
[63] See Hofstede/ Hofstede (2005), p. 165.
[64] See Hofstede (Internet, 2007).

Long-Term Orientation (LTO) versus short-term orientation: This fifth dimension, also called the Confucius dimension, was developed from a study among students in 23 countries around the world using a questionnaire designed by Chinese scholars.[65] LTO shows that value is given to virtue regardless of what the truth is. Associated values are thrift and perseverance; while standards associated with Short Term Orientation are respect for tradition, fulfilling social obligations, and protecting one's 'face'.[66]

2.3.2 The Chinese Culture

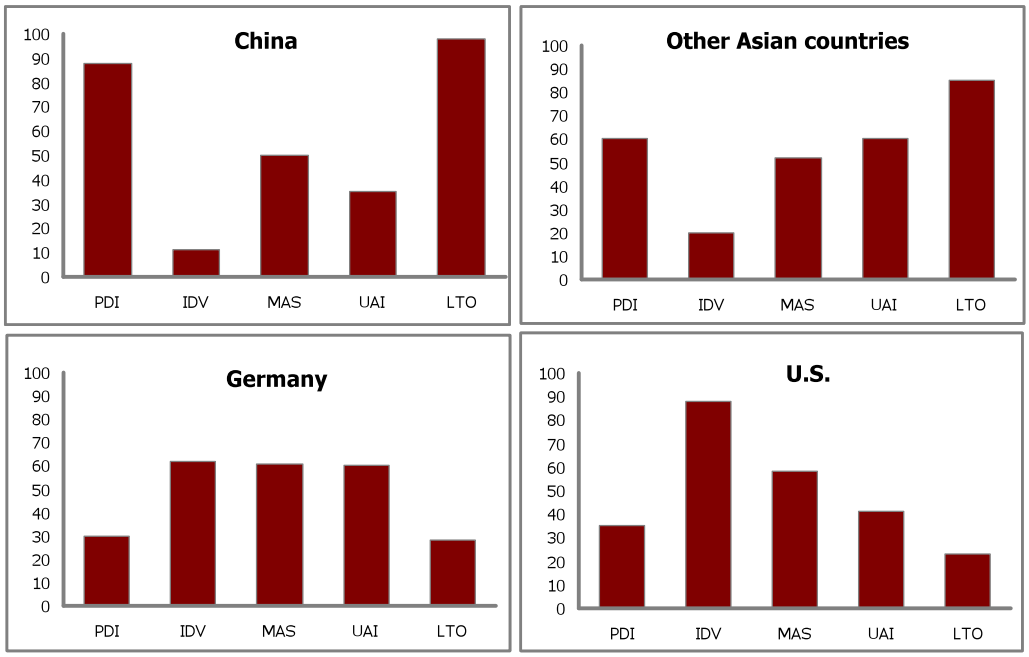
Cultures are complex and multidimensional. A number of definitions exist for the word 'culture'.

> "Culture is a system of shared beliefs, values, customs, behaviours, and artefacts that the members of society use to cope with their world and with one another, and that are transmitted from generation to generation through learning."[67]

Geert Hofstede applied the five dimensions explained in point 2.3.1 to several cultures; and he concluded the following for China, other Asian countries, Germany and the U.S.

[65] See ibid.
[66] See ibid.
[67] See The Culture Concept (Internet, 2007).

Figure 1: Comparison of Cultural Dimensions



Source: Hofstede (Internet, 2007).

Since this analysis discusses also challenges between Chinese and Western culture, the difference between these and additionally to other Asian countries are shown below.

Of particular note is China's significantly higher PDI ranking when compared to the average of other far-east-Asian countries and western countries like Germany and the U.S. This index shows that China has a high level of inequality in power distribution and wealth within its society. This condition is not necessarily forced from within the populous, but is rather accepted by the society as being a part of their culture.[68]

Compared to other Asian and Western countries, China has a lower rank in the IDV. A possible explanation here, according to Hofstede, could be the emphasis on a collectivist society promulgated by communist rule. Chinese society places more emphasis on relationships rather than individual actions. People want to take responsibility for members of their 'in-group'.

[68] See Hofstede (Internet, 2007).

Not much difference can be found in the MAS between China and the other countries. However, the MAS is reasonably high. Chinese culture behaves in the 'masculine' way, which means that social status, financial success and achievement are considered to be important criteria to evaluate people's lives.[69]

China's UAI does show a small difference to other Asian countries and Germany. From this it can be seen that in general Chinese people do not avoid uncertainty and many Chinese are displaying risk–taking behaviour at the present time.[70]

In Hofstede's analysis, LTO has the highest-ranking factor. "This Dimension indicates a society's time perspective and an attitude of persevering; that is, overcoming obstacles with time, if not with will and strength."[71] This dimension is most significant in East-Asian countries. It implies that Chinese people put great value in long time orientation and on their own future. This could be extrapolated from general values and behaviour to relate to business behaviour as well.[72]

Hofstede's conclusion is that the following indexes highlight the characteristics of the Chinese culture: PDI, IDV and LTO. The strong distribution of roles, people's collectivist attitude and moreover the future orientation are core characteristics which should be considered when seeking to develop successful business cooperation.

2.3.3 Education System

Another factor which can exert reasonable influence on a country's economic situation is the education system within that country. Universities play a key role in shaping the development of future scientists, professionals, bureaucrats (and so on) who are educated within their walls. Hence admission into the WTO has meant not only that economic and tangible assets have grown; the government has also established a policy to raise the standards of the educational qualifications Chinese students can obtain.[73] In this vein, the government launched a program whereby all children are entitled to a nine-year education; also in rural areas. During the period from 1998 to 2003 the number of students

[69] See ibid.
[70] See ibid.
[71] See ibid.
[72] See ibid.
[73] See OECD (2005), p. 2.

has grown by three and a half times[74] with an especially strong emphasis on the technical subjects. Another facet of this program was to increase wages for educated workers in the urban labour market with the goal of incentivizing people to work towards higher education.[75]

Although the Chinese education system is quite similar to systems in Western countries, the difference in cultural origins come through in how professors teach their classes and in how students adopt knowledge. The Chinese education system was shaped thousands of years ago. Chapter 2.3.3 explained that China is a collective and stratified society. The education system reflects this social need of the Chinese to develop harmony in a collective and stratified society.[76] The pedagogical method in university classes has been strongly influenced by Confucianism; a complex system of moral, social, political, philosophical, and religious thought.[77] Moreover, the university system is influenced by the political utilitarianism of education because Confucian moral virtues focus on an "ideal" population where everybody finds his or her place in the hierarchical structure.[78] The Chinese cultural schema of education has been described as "jiao shu yu ren", which means "teaching books and cultivating people".[79] Chinese students strongly rely on the power of books to transfer knowledge, and are expected to memorize material in case of need.

Another aspect deriving from the Confucian philosophy is the significance of examinations in the Chinese education scheme. Successful students are celebrated and awarded as people with morals and virtues and as fruits of the Chinese 'jiao shu yu ren' education schema.[80] This shows that students are not just studying diligently for themselves, but also to not damage their parents' 'face'.

The most noticeable differences between Western and Chinese education schemes are the role of teachers and students, but moreover the attitude towards examinations.[81] In China, teachers act almost like a family member and give advice regarding which infor-

[74] See ibid., p. 3.
[75] See ibid., p. 3.
[76] See Hui (2005), p. 3.
[77] See Hofstede/ Hofstede (2005), p. 400.
[78] See Hui (2005), p. 3.
[79] See ibid.
[80] See ibid.
[81] See ibid., p. 5 - 6.

mation is necessary to know and which is not. Because of this, the learning strategy of Chinese students would be challenged if students were required to differentiate between important and unimportant information.[82] This is stated in the fact that China's number of graduations from advanced programs such as the PhD is still low compared to other countries.[83]

2.4 Technological: R&D Behaviour in China

It is expected that the shift of R&D facilities to emerging markets like China and India will continue in the following years. The Chinese government plans to become a major innovation economy by 2020. Research and innovation should become the future motor of its new economic development strategy.[84] Several changes in Science and Technology identify why China has the potential to achieve its goal of becoming one of the largest R&D markets:

- Subsidised loans will be provided to firms in high-tech export industries by the Chinese development bank. This subsidised funding would be up to 50% of total debt company and is aimed to stimulate private R&D.[85]
- The new tax system introduced by the Chinese government allows firms to offset 150% of their R&D spend on income taxes. Also, if companies do not want to offset this amount in the current year, they can hold it for use for up to five years.[86]
- China also encourages central government departments to create 'seed funding' for venture capital. They also allow insurance and investment companies to invest in venture capital funds. Additional tax incentives for venture capital enterprises focus on supporting start-ups and new technology fields: both of these initiatives will further encourage R&D in China.[87]
- The number of researchers in China has grown by 77 % between 1997 and 2004.[88]
- Also, the government tries to create better linkage between universities and companies by the creation of innovation centres and the development of strategic allian-

[82] See ibid., p. 3.
[83] See OECD (2006), p. 138.
[84] See ibid., p. 90.
[85] See ibid.
[86] See ibid.
[87] See ibid., p. 91.
[88] See ibid., p. 44.

ces between universities and companies.[89]

These changes actioned by the Chinese government are aimed at making changes to the fundamental R&D behaviour of the country. It is therefore reasonable that an increasing number of companies are eager to move their R&D facilities to China. This is further supported in that China currently has the world's fourth largest R&D spend at 94 billion USD, just behind the United States, the European Union and Japan.

3 Challenges for Open-Innovation Companies in China

The following model will analyse the challenges and problems faced by an OMIC in China. It will provide a detailed discussion of the OI approach under cultural and KM principles. The concept of the virtual OMIC is based upon a business model, which stipulates that this company searches for knowledge external to itself in order to supply new innovations to their clients, without having to obtain detailed requirements.

3.1 Problem definition

Since the time when China set itself the high priority goal of becoming a more knowledge-based economy and society, Knowledge Management (KM) has become increasingly important.[90] However, compared to western countries, KM in China is organized in a different way.

> "Knowledge Management in China is distinctive, constrained somewhat by technological limitations, but influenced more significantly by psychological factors (such as cultural values) among groups and social levels." [91]

Distinctive aspects are related to knowledge generation, documentation and transfer. In China, KM has to be observed from a different perspective when compared to western countries. Cultural characterises have a great impact on how knowledge is shared between individuals and organizations. Given the cultural and political characteristics in China, an OMIC could face several challenges during the scouting process. Derived from

[89] See ibid., p. 89.
[90] See Burrows/ Drummond/ Martinsons (2005), p. 73.
[91] Burrows/ Drummond/ Martinsons (2005) p. 73.

theoretical explanations, the key issues are around technology identification, evaluation, and the project coordination between all involved parties.

The first problem of identifying a technology is influenced by several critical aspects. On one hand this is the business and global environment (cultural and political issues) but on the other hand it is also the internal organization (filtering the right information regarding the novelty degree of an innovation). The second problem is that technology evaluation is contingent upon the creation and usage of knowledge. However, knowledge in China is difficult to obtain and so the evaluation process may be affected. The third problem arises from the organization of the overall scouting process. The motivation of all involved parties has to be considered and viewed in light of cultural and political issues.

Specific reasons have to be found for these problems in order to create solutions and opportunities for future OMICs.

3.2 OMIC Analysis

Based on the problem definition, the following analysis will show which challenges an OMIC currently faces in China. This detailed analysis will help an OMIC to contrast their competitive environment and to create strategies and processes by taking all relevant factors into account. It will provide a detailed discussion of the OI approach under cultural and KM principles.

3.2.1 Technology Identification

OMICs, especially in China, face the challenge of identifying new knowledge and innovations from the outside market. There are several causes for difficulties of technology identification in China. Knowledge itself is different when observed in China compared with Western countries.[92] The codification of knowledge explains to what extent and how knowledge is documented or expressed in some other way. In China knowledge rather exists in tacit than in explicit form and therefore is difficult to obtain.[93] Also, the theory of Hofstede (explained in point 2.3) helps to understand the difficulty of a knowledge shar-

[92] See ibid., p. 75.
[93] See ibid., p. 75.

ing community by looking at the cultural preferences of the Chinese people to share knowledge with their in-group members and to avoid offering explicit knowledge to out-group members. The strong preference for personal and social relations means that knowledge is less published or documented compared to Western countries. This results in a lack of open source information.[94]

Moreover, deficiencies in the rule of law, particularly concerning IPR technology-based industries, create the sense that companies must either protect their own knowledge or be compensated for sharing it.[95] As explained in point 2.1, the IP system in China still has its weaknesses. Therefore, innovators may not trust companies since they do not believe that other companies or organizations will not copy their innovations. Therefore, the lack of trust generated by the deficiencies of law does not motivate innovators and scientists to share their knowledge.

IT often provides a platform for KM in China. Knowledge platforms allow people to share their know-how and experiences and help them to build up their own networks. In Western countries, TS is supported by scientist networks. However, since knowledge in China is mostly shared with fellow in-group members and therefore tends to be managed in context rather than as a process,[96] an OMIC in China cannot benefit as much from knowledge sharing as in Western countries. Moreover, in Western countries OMICs can benefit from networks and formal co operations with universities. However, such networks are not yet a common approach in China because of both a lack of incentive and infrastructure.[97] Scientist networks only barely exist and communication and information exchange through forums is not yet developed enough to support companies in the field of technology identification.

China's market structure could also be a reason for difficulties in the field of technology identification. Even though China's economic rate of growth in 2005 was 9.5%[98] and several multinational companies were eager to move R&D facilities to China,[99] the highest

[94] See Chan (Internet, 2007).
[95] See US embassy in China (Internet, 2007).
[96] See Burrows/ Drummond/ Martinsons (2005), p. 74.
[97] See ibid.
[98] See OECD (2005), p. 1.
[99] See US embassy in China (Internet, 2007).

cross-border flow of R&D still takes place within the OECD countries. In most cases, R&D projects have their origin in the United States, European Union or Japan.[100]

A reason that China still creates a weak number of patents could partially originate in the Chinese education system. As explained in section 2.3.3, in comparison to the Western education the Chinese education is still based on Confucius' principles and therefore does not encourage strongly individual and innovative thinking such as it is in Western countries. This issue perhaps also underlies the high rate of counterfeit commodities.

3.2.2 Technology Evaluation

Once a technology has been identified, the challenge for an OMIC is to identify whether the innovation is of a high enough quality to match the requirements of the client. Several reasons might explain why the technology evaluation process can involve difficulties.

The OMIC team has to possess widespread as well as in-depth knowledge about different technology fields. For the research team it is very hard to develop specific knowledge in several technology areas at once. Possible supportive methods for these issues could be employing a network of experts, a KM system or the involvement of technology suppliers and clients. However, several factors conflict with these supportive methods. Networks between companies and universities are still not very common in China and KM is also not easy to create. By virtue of the given cultural traditions, the Chinese favour informal and implicit forms of communication. They prefer to transfer knowledge through interpersonal contact rather than through formal or written means. This issue inhibits knowledge codification and restricts information access much more than technological factors.

A network of scientists would be able to support an OMIC to more carefully evaluate a technology. However, networking with universities and experts presents difficulties which are not really experienced in Western countries. Not only that Chinese prefer to share their knowledge within in-groups explains challenges for networks, but the cultural characteristic of long term orientation is a further possible reason. As mentioned in section 2.3.2, Chinese have a high index in LTO. This characteristic also refers to business

[100] See OECD (2006), p. 123.

cooperation. Fast moving business relationships, such as we have in Western countries, are not yet commonplace in China.

Specific knowledge essential for technology evaluation may be obtained by the integration of the customer and supplier of technology into the evaluation process. This task is central for OMIC's ability to obtain information (compare section 2.3.2). A lack of communication or integration of customers into this process would have the result that the company does not fully understand specific requirements and therefore possible failures cannot be identified at the earliest possible stage. However, as mentioned above, cultural and IP issues mean it can be difficult to obtain knowledge from papers and personal communications (without a prior relationship). Often, Chinese papers do not deliver explicit knowledge since scientists fear that their technology will be copied. Another aspect is again the cultural challenge and this is also a reason for the problems an OMIC faces in the task of technology identification. The integration of suppliers of technology is of similar importance. The integration of technology suppliers (or owners) can provide operational benefits such as the earlier identification of technical problems and strategic benefits such as the improved utilisation of internal resources. However, the communication with the technology owners in China is sometimes very hard.

In order to evaluate technologies carefully, the internal organization of an OMIC has to be structured effectively. Knowledge has to be shared amongst individuals and this process should be the responsibility of one project manager. Section 2.3.1 shows that the Chinese culture favours hierarchical structures. Therefore, Chinese managers rarely acquire or accept knowledge from their subordinates. Vertical knowledge transfer is thus restricted and good ideas or proposals could be lost because of this organization. Chinese decision making by corporate managers, as well as by government officials, is comparatively implicit, relying on analogical and correlative thinking, rather than on rational and analytic thinking.

3.2.3 Project Coordination

Another main challenge for OMIC's in China is in organizing the overall OMI process. The challenges as explained above are prevalent in the environment and OMI in China must focus on how to overcome these. Even with the support of IT-system knowledge plat-

forms in China, knowledge tends to be managed within its own context rather than as a process. Studies have indicated that Chinese managers make limited use of computer-based information systems when compared to their counter-parts in Western countries.[101] Because of this, an individualised approach must be created for each particular business with consideration given to the relevant information which influences that company's own OMI approach. There are some general issues which tend to challenge the process. On the one hand, Confucianism influences how KM activities are organized internally, as explained in section 2.3.3 The desire of both managers and employees to avoid conflicts and thereby not have to risk losing 'face' results in a common respect for the organization's hierarchical structure and the aim of achieving "collective" goals. (Nonetheless, the head of a department often sets these). On the other hand, when using OMI, one has to be mindful of incorporating a working incentive system. Knowledge transfer requires sponsors who motivate the involved parties to offer and share their knowledge. Cultural characteristics have to be carefully considered in order to ensure everyone is respected and treated in the right way within their place in the hierarchical structure.

Moreover, when adopting an OMI approach, one has to be mindful of the decision-making tendencies of Chinese people. Chinese decision-making is characterised as being implicit; relying more on analogical and correlative thinking rather than rational and analytic thinking. This means that there is room to encourage decision-making methods which might strengthen a department's ability to make more sophisticated, analytical decisions.

These points should be documented in order to help individuals to act systematically and to enable them to define their approach to operate within a company with a focus on OMI. A defined process is a key for organizations to follow their business plans. This is especially so in China where OMIC's face additional challenges in the cultural and political realm. Thus, a defined process around OMI will support organizations to reach their strategic and economic business goals.

[101] See Martinsons/ Westwood (1997), p. 1.

3.3 Business Case

The information presented in chapters 2 and 3 showed that within the creation of an effective scouting process there are opportunities to take, but also challenges to mitigate. A sample company, which will be presented in this chapter, is not alone in experiencing difficulties in its quest to develop a proficient scouting process. Cultural and political challenges hamper the development of innovation management in China and accordingly this company has problems with this step. Three case studies have been analyzed supported by using the models of Porter's five forces and a SWOT-analysis. In summarizing the gathered information from the three case studies, the following conclusions can be drawn. In order to identify possible improvements, figure 2 summarizes crucial problems in each scouting process. The checklist showed in figure 3 will illustrate which tasks have been organized differently in each scouting process.

Figure 2: Main Problems Appearing in the Business Cases

Analysis / Main problem	Case Study: 1	Case Study: 2	Case Study: 3
Identification of technology			
Understand technology	ρ	ρ	
Evaluation of technology	ρ	ρ	
Set up contact to client	ρ		
IPR issues			ρ
Cooperation with client			ρ
Project Outcome	v	v	v

Project failed

Project forward to the feasibility study

As is observable in figure 2, the main challenges for this company were in the areas of understanding and evaluating the technology. In one case the team was confronted with difficulties surrounding IPR, in another establishing a working liaison with the technology owner because of problems communicating with their client. Figure 3 shows some possible reasons for these problems.

Figure 3: Checklist of Project Tasks

Analysis Project tasks	Case Study: 1	Case Study: 2	Case Study: 3
Technology screening	×	×	×
Check usability of technology for client	×	×	×
Technology benchmark			×
Contact to technology owner		×	×
- Check about right understanding of technological approach		×	×
- Check about additional technological functions			×
- Check company details		×	×
Consultation of experts			×
Personal contact with technology owner		×	
Offer motivation and incentives to technology owner			
Project follow up			
Project Outcome	🟠	🟠	🟢

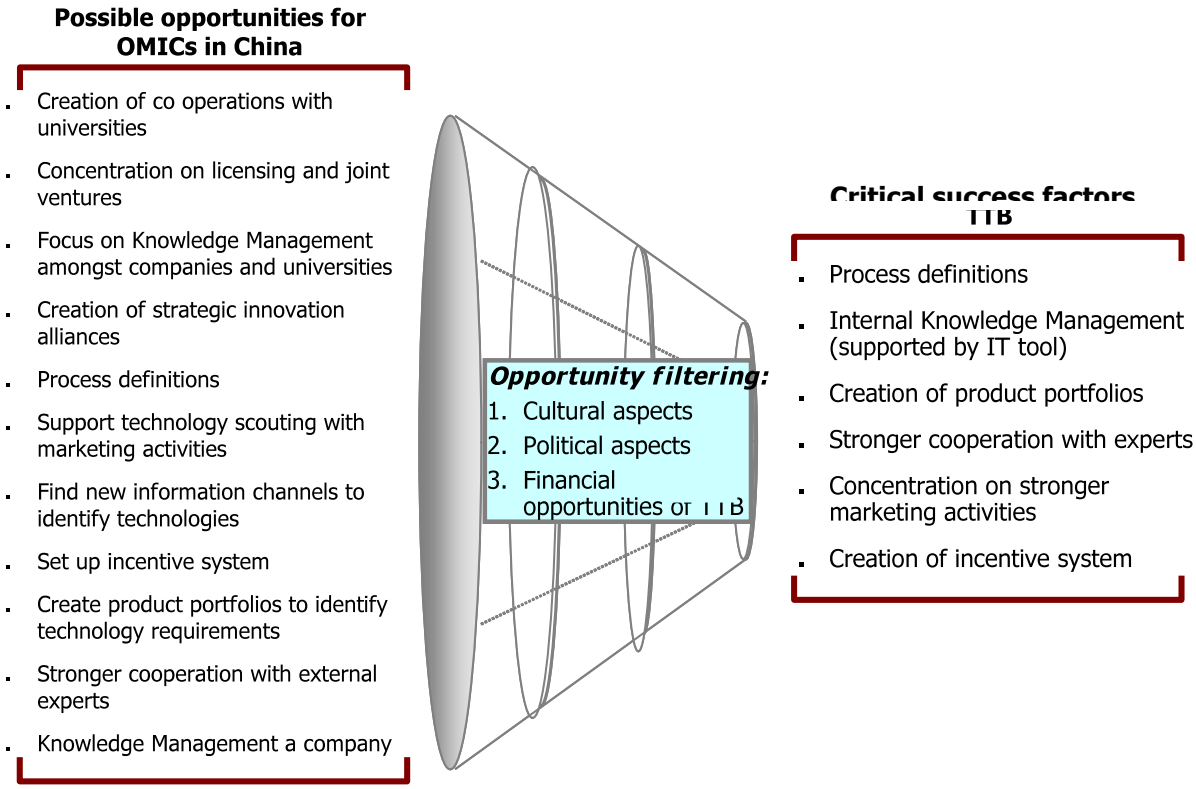
Key tasks, such as the consultation of experts and establishing a permanent contact with the technology owner, were not sufficient carried out in case studies one and two. Although the technology of case study three will be forwarded into the next process step, an important task interrupted the evaluation of the technology: since the company did not want to offer incentives for the technology owner without obtaining enough information, he declined to send the final prototype. However, in summarizing the two figures, it is noticeable that the key challenges are around understanding and evaluating the technology, and most importantly, the organization of the whole scouting process, particularly contact with consultants and the technology owner.

4 Critical Success Factors for a OI Model in China

Four analysis methods (PEST, OMIC, Business Cases and SWOT) were carried out for a Chinese multinational company and highlighted the challenges faced within the OI model in China. This chapter will introduce ideas around possible improvements. The

following graph introduces possibilities for OMICs in general and specific potentials which demonstrate critical success factors for a working scouting activity.

Figure 4: Possibilities for Improvement for Siemens TTB China



Suggestions of optimization were chosen under the consideration of cultural and political aspects as well on the experiences gathered out of the business cases. Moreover, the concepts will meet the following criteria: Firstly, the ability to deliver a low cost solution which offers efficient and effective support for work to be carried out. Secondly, to offer a solution which is easy to use and implement and finally, to focus on two key areas requiring improvement – these will be analyzed in detail. Given the information gathered from the business case analyses, the two key areas requiring most attention are: developing a definition of a knowledge 'tool' and developing a more concrete definition and process for TS; one which will incorporate checklists and rigorous procedures. Further suggestions for improvement will be mentioned, but these will not be analyzed in as much detail in order for the focus to be on these two key points.

4.1 Process Definition

As identified in the business case studies, OMIC´s have problems identifying the right information at the right time. This results in a lack of information which affects the quality of the technology evaluation which in turn results in project times that are too long and costs that are too high. Such a definition would help employees of OMICs to search and evaluate new technologies efficiently without spending too much time doing this. The process definition would organize the internal workflow and would support new employees to become involved with their tasks more quickly. Although a scouting process has to be flexibly organized, a guideline would certainly create a framework for the important tasks which are standard for each and every scouting process.

4.2 Knowledge Management Tool

As already identified, knowledge in China 'displays' characteristics which differ from Western countries. Knowledge in China is more prevalent in the tacit rather than the explicit form. Because of this, the technology identification and evaluation process is hampered as information is more difficult to obtain. As was identified in the business case studies, OMICs must step up to the challenge of developing a high level of technical knowledge in each technology area in which they may be scouting in.

A possible aid to support OMICs information research is a KM platform. Such a platform is justified by the theoretical concept of a knowledge life-cycle. This life-cycle demonstrates how knowledge can be understood and managed through the stages of the cycle: Create, store, find, acquire, use and learn. Within the framework of a company's scouting process, the creation and storage of knowledge is mostly carried out by the technology owner. The technology owner invents a novel technology/product and may also publish a paper and/or register a patent. Mostly, OMICs seek such information, acquires it, uses it and learns from it. However, once one scouting process is complete, OMICs starts a new process without creating or storing information which has just been learned. This means that valuable know-how stays in tacit form and will not be transferred into an explicit and transferable form. Such acquired knowledge and experiences would however be of great assistance for other team members. To remedy this, OMICs could apply the knowledge life-cycle to transfer its own tacit knowledge into explicit knowledge. Implementing a KM-

platform, supported by an IT-solution, whereby employees input detailed information about their project experiences would allow this cycle to be applied in practice. In order to build a KM-platform up, there are two important issues to consider: Firstly, what type of information is to be collected for the database and secondly, how to make this database user-friendly.

4.3 Networks and Co operations

Informal networks are of great importance for TS. As explained in section1.2.1, the time to market for new innovations can last as long as 18 months. Especially in the business environment of fast moving product life-cycles and the cultural characteristics of China, informal networks are essential for creating business success. Currently, OMICs mainly conduct research in formal networks such as databases and on the internet. By supporting their informal networks, OMICs would be able to improve on their ability to obtain more information and turn technologies into products for the market faster.

4.4 Incentive System

The scouting process in business case study three had problems because the technology owner expected funding when the company could not offer it. As explained in section 1.3.2, defining and advertising an incentive system that includes all of the parties involved is a critical success factor. It is very difficult to expect the technology owner to share his or her information without seeing a benefit. In addition, OMIC employees can also be motivated by the creation of incentives. An incentive system would create a win-win situation and would motivate all parties involved. However, incentive systems in China have to consider strongly cultural values and characteristics. To increase the performance of internal and external technology scouts by incentives would offer not only financial benefits. Also, it would offer a challenge to not loose their 'face' which results that employees want to perform better as their colleagues. Therefore, an incentive system could be work nearly without delivering financial incentives, driven by the cultural characteristic of the Confucius dimension. However, an incentive system for academic and industrial information sources has to be thought-out carefully. Financial incentives can encourage information sharing; moreover, a challenge has to be created.

Conclusion

The approach of OMI has become increasingly popular over the last few years. Several companies which have changed their strategies to an outside-in approach has been benefited from greater market know how and faster innovation cycles. However, an OMIC in China faces challenges in the scouting process because of two key reasons: firstly, political issues, and secondly cultural issues which are both unsupportive of a knowledge-sharing environment. Due to the different characteristics of knowledge in China, an OMIC finds that it is more difficult to apply an OMI business model in China than it is in Western countries. However, in spite of these challenges, the Chinese market is currently the world's fastest growing market and companies should not shy away from setting up research facilities in China. The current lack of infrastructure between universities and companies means that there are great prospects for improvement. With developments in these areas, opportunities will also arise which will foster a better environment for TS in China. Critical success factors for a working scouting activity are knowledge management, networks to experts and universities, defined processes and working incentive systems. As many companies continue to shift their R&D laboratories to China, strategic changes recommended in this report would be of benefit for OMICs to capture its share of the growing technology innovation market.

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