Alliance-based network view on Chinese firms’ catching-up: case study of Huawei Technologies Co.Ltd

Citation for published version (APA):
Zhang, Y. (2009). Alliance-based network view on Chinese firms’ catching-up: case study of Huawei Technologies Co.Ltd. UNU-MERIT, Maastricht Economic and Social Research and Training Centre on Innovation and Technology. UNU-MERIT Working Papers, No. 039

Document status and date:
Published: 01/01/2009

Document Version:
Publisher's PDF, also known as Version of record

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.umlib.nl/taverne-license

Take down policy
If you believe that this document breaches copyright please contact us at:
repository@maastrichtuniversity.nl
providing details and we will investigate your claim.

Download date: 19 Sep. 2020
Alliance-based Network View on Chinese Firms’ Catching-up: Case Study of Huawei Technologies Co.Ltd.

Ying Zhang
Alliance-based Network View on Chinese Firms’ Catching-up: Case Study of Huawei Technologies Co.Ltd.

Ying Zhang
UNU-MERIT, Keizer Karelplein 19, 6211 TC, Maastricht, the Netherlands
(Email: Zhang@merit.unu.edu)

Abstract
With China’s rapid economic growth in recent years, many Chinese firms especially in high-tech industries have started to technically lead in the international market. In this study, we aim to uncover the root causes that lead to Chinese firms’ catching up from network perspective. By taking Huawei Technologies Co. Ltd. as a case, we integrate absorptive capacity development and firm-level catching up into an alliances-based network framework. We found that network alliances with firms and universities complement each other at different catching up stages; and alliances-based network provides a springboard for Chinese firms to shorten catching up path. We argue that in Chinese context, impact of FDI on firms’ performance comes into effect only if partnership is carried out; alliances with universities facilitate development of absorptive capacity at an early stage; Partnering with leading players stimulate R&D investment at a late stage and simultaneously enhance firm’s innovation performance as well.

Key words
Strategic alliances, Network, Chinese firms, absorptive capacity, catching up

JEL Code: M13, O32, O19, L24

UNU-MERIT Working Papers
ISSN 1871-9872

Maastricht Economic and social Research and training centre on Innovation and Technology, UNU-MERIT

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at the Centre to stimulate discussion on the issues raised.

1 Thanks are given to Professor Geert Duysters and doctoral researcher Tina Saebi and doctoral researcher Asel Doranova for their thorough review and valuable comments.
1. Introduction

The central idea of national catching up is the technologic and economic convergence between leading countries and followers (Abramotiz, 1986). Since 1960s, with the empirical studies of catching up experience of the US, Japan, and South Korea, this theory has been rapidly developed. Freeman (2002) argued that technology and innovation are central to the catching-up process; latecomer firms have advantage to target progressive and dynamic industries. Perez and Soete (1988) claim that once latecomer firms have enough time and sufficient productive capability as well as other resource endowment (especially human capital relevant for new technologies), catching up can be achieved through ‘window of opportunity’.

As one of emerging economies, China’s spectacular economic growth and unprecedented success have attracted much attention from both academic scholars and policy-makers alike. Undoubtedly, today’s China has been the single most important new development affecting the world economy at the outset of the 21st century (Elchengreen and Tong, 2007). China’s GDP has been the third largest country in the world after the US and Japan. China is now the world’s sixth largest trader, supplying more than six per cent of global exports, and the leading destination of foreign direct investment.

With China’s rapid development, many Chinese firms have already been the leading players in the international market. LUBS research report said that Chinese multinationals could no longer be regarded as ‘apprentices’ on the international stage; they have already been investing in the developed countries to obtain intellectual property and to learn from joint venture partners (LUBS report, Jan. 2009).

In the academic field, much attention has focused at macro-economic level on the impact of FDI on China’s economic growth. In the early stage, inward FDI in China was extensively studied. Scholars made consensus that FDI significantly and positively impacted on China’s industrialization as well as productivity (i.e. Kueh, 1992; Wang and Swain, 1995; Liu et al., 2001; Heid and Ries, 1996). Later on, as Chinese firms emerged as a strong group of foreign direct investors in other developed and developing countries, much research effort was switched to Chinese outward FDI and its impact on firm’s development and other countries’ economic growth (i.e. Elchengreen and Tong, 2007).

We found that fewer studies at micro-level have considered frameworks that lead to Chinese firms’ catching up. Maybe it is because the number of successful catching up firms from China is not large. Child and Rodrigues (2005) have ever initiated an article aiming to stimulate discussion on this issue. However, as we can see, the studies are still very limited. Yu et al. (2006) gave the evidence that there have been a number of Chinese companies catching up. Duysters et al. (2009) argued in a case study of Haier Group that there is an alternative strategy for many Chinese firms to the much-acclaimed East-Asian route to growth. They all highlighted the importance of strategic alliances in the cases but unfortunately did not pay much attention to explore the catching up framework.

Therefore in this study, we seek to identify a framework that part of Chinese firms in ICT industry used for catching up. By taking Huawei Technologies Co. Ltd. as a case work, we try to find out the strategies that Chinese firms used for developing absorptive capacity and innovation performance.

Based on the case study of Huawei, we argue that FDI is inter-dependent with strategic alliances in the early stages of catching up and network alliances with universities and other firms effectively facilitate Chinese firm’s development. We are not saying that this network perspective view on catching-up framework is suitable for all Chinese firms, but at least it provides other latecomer firms with a referred mechanism. We expect this study could stimulate more discussion on Chinese firms’ catching up, catching up strategies, and catching up frameworks.

The study proceeds as follows. Firstly, a brief explanation of core concepts like strategic alliances and absorptive capacity is given in section 2. Afterwards, an overview of catching up in China’s context is presented, including China’s absorptive capacity at national level and Chinese firms’ mode choice in a catching up trajectory. Then, section 4 focuses on the case study of Huawei Technologies Co.Ltd. from alliances-based network perspective; and finally we give the discussion, conclusion, and future research in section 5.

2. Core Concepts

2.1 Strategic Alliances

In line with previous alliance research (Yoshino and Rangan, 1995; Osborn and Hagedoorn, 1997; De Man et al., 2001; Heimeriks, 2004), we define strategic alliances as agreements between two or more partners as a cooperative form towards a common goal by sharing necessary resources as well as coordinating activities.

Besides the advantages that collaboration encompasses such as flexibility, commitment reduction, and facilitating organizational learning etc. (Mowery et al.,1992; Chan, 1997) , strategic alliances have additionally advantages in offering opportunities to (a) access market; (b) accelerate the return on investment; (c) share the cost
of investment such as R&D; (d) spread risk; (e) access resources such as complementary technology; (f) create efficiencies through economies of scale and scope; (g) co-opt competition. Companies using strategic alliances might gain an early window on emerging opportunities that they may want to commit to more fully in the future (Schilling and Steensma, 2001) and obtain overall level of flexibility by establishing a limited stake in a venture while maintaining the flexibility to either increase their commitment later or shift these resources to another opportunity (Schilling and Steensma, 2001)

2.2 Absorptive Capacity

Cohen and Levinthal (1990) define absorptive capacity as a firm’s general ability to value, assimilate, and commercialize new, external knowledge. They argue that a firm’s absorptive capacity is developed cumulatively, path dependent, and based on prior investments in its member’s absorptive capacity.

In the school of absorptive capacity, many scholars explored internal determinants of absorptive capacity. Nicholls-Nixon (1993) examined the role of absorptive capacity in pharmaceutical firms’ responses to the technological discontinuity created by the emergence of biotechnology. She measured absorptive capacity in three ways: the number of biotechnology patents the firm held, the number of new products it had on the market or under development, and its reputation for expertise in the human health applications of biotechnology. She found that firms with high levels of absorptive capacity invested more in their own R&D, utilized alliances, in-house expertise with relevant technologies, and communications with alliance partners.

Absorptive capacity of alliance partners are related to learning process. Lane and Lubakin (1998) argue that absorptive capacity is a function of the absorptive capacity of the dyad. Koza and Lewin (1998) address the importance of absorptive capacity by considering different type of alliances in terms of non-equity alliances (such as joint R&D, franchising, and licensing) and equity alliances (such as joint venture). They propose that non-equity based exploration alliances are greater interdependent than equity based exploitation between absorptive capacity and learning of each partner.

3. Catching up Analysis in Chinese context

Based on a historical analysis, Mokyr (1990) argues that technology catching up is an outcome of a process of technology accumulation. Abramovitz (1989:222) argues that a country’s potential for rapid growth is strong not when it is backward without qualification, but rather when it is technologically backward but socially advanced. In other words, absorptive capacity can be established only if sufficient social capability has been built. In the dynamic economic evolution, the potential for developing absorptive capacity at a basic level is not only associated with a country’s endowment of highly skilled labor but also closely related to the corresponding mechanism of open communication. Therefore, we argue that an embedded catching up system is developed within an individual-organization-society ‘pyramid’ in which absorptive capacity is built on social capability and catching up is generated when absorptive capacity and social capacity are prepared.

3.1 China’s absorptive capacity at national level

To measure China’s national-level absorptive capacity, two indicators can be chosen. First is the endowment of researchers and the other is the ratio of R&D investment over GDP. According to the announcement from OECD in 2006, the number of researchers in China has increased over 77% from 1995 to 2005, China has ranked the second worldwide with 926,000 researchers by 2005, just behind the United States. Figure 1 gives the comparison across OESO, Netherlands, European Union Countries, and China on ratio of R&D investment over GDP. In order to identify the main characteristics of China’s national absorptive capacity, the source of R&D expenses and the allocated distribution of R&D fund are also considered. From figure1 we can see China’s investment in R&D over GDP was averagely above 1.05% per year; by 2006, this ratio had approached to 1.5%. According to the report submitted by National Development and Reform Commission to National People’s Congress, China is aiming to raise spending on research and development up to 1.58 percent of GDP in 2009. These two indicators implicate that China’s absorptive capacity at national level has been tremendously developed; measuring at a country level, the technology gap between China and European developed countries is getting smaller.
According to China Statistic yearbook of Science and Technology (2007), government has not been a major source of R&D fund. From figure 2 we can see in 2006, only 24.7% of R&D fund was from government; whereas 69.1% was from enterprise and 4.6% from banks, which is comparable with that in 1999, in which the ratio is 32.4%, 34.9%, and 8.8% respectively. A report from Economist on Dec. 20, 2008 said that China is now close to surpassing Japan in total research spending, from almost nothing a decade ago; and corporate R&D in China has soared 23% comparing with 1-2% between 2001 and 2006 in America and Europe. The changes in the source of R&D investment imply that Chinese enterprises have intentionally started to build up absorptive capacity.

With respect to the distribution of R&D expenditure, the data from China Statistic Yearbook of Science and Technology (2007) reflects that 71% of R&D funds were allocated to enterprises and 18.9% to domestic research institutes and universities. Since public research institutes & universities in China are closely technological collaborating with enterprises, it is sensible that part of R&D investment by enterprises was spent in the university-industry collaborative R&D projects.

3.2 Chinese firms’ catching up strategies
At national level, absorptive capacity can be developed through many channels, of which the most attractive and well researched is foreign direct investment (De Mello, 1997; Dunning, 1993). Studies on this topic have offered many empirical evidences, showing that FDI is an important vehicle for technology transfer and contributing to host countries’ economic growth (Borenszein et.al, 1998; Reichert and Weinhold, 2001).

The important role of Multinational Enterprises (MNEs) in host countries is that technologies can be transferred not only through linkage between MNEs and their subsidies in the host country\(^2\), but also through knowledge spillovers via inter-organization cooperation. Through labor turnover, competition force, demonstration effect, and forward as well as backward linkages, FDI could undoubtedly be used at the pre-catching up stage to establish a minimal level of absorptive capacity for host country firms.

---

\(^2\) mainly determined by the absorptive capacity of MNE’s subsidies in host country and the willingness of their parent company to take technology transfer.
Table 1 presents the conclusive characteristics and strategies applied at each stage of catching up by backward country firms. In addition to absorptive capacity, knowledge accumulation at each stage is also notified. It is clear that as catching up proceeds, strategies used for acquiring external technologies evolve as well.

In China, since 1978 when open-door economic reform was initiated, FDI has been acknowledged as the main mode to accelerate Chinese economy growth. The underlying argument concerns that the MNEs’ entries have a forecement effect on Chinese local companies. On the one hand, local companies that could not shoulder competition pressure from foreign rivals were firstly displaced. On the other hand, the survival indigenous companies which can survive were forced to improve absorptive capacity via inter-firm cooperation (such as forward and backward linkage in FDI). Many local multinational enterprises such as Changhong, Huawei, Haier, Lenovo, and Galanz et al. surviving at that time had significantly benefited from cooperating with foreign enterprises. Therefore, we argue that the effect of FDI is inter-dependent on the corresponding inter-firm collaborations.

As indicated in table 1, catching up country has a variety of choices to enhance absorptive capacity. At different stages, absorptive capacity could be developed through an integrative mechanism where national actors complement each other. In other words by taking China as an example, numerous strategies are implemented at the same time by national actors. Firms that have already been relatively technologically advanced are preferable to implementing less committed governance modes such as R&D agreement and strategic alliances. Firms that sit behind are on the contrary feel security to rely on stronger ties forming a valid and high committed governance mode, i.e. merger and acquisitions, or joint ventures. At a firm level, each Chinese enterprise has its own learning network with a number of learning partners and learning modes. Firms that can manage its network well and actively play as a network hub or cover network structure hole are able to preemptively grasp technical knowledge and market.

Table 1 Strategies used in different stages of catching up

| Economic Growth Stage | Absorptive Capacity | Economies’ characteristic | Strategies to accumulate knowledge | Level of knowledge accumulation |
|-----------------------|---------------------|---------------------------|------------------------------------|--------------------------------|
| Pre-catching up       | Very low but might be increasing | Resource-based; Unskilled labor; Low level of inward technology transfer | Low level of Inward FDI and no outward FDI | Low but might be increasing |
| Catching up           | Increasing to reach peak | Knowledge infrastructure and domestic industrial capacity; high rate of knowledge accumulation and absorption of external knowledge | Assimilation of spillovers from trade or inward FDI; Technology licensing; reverse engineering (early stage) and R&D (late stage); acquisition of technology by M&A | Rapidly increasing |
| Pre-frontier          | declining           | Assimilation becomes difficult; marginal return of absorptive capacity declining. | Strategic alliances; in-house R&D; outward FDI; joint venture | Increasing rate decline and reaching the flat range |

Network leader in Chinese catching up networks are identified having a number of common traits. For instance, they either posit the important interfaces across different sub-network as a broker or connect with almost all the other actors as a center. The involved actors in network include profit-oriented firms, universities & institutes, and western companies doing business in China. Based on the observation on Chinese context, we therefore have

**Proposition 1**: firms that embrace higher volume of network resource have higher probability to access a variety of knowledge and markets.

**Proposition 2**: firms that locate in network center have higher probability to catch up successfully.

We give the proof of these two propositions in section 4 by studying a case of Huawei Technologies Co. Ltd.

---

3 This happened in the late 1980s till mid of 1990. Some state-owned-enterprise that did not endow capability to shoulder the competitive stress went into bankrupt.
4. **Case study of Huawei Technologies Co. Ltd.**

In principle, success in catching up is labeled by the increased marketing performance and raised innovative capability. In this section, an integrative strategy package will be illustrated to see why some Chinese firms could be successful in the international market and how could they ladder quickly to the upper stages. We will take the experience of Huawei Technologies Co. Ltd. as an example and specifically analyze the strategies for developing absorptive capacity and innovation performance.

Huawei is a Chinese company in ICT industry. It is the largest and most prestigious networking and telecommunications equipment supplier in China. Huawei has now had eight overseas regional departments and 85 branch offices around the world. Its industrial status in ICT industry is equal to many multinational companies from western countries.

Huawei’s business includes manufacturing and supplying CDMA, 3G terminals, intelligent optical network ASON, core routers, and switching in the world. To help readers have more familiarity with Huawei, we list part of Huawei’s recent marketing performance as below:

- Huawei’s WCDMA products have won business application in 26 countries and regions, including Netherlands, United Arab Emirates, HKSAR, Mauritius, and Malaysia (Ditterner, 2005).
- Huawei’s 75% of sales were from overseas market and by 2005 Huawei ranks No.2 in the global market in respect of optical network and DWDM products (Ovum-RHK, 2005).
- Sales amount of Huawei’s softswitch products rank No. 1 in the world (Ditterner, 2005).
- Intelligent NetworkHuawei has the most subscribers around the world in this field (Ovum-RHK, 2005)
- Huawei’s IP DSLAM products rank No.1 in the global market (Infonetics, 2005 Q2).
- Sales amount of Huawei’s MSAN products also ranks No. 1 in the global market (Source: Infonetics, 1H05)
- Huawei’s routers rank No.3 in the global router market (Gartner, 2005 Q2)
- Huawei is the global WCDMA network priority suppliers of Vodafone
- Huawei is the global cooperative partner in WCDMA and broadband equipment
- Huawei undertakes the largest NGN network of Germany

To estimate Huawei’s innovation performance, we collected patent data from SIPO, USPTO, and EPO, as the performance in USPTO and EPO can represent Huawei’s innovative power in developed regions; and patents in SIPO either in English or Chinese can reflect Huawei’s competitive capability of innovation performance within China’s domestic market. The data from other countries patent databases was not collected, even though Huawei has been recognized and awarded by World Intellectual Property Organization (WIPO) in 2009 as the World’s Top International Patent Seeker (which ended the almost one decades of domination by Netherlands’ Philips Electronics as the first place on the list).

![Figure 3 Huawei’s patents in USPTO, EPO, and SIPO](image)

Based on the data collected, we drew the picture in figure 3. Since the number of patents is usually considered as an important indicator of firm’s innovation performance, we can see that Huawei’s innovative capability primarily emerged in 1998 and its marginal increase rate was really high from 2000. In China’s domestic market, English

---

4 All these information has been collected in "Shenzhen Company Profiles". [www.torinowireless.it/download.php?fileID=187&lang=it](www.torinowireless.it/download.php?fileID=187&lang=it)
versioned SIPO patents are specially used to defend from foreign competitors. Figure 3 shows that Huawei worked also hard in China’s competitive ‘domestic international market’. Despite the number of patents applied in USPTO is too small to be recognized in figure 3, if just considering the proportion of patents applied in USPTO by Huawei over the whole number of Chinese patents in USPTO each year, we can have conclusion that almost 16% of Chinese patents applied in USPTO each year were accounted by Huawei. Moreover, more patents assigning to Huawei in Europe than that in USPTO implies that Huawei has larger market share in Europe than in U.S. From both marketing and innovation performance perspectives, Huawei’s catching up performed successfully.

In order to have thoroughly logical analysis, let us go through with Huawei’s history. Huawei was established by Ren Zhengfei in 1988 in Shenzhen, Guangdong province, China. Initially it was just a small distributor of imported PBX products without any telecommunication knowledge. Five years later, in 1993, Huawei had achieved its primary threshold of knowledge accumulation on PBX and successfully made the first breakthrough in C&C08 digital telephone switch by effectively taking advantage of the technology diffusions from Shanghai Bell (the first Sino-foreign joint venture in China). Huawei thereafter successfully monopolized Chinese rural market and small cities. Afterwards, with higher product quality and improved product development, Huawei started to compete with foreign multinational companies also in South Africa, south-east Asia, and South America) and gradually penetrated to developed countries. By keeping support from Chinese government. Getting trust from government means that Huawei was not only able to receive much more privilege in China’s domestic market, but also having more financial credits for R&D fund. In 1994, Huawei became the first Chinese firm that established long distance transmission equipment business, launching HONET integrated access network and SDH product line.

By 1996, Huawei had monopolized China’s rural regions and part of urban areas. Since then, Huawei started to extend market to overseas by using the similar marketing strategy called “from developing to developed regions”. Huawei firstly accessed to backward market that foreign multinationals did not intensively invest (for instance, South Africa, south-east Asia, and South America) and gradually penetrated to developed countries. By keeping collaboration with Chinese universities, Huawei step by step competed with foreign multinational companies also in overseas market. In 1997, Huawei successfully released its GSM products and eventually expanded to offer CDMA and UMTS, which was at that time considered impossible for developing country’ firms.

In order to avoid direct competition with Shanghai Bell in 1990s, Huawei explored rural market with political support from Chinese government. Getting trust from government means that Huawei was not only able to receive much more privilege in China’s domestic market, but also having more financial credits for R&D fund. In 1994, Huawei became the first Chinese firm that established long distance transmission equipment business, launching HONET integrated access network and SDH product line.

By 1996, Huawei had monopolized China’s rural regions and part of urban areas. Since then, Huawei started to extend market to overseas by using the similar marketing strategy called “from developing to developed regions”. Huawei firstly accessed to backward market that foreign multinationals did not intensively invest (for instance, South Africa, south-east Asia, and South America) and gradually penetrated to developed countries. By keeping collaboration with Chinese universities, Huawei step by step competed with foreign multinational companies also in overseas market. In 1997, Huawei successfully released its GSM products and eventually expanded to offer CDMA and UMTS, which was at that time considered impossible for developing country’ firms.

In order to develop management skills and structure, Huawei invested in collaboration with IBM Consultant. Since 1998, this collaboration optimized Huawei’s management, organization, and product development structure. Quite fast, Huawei became a leading player in the telecommunication industry by providing diversified products ranging from switching, integrated access network, NGN, xDSL, optical transport, intelligent network, GSM, GPRS, EDGE, W_CDMA, CDMA2000 as well as a full series of routers, and other LAN equipment.

Besides catching up in management, Huawei invested heavily in Research and Development. Averagely each year, at least 10 % of annual sales were put into R&D for developing absorptive capacity. Huawei so far has established 14 R&D centers around the world, being embedded in the collaboration with suppliers, customers, universities, and leading players. Huawei’s alliance-based network is characterized by multidiscipline, multi-level, and multiregions. Table 2 lists Huawei’s partnership history with leading players, from which we identify that firstly, Huawei’s alliances activities started very early even when it was just founded; Secondly, alliances happened frequently with alliance partners who were not restricted within the same sector; Finally, alliances network enlarged and embedded quickly, by which Huawei gained a list of partners to work with in a stable way.

As what Huawei people declared, they aim to be abreast with the latest technology and quickly incorporate advanced technology into its own knowledge base. Huawei people believe that the cooperation with leading multinational companies can help them enlarge technology base and achieve win-win outcome. Therefore, since 1997, Huawei have established joint ventures (1) with Siemens on the research, production, sales, and services of
TD-SCDMA in order to further advance its technology development; (2) with Motorola in Shanghai to engage in providing global customers with powerful UMTS products, solutions, and HSPA; (3) with many prestigious companies such as Intel, Texas Instruments, Freescales Semiconductor, Qualcomm, Infineon, Agere Systems, Microsoft, IBM, Sun Microsystems HP, ADI, Altera, Motorola, Oracle, SUN, TI, and Xilinx for a number of joint laboratories; (4) with many other world leading management consultant companies such as Hay Group, PwC, and FhG to introduce a series of advanced processes such as IPD (Integrated Product Development), ISC (Integrated Supply Chain), IT-based management system in human resource management, financial management, and quality control.

Figure 4 shows that technological alliances with foreign firms are classified into three groups: with Japanese, American, and European enterprises. Of there, thirty-six per cent inter-firm alliances were conducted with American firms; forty-three were focused with European enterprises; and twenty-one per cent alliances were happened with Japanese companies. The regional distribution of Huawei-foreign alliances indicates that Huawei’s strategic alliances are intended to be with advanced countries firms that embrace relatively high industry reputation, lager technology base, and embedded collaboration networks. If we consider further to check the network position of Huawei’s alliances partners in the corresponding region/sector, we can find that all of them are absolutely holding the cluster center. This means that Huawei’s strategy to work with them is beneficial for it as a network broker accessing a larger network resource from other clusters.

![Figure 4 Regional Distribution of Huawei-foreign Alliances](http://www.huawei.com)

Besides dyadic alliances, Huawei is actively working on numerous promising technology networks. In May 2006, Huawei was invited to join the SCOPE Alliance Network and committed to support SCOPE’s mission of enabling and promoting the availability and interoperability of open carrier grid base platforms. In Dec. 2008, Huawei entered into the Open Handset Alliance Network and planned to launch smart phones based on the Android platform in 2009. In Feb. 2009, Huawei was invited to participate Open Patent Alliance (OPA), which is a group formed in June 2008 by members of the WiMAX ecosystem such as Alcatel-Lucent, Cisco, Clearwire, Intel, and Samsung Electronics, aiming to form a WiMAX patent pool and aggregate patent rights to implement the WiMAX standard. Huawei’s participation was derived from its significant contribution to development of OFDM & MIMO broadband wireless technologies. As the vice president of Wireless product line and president of CDMA & WiMAX product line of Huawei said, Huawei’s joining OPA will ultimately promote Huawei to offer broader choice and lower TCO for WiMAX technology and also will help them deliver more products with high quality around the world at affordable prices.

### Table 2 The Memo of Huawei’s Alliances (1989-present)

| Announced Date (mm/dd//yy) | Name of Partners | Partner Nation | Joint Venture |
|---------------------------|------------------|----------------|---------------|
| 1989-1994                 | Shanghai Bell Telephone Manufacturing Company (BTM) Huawei Technologies Co Ltd | Sino-U.S. JV China | No |
| 02/20/97                  | Huawei Technologies Co Ltd Texas Instruments | China USA | No |

---

5 Refer to Huawei’s global website [http://www.huawei.com](http://www.huawei.com)
| Date       | Entity Name 1                        | Entity Name 2                        | Region 1  | Region 2 | Agreement Type |
|------------|-------------------------------------|-------------------------------------|-----------|----------|----------------|
| 04/09/97   | BETO TELEKOM Huawei Technologies Co Ltd | Huawei Technologies Co Ltd         | Russian Fed | Russian Fed | Yes            |
| 08/26/99   | Huawei Technologies Co Ltd Fujian Provinical Mobile | China | China | No            |
| 06/08/00   | Huawei Technologies Co Ltd QUALCOMM Inc | Huawei Technologies Co Ltd         | China | USA      | No             |
| 11/27/01   | NEC Corp Matshita Commun Industrial Huawei Technologies Co Ltd | Japan | Japan | China | Yes            |
| 10/21/02   | Huawei Technologies Co Ltd Agere System | Huawei Technologies Co Ltd         | China | USA      | No             |
| 10/21/02   | Huawei Technologies Co Ltd Microsoft | Huawei Technologies Co Ltd         | China | USA      | Joint lab      |
| 10/23/02   | Huawei Technologies Co Ltd NEC Corp | Huawei Technologies Co Ltd         | China | Japan    | Yes            |
| 03/19/03   | 3Com Corp Huawei Technologies Co Ltd | Huawei Technologies Co Ltd         | USA | China    | Yes            |
| 06/04/03   | Avici Systems Inc Huawei Technologies Co Ltd | Huawei Technologies Co Ltd | USA | China    | No             |
| 08/29/03   | Huawei Technologies Co Ltd Siemens Info & Commun Mobile | Huawei Technologies Co Ltd | China | Germany | Yes            |
| 09/16/03   | Huawei Technologies Co Ltd Infineon Technologies AG | Huawei Technologies Co Ltd | China | Germany | No             |
| 02/12/04   | Information & Communication Mo Huawei Technologies Co Ltd | Huawei Technologies Co Ltd | Germany | China    | Yes            |
| 04/25/05   | Huawei Technologies Co Ltd Intel | Huawei Technologies Co Ltd         | China | USA      | No             |
| 03/02/06   | Huawei Technologies Co Ltd HP | Huawei Technologies Co Ltd         | China | USA      | No             |
| 05/31/06   | Huawei Freescale Semiconductor | Huawei Technologies Co Ltd         | China | USA      | No             |
| 07/25/06   | Motorola Inc Huawei Technologies Co Ltd | Huawei Technologies Co Ltd         | USA | China    | Yes            |
| 02/13/07   | Huawei Technologies Co Ltd Qualcomm Inc. | Huawei Technologies Co Ltd | China | USA      | No             |
| 05/14/07   | Huawei Technologies Co Ltd Global Marine Systems Ltd | Huawei Technologies Co Ltd | China | United Kingdom | Yes |
| 05/21/07   | Huawei Technologies Co Ltd Symantec Corp | Huawei Technologies Co Ltd         | China | USA      | Yes            |
| 10/31/07   | Huawei Technologies Co Ltd International Telecommunication Union | Huawei Technologies Co Ltd         | China | Internationa l Institute | No |
| 1998-2003  | Huawei Technologies Co Ltd IBM | Huawei Technologies Co Ltd         | China | USA      | Consultant Agreement |
| 12/12/08   | Huawei Technologies Co Ltd Microsoft | Huawei Technologies Co Ltd         | China | USA      | No             |
| 03/20/09   | Huawei Technologies Co Ltd Infineon | Huawei Technologies Co Ltd         | China | Germany | No             |
| 08/09/09   | Huawei Technologies Co Ltd Sun Microsystems Inc. | Huawei Technologies Co Ltd         | China | USA      | Telecom Lab |
| 01/01/01   | Huawei Technologies Co Ltd Hay Group | Huawei Technologies Co Ltd         | China | USA      | Consultant agreement |
| 1997-Now   | Huawei Technologies Co Ltd | Huawei Technologies Co Ltd         | China | USA      | Consultant   |


In line with allying with leading players, Huawei never stopped research alliances with universities. So far, Huawei has been building advanced research labs with more than 20 Chinese domestic research institutes and universities such as Beijing University (since Nov. 2005), Zhongshan University, China (since Dec. 2008), Zhejiang University, China (since March, 2008), Tsinghua University, China (since Jan. 2007), University of Science and Technology of China (since April, 2009), Xi Dian University, China (since Dec. 2007), Sanjiang University, China (since Sept, 2007), Northwest Polytechnical University, China (since Oct. 2004) etc.

Moreover, more than 10 joint training programs with Chinese universities in different regions were founded, namely 'Huawei High Level Talented-Person Cultivation Base' (Huawei Rencai Pei Yang Ji Di). These joint programs are purposive to provide Chinese graduates with pre-career education. Huawei treated universities and institutes as its knowledge incubator because it has been proved to offer Huawei much more benefits than expected. In recent years, Huawei extended investment on technological alliances to a number of foreign universities such as INATEL University, Brazil (since Sept. 2003) and Shirif University, Iran (since July, 2009).

In order to find a short-cut solution for standardization of technical training in China’s ICT sector, Huawei established Huawei University in 2005. This university has seven University Subsidiaries located across China (in Beijing, Xi’an, Nanjing, Hangzhou, Chongqing, Kunming, and Kuilin). It is aimed to enhance the intra-sector communication and offer the best training for ICT players in China. Technological engineers and managers from each ICT firm are welcomed. In order to catch up the international training standard, Huawei University invested dramatically on hiring professional researchers domestically and abroad. Unlike alliances with other firms, Huawei University not only offered a springboard for China’s ICT sector to develop absorptive capacity interactively, but also enhanced Huawei’s reputation. The exchanged information/technology intra China’s ICT sector was thereafter blooming out; and Huawei certainly becomes the ‘Knowledge Hub’ of ICT network in China.

Comparing with technological alliances, Merger and Acquisitions (M&As) were not implemented quite often by Huawei. Table 3 lists M&As activities involving Huawei from 1989. From that we can see Huawei’s activities in acquisition started just from recent years and they were mainly located in China’s domestic market or backward countries. This implies that M&As was not a priority of governance mode for Huawei in absorbing technology/knowledge. In contrast, it was a short-cut way to dominant low-income market.

Therefore, strategic alliances are the priority strategy that Huawei used to absorb external knowledge. The universities-involved network facilitated Huawei to grab human capital preemptively and efficiently digest frontier technology as well. Because a number of top Chinese universities have cooperation with foreign universities, Huawei benefits a lot in term of knowledge diffusion. Huawei could hear the latest research result raised in academy field and from this point universities are also acting Huawei’s listening ear.

Also, Huawei’s partnership history indicates that Chinese firms can shorten catching up process by using alliances-based network. Unlike the widely acceptable catching-up model in which latecomers go through OEM, ODM, and OBM (i.e. Lee and Lim, 2001), Huawei’s technological catching-up is characteristic of stage-skipping. By going through replicable imitation stage, innovative imitation stage, and self-innovation step within 20 years, Huawei maintains its own brand. To build up the basic knowledge base, Huawei insists on close collaboration with local universities and research institutes. It can be identified that Huawei’s initial success is attributed to a large alliance-based network; and only if the R&D collaboration with universities is executed, alliances with leading players could become ‘a cherry on the cake’.

Moreover, Huawei’s strategy in choosing network positions could not be ignored, because the network position determines the orientation of knowledge flow. Huawei’s concentrative working on alliance-based network with universities and leading players has offered itself continuously upgraded network position as well as high reputation.

Note: the alliances partners appeared above are mostly Huawei’s long-term collaborators. Despite some of them have been competitors, the dyadic alliances are still continuing and partnership is nature of stability and repeatability.

| Source: SDC database and various media announcement. |

| Year   | Alliance                        | Partner                                      | Nature       | Agreement            |
|--------|---------------------------------|----------------------------------------------|--------------|----------------------|
| 1997-Now | Huawei Technologies Co Ltd      | China                                        | Consultant   | Agreement            |
|        | FhG                             | USA                                          | Consultant   | Agreement            |

6 Unlike other foreign MNEs strategies in attracting excellent graduates, Huawei, from the beginning, keeps working with universities to nurture the pre-graduates; it even set up the Huawei training centers in many universities. The excellent graduates are attracted there, not only because the average salary per year offered to graduates is relatively higher than that by foreign MNEs, but also because the rich program of training are provided each year.

7 Huawei did not picked up the analogue electronic switch technology as a basic level, but rather smartly jumping to the most popular technologies taken by foreign companies at that time—the digital electronic switch technology.
Today, Huawei has not been that small firm without any market influence as 20 year ago; in contrast, it has been no questionably considered as a central actor in China’s ICT sector network.

The miracle changes of Huawei’s position implicate that Huawei’s strategy for developing network power is really effective. In the international market, Huawei plays as a strong competitor with multinational companies such as Cisco System and Alcatel-Lucent etc. also as a humble learner from them. Encompassing a double-face identity (contributor as well as learner) gave benefits to Huawei that many competitors are more likely to invite it attending technology-based networks for research and patent sharing.

Figure 5 presents Huawei’s strategy in alliance-based network. Except Huawei that located in the centre of figure 5, five groups of actors play in this network, which include western multinational companies (WMNC), western countries’ universities (WU), Chinese universities (CU), Chinese domestic companies (CC), and companies with low performance but high technology base either in China or overseas (LC). From the case study above, we can see Huawei attracted knowledge/technology inflow through a large number of stable direct connections with western multinational companies and Chinese universities. Moreover, in case of collaboration that happened between other Chinese firms and Chinese universities, Huawei absorbed knowledge diffusion indirectly through knowledge spillovers. This was similar in the cases between western multinational companies and western universities. Through direct collaborations with Chinese universities and western firms, the technology produced by western universities could be reached indirectly. On the one hand, Huawei extends knowledge acquisition via Chinese universities; on the other hand, Huawei keeps effort on speeding up indirect knowledge diffusion. The data from Huawei’s global website indicates that so far more than 30 R&D subsidiaries have been set up in Western Europe and North America and more than 75% of researchers are hired from local places.

Moreover, knowledge inflow could also be derived from acquisitions in developed and developing nations, or domestic market. Even though there were not too many acquisition cases related to Huawei, Huawei’s motivation on acquisitions is very clear. We say that to promote its network position and enhance absorptive capabilities, Huawei’s action in acquiring target firms that contained high volume of technology but performed inefficiently due to dead management or blocked financial supply can be motivated.
**Table 3 Huawei M&As (1989-2008)**

| Announced Date (mm/dd/yy) | Target Name            | Target Industry Sector | Target Nation | Acquirer Name       | Acquirer Industry Sector             | Acquirer Nation |
|---------------------------|------------------------|------------------------|---------------|---------------------|--------------------------------------|-----------------|
| 10/28/05                  | Huawei-3com Co Ltd     | Prepackaged Software   | China         | 3Com Corp           | Computer and Office Equipment        | United States   |
|                           |                        |                        |               |                     |                                      |                 |
| 11/03/05                  | Huawei Technologies-South | Business Services     | South Africa  | Nulane Investments | Business Services                    | South Africa    |
|                           |                        |                        |               |                     |                                      |                 |
| 11/07/05                  | Huawei Electronics Co Ltd | Chemicals and Allied Products | China | Henkel AG & Co KGaA | Soaps, Cosmetics, and Personal-Care Products | Germany         |
|                           |                        |                        |               |                     |                                      |                 |
| 11/15/06                  | Huawei-3com Co Ltd     | Prepackaged Software   | China         | 3Com Corp           | Computer and Office Equipment        | United States   |
|                           |                        |                        |               |                     |                                      |                 |
| 03/19/03                  | 3Com Corp-Assets       | Prepackaged Software   | China         | Huawei Tech-Entr Bus Asts | Communications Equipment             | China           |
|                           |                        |                        |               |                     |                                      |                 |
| 02/08/04                  | SUNDAY Communications Ltd | Telecommunications   | Hong Kong     | Huawei Technologies Co Ltd | Communications Equipment             | China           |
|                           |                        |                        |               |                     |                                      |                 |
| 08/08/05                  | Marconi Corp PLC       | Communications Equipment | United Kingdom | Huawei Technologies Co Ltd | Communications Equipment             | China           |
|                           |                        |                        |               |                     |                                      |                 |
| 06/07/06                  | Harbour Networks Hldg-Assets | Prepackaged Software | China         | Huawei Technologies Co Ltd | Communications Equipment             | China           |
|                           |                        |                        |               |                     |                                      |                 |
| 06/23/06                  | Intercellular Nigeria Ltd | Telecommunications   | Nigeria       | Huawei Technologies Co Ltd | Communications Equipment             | China           |
|                           |                        |                        |               |                     |                                      |                 |
| 10/26/07                  | Shanxi Huashang Media Grp Co | Advertising Services | China         | Huawen Media Investment Corp | Wholesale Trade-Nondurable Goods   | China           |

*Source: SDC database and collected by author*
5. Conclusion

Due to the research gap in previous studies on Chinese firms’ catching up from alliance-based network perspective, this study is aimed to find out the root causes of Chinese firms’ rapid development. The presentation of a case study on Huawei Technologies Co.Ltd. indicates that alliances-based network is an efficient mode for Chinese firms to shorten catching up path. Departing from previous studies that interpret Chinese firms’ development through FDI and government policy, this study not only highlights FDI’s positive impact on Chinese firm’s development, but also more importantly clarifies the significant role of collaboration network in foreign investment.

By analyzing the case of Huawei Technologies Co.Ltd., two propositions were proved thoroughly. We say that at least in China’s context, firms that embrace higher volume of network resource have higher probability to access a variety of knowledge and markets; and firms that locate in network center are more likely to accomplish catching up successfully and quickly.

We argued that for firms aiming to establish a primary base for absorptive capacity, alliances-based network could help to recognize knowledge diffusion at the first moment. We clarified the role of firm’s alliances-based network in the whole catching up path and involving actors, and stressed that the triangle shaped alliances cycle with universities and leading players can not only guarantee the network stability but also provide a suitable platform for absorptive capacity development. On the one hand, Chinese firms could establish a primary level of absorptive capacity with technologically working with universities; and on the other hand through alliances with leading players, Chinese firms could be motivated in R&D investment.

Unlike previous studies, we claimed that FDI’s impact works through alliances-based network in China. Even though FDI is an effective mode for technology transfer which has been widely received consensus, we claim that it is true only when a firm stays at a pre-catching-up stage where knowledge absorption is passive; once if a firm is
willing to actively absorb knowledge, wherever it stays in the catching up path, alliance-based network is the most effective mode. This is much departing from previous network studies, as combining alliances with universities and firms was not ever highlighted for backward firms. We argue that for backward country firms, universities and counterpart firms are quite necessary to be incorporated into alliances packages, because alliances with universities could significantly enhance a firm’s absorptive capacity in early stage; and allying with universities as well as firms could facilitate firm’s capability to absorb in the late stage.

Alliances with partners from different regions are also important. As we claimed before that only if working with universities is executed, working with leading players could possibly become ‘a cherry on the cake’. For each Chinese firm, this does work effectively because working with advanced partners could be feasible only if firms have required knowledge base for certain technologies. And of course allying with advanced firms could possibly keep the company being abreast with the latest innovation and technology development, being alert to the competition, and investing in R&D as well as sharing the innovation challenge & risks.

As the contributions of this study, we highlight that this study opened up a new stream of research on emerging economies firms’ catching up from network perspective. Strategic alliances will not only be an advanced governance mode for developed country firms to speed up new product development, but also an important strategic manner for emerging country firms to rapidly catch up. The case of Huawei proves that strategic alliance-based network is able to enhance firm’s absorptive capacity from the very beginning. This case from Chinese firm shows that the pre-alliances with universities would be win-win awarded, as firms’ absorptive capacity could be built through technological alliances and universities could receive research fund as a return. We believe that network-stimulated development for backward country firms will be demonstrated as an efficient mode in other national context.

Of course, this study contains several limitations. First, due to the strict permission to access Huawei’s intra database, we could not have more detailed information. All the data in this study were collected either from academy databases or media announcement. It is clear that there are still lots of alliances not being incorporated in the academy database. Therefore, we suggest that future studies could pay more attention on first-hand data collections, preferably interviews. Second, this study was conducted upon a single company that has been very successful in China. However, it would be more completed if having more cases on this issue. We suggest that future studies can make comparison on a couple of cases, one firm caught up successfully due to high volume of strategic alliances; the other failed because of weak capability on strategic alliances (maybe due to a small number of alliances, or maybe due to weak alliance capability), so that a more objective judgment upon the impact of alliance-based network on emerging country firms’ catching up could be comprehensively presented.
Reference
[1] Abramovitz, Moses (1986). Catching-up, forging ahead and lagging behind. The Journal of Economic History. 46(2): 385-406
[2] Amsden, A. (1989). Asia’s Next Giant: South Korea and Late Industrialization. Oxford University Press. New York.
[3] Blomstrom, M. (1991). Foreign investment and spillovers: a study of technology transfer to Mexico. London; Routledge.
[4] Borensztein, E., Gregorio, J.D., and Lee, J-W. (1998). How does foreign direct investment affect economic growth? Journal of International Economics. 45 (1): 115-135.
[5] Bower, G.H. and Hilgard, E.R. (1981). Theories of learning. Englewood Cliffs. NJ: Prentice-Hall.
[6] Child, J. and Rodrigues, S.B. (2005). The internationalization of Chinese firms: a case for theoretical extension? Management and Organization Review 1 (3): 381-410.
[7] China Annual Report on National High-Tech Industry Zone (2006). http://www.chinatorch.gov.cn/yjbg/yjbg/200709/5353.html
[8] China Bureau of Statistics (2006). http://www.sts.org.cn/sjkl/index.htm
[9] Cohen, Wesley and Daniel Levinthal (1989). Innovation and Learning: the two faces of R&D. The Economic Journal. 99:569-596.
[10] Cohen, Wesley and Daniel Levinthal (1990) “Absorptive capacity: A new perspective on learning and innovation”, Administrative Science Quarterly, vol. 35. No. 1. Special Issue: Technology, organization and innovation, pp. 128-152.
[11] Criscuolo, P. and Narula, R. (2002). A novel approach to national technological accumulation and absorptive capacity: aggregating Cohen and Levinthal. MERIT Research Memorandum: 2002-16.
[12] Dahman, C.J. (1994). Technology Strategy in East Asian Developing Economies. Journal of Asian Economics. 5: 541-572.
[13] De Man, A.P., Koene, P., and Rietkerken, O. (2001). Managementtechnieken voor internorganisatorische kennisoverdracht. Holland Management Review. Vol. 80. 57-65.
[14] De Mello, A.R. (1997). Foreign Direct Investment in Developing Countries: a Selective Survey. Journal of Development Studies. 34: 1-34.
[15] Dunning, J. (1993). Multinational Enterprises and Global Economy, Wokingham: Addison-Wesley.
[16] Duysters, G., Jacob, J., Lemmens, C. & Yu, J. (2009). Internationalization and technological catching up of emerging multinationals: a comparative case study of China's Haier group. Industrial and Corporate Change, 18: 325-349.
[17] Ellis, H.C. (1965). The transfer of learning. New York: MacMillan.
[18] Este, W.K. (1970). Learning theory and mental development. New York: Academic Press. Eichengreen, B., Tong, H. (2007). Is China's FDI coming at the expense of other countries? Journal of the Japanese and International Economies. 21(2):153-172.
[19] Felipe, J. (2000). Convergence, catching-up and Growth Sustainability in Asia: Pitfalls. Oxford development Studies. 28 (1): 51-69.
[20] Freeman, C. (2002). Continental, national and sub-national innovation system----complementarity and economic growth. Research Policy. 31: 191-211.
[21] Heimeriks, K.H. and Duysters, G.M. (2004). A study into the alliance capability development process. Eindhoven: Technology University Eindhoven. 2004
[22] Hobday, M.(1995). East Asian Latecomer Firms: Learning the Technology of Electronics. World Development.23(7).
[23] Hobday, M. (1996). Innovation in South-east Asia: Lesson for Europe? Management Decision. 34(9):71-81.
[24] Hu, Mei-Chih. and Mathews. (2008). China National innovative capacity. Research Policy. 37:1465-1479.
[25] Gerschenkron, A. (1962). Economic backwardness in historical perspective: a book of essays. Cambridge, MA. Belknap Press of Harvard University Press: London.
[26] Kim, L. (1980). Stages of Development of Industrial Technology in a Developing Country: a model. Research Policy. 9.
[27] Kim, L. (1995). Absorptive Capacity and Industrial Growth: A conceptual Framework and Korea’s Experience. Social Capability and Economic Growth. London: Macmillan.
[28] Kim, L. (1998). Technology Policies and Strategies for Developing countries: Lessons from Korean Experience. Technology Analysis and Strategic Management. 10 (3): 331-323.
[29] Kim, L. (1999) Building technological capability for industrialization: analytical frameworks and Korea’s experience. Industrial and Corporate Change. 8(1):111-136.
[30] Koza, M.P. and Lewin, A.Y. (1998). The Co-Evolution of Strategic Alliances. Organization Science. 9 (3): 255-264. Kueh,Y.Y. (1992). Foreign investment and economic change in China. China Quarterly 131:637–690.
[31] Lall, Sanjaya (1992) “Technological capabilities and industrialization” World Development, vol. 20. No. 2, pp. 165-186.
[32] Lane, P.J. and Lubatkin, M. (1998). Relative Absorptive Capacity and International Learning. Strategic Management Journal. 19 (5): 461-477.
[33] Liu, X., Parker, D., Vaidya, K., and Wei, Y. (2001). The impact of foreign direct investment on labour productivity in the Chinese electronics industry. International Business Review. 10 (4): 421-439.
[34] Mokyr, J. (1990). Punctuated Equilibria and Technological Progress. The American Economic Review. 80 (2): 350-354.
[35] Mowery, D.C., and Oxley, J.E. (1995). Inward technology transfer and competitiveness: the role of innovation system. Cambridge Journal of Economics. 19(1): 67-93.
[36] Reichert, U. N., and Weinhold, D. (2001). Causality test for cross-country panels: a new look at FDI and economic growth in developing countries. Oxford Bulletin of economics and Statistics. 63 (2): 157-171
[37] McAlleeese, D., and McDonald, D.(1978). Employment growth and development of linkages in foreign-owned and domestic manufacturing enterprise. Oxford Bulletin of Economics and statistics. 40: 321-339.
[38] Narula, R. and Sadowski, B.M.(2002). Technological catch-up and strategic technology partnering in developing countries. International Journal of Technology Management. 23(6): 599-617.
[39] Narula, R., and Marin, A. (2003). FDI spillovers, absorptive capacity and human capital development: evidence from Argentina. Working paper at UNU-MERIT: 2003-016.
[40] Nicholls-Nixon, C. (1993). Absorptive capacity and technological sourcing: implications for the responsiveness of established firms. Unpublished Ph.D. dissertation. Purdue University
[41] Osbom, R.N. and Hagedoorn, J. (1997). The institutionalization and Evolutionary Dynamics of International Alliances and Networks. The academy of management journal. Vol. 40, No. 2. 261-278.
[42] Perze, C., and Soete, L. (1988). Catching up in technology: entry barriers and windows of opportunity. In Dosi, G., et al.(Eds.). Technical change and economic theory. Printer, New York. 458-479.
[43] Reichert, N. U. and Weinhold, D. (2001). Causality Test for Cross-Country Panels: a New Look at FDI and Economic Growth in Developing Countries. Oxford Bulletin of Economics and Statistics. 63 (2): 153-171.
[44] Reuber, G.L., Crookell, H., Emerson, M., and Gallais-Hamonno, G. (1973). Private foreign investment in development. Oxford; Clarendon Press.
[45] Rogers, M. (2004). Absorptive capacity and economic growth: how do countries catch-up? Cambridge Journal of Economics. 28:577-596.
[46] Schilling, M.A. and Steensma, K. (2001). The use of modular organizational forms: an industry level analysis. Academy of Management Journal. 44: 1149-1169.
[47] Sun, Q., Tong, T., and Y. Q. (2002). Determinants of foreign direct investment across China. Journal of International Money and Finance. 21(1): 79-113.
[48] Wang, Z.Q. and Swain, N.J.(1995). The determinants of foreign direct investment in transforming economies: evidence from Hungary and China. Weltwirtschaftliches Archiv 131: 359–382
[49] Xu, B. (2000). Multinational enterprises, technology diffusion, and host country productivity growth. Journal of Development Economics. 62: 477-493
[50] Yu, J., de Man, A-P, Duysters, G., and van Rijswijk.T. (2006). Catch up strategies of Asian firms: a micro-level perspective. Serbian Journal of Management. 1(1): 49-65.
[51] Yoshino, M.Y., and Rangan, U.S. (1995). Strategic alliances: an entrepreneurial approach to globalization. Boston MA: Harvard Business School Press.
The UNU-MERIT WORKING Paper Series

2009-01 Effectiveness of R&D Tax Incentives in Small and Large Enterprises in Québec by Rufin Baghana and Pierre Mohnen

2009-02 Bridges in social capital: A review of the definitions and the social capital of social capital researchers by Semih Akçomak

2009-03 The Role of Firms in Energy Transformation by Radhika Perrot

2009-04 Standards as a platform for innovation and learning in the global economy: a case study of Chilean salmon farming industry by M. Abraham Garcia-Torres

2009-05 Consumer behaviour: evolution of preferences and the search for novelty by M. Abraham Garcia-Torres

2009-06 The role of consumption and the financing of health investment under epidemic shocks by Théophile T. Azomahou, Bity Diene and Luc Soete

2009-07 Remittances, lagged dependent variables and migration stocks as determinants of migration from developing countries by Thomas H.W. Ziesemer

2009-08 Thinking locally: Exploring the importance of a subsidiary-centered model of FDI-related spillovers in Brazil by Anabel Marin and Ionara Costa

2009-09 Are International Market Demands Compatible with Serving Domestic Social Needs? Challenges in Strengthening Innovation Capacity in Kenya’s Horticulture Industry by Mirjam Steglich, Ekin Keskin, Andy Hall and Jeroen Dijkman

2009-10 Industrialisation as an engine of growth in developing countries by Adam Szirmai

2009-11 The motivations, organisation and outcomes of university-industry interaction in the Netherlands by Isabel Maria Bodas Freitas and Bart Verspagen

2009-12 Habit Formation, Demand and Growth through product innovation by M. Abraham Garcia-Torres

2009-13 The Diffusion of Informal Knowledge and Innovation Performance: A sectoral approach by M. Abraham Garcia-Torres and Hugo Hollanders

2009-14 What does it take for an R&D tax incentive policy to be effective? by Pierre Mohnen and Boris Lokshin

2009-15 Knowledge Base Determinants of Technology Sourcing in the Clean Development Mechanism Projects by Asel Doranova, Ionara Costa and Geert Duysters

2009-16 Stochastic environmental effects, demographic variation, and economic growth by Théophile T. Azomahou and Tapas Mishra

2009-17 Measuring eco-innovation by Anthony Arundel and René Kemp

2009-18 Learning How to Consume and Returns to Product Promotion by Zakaria Babutsidze

2009-19 Strengthening Agricultural Innovation Capacity: Are Innovation Brokers the Answer? by Laurens Klerkx, Andy Hall and Cees Leeuwis

2009-20 Collinearity in growth regressions: The example of worker remittances by Thomas H.W. Ziesemer

2009-21 Foreign Direct Investment in Times of Global Economic Crisis by Sergey Filippov and Kálmán Kalotay

2009-22 Network-independent partner selection and the evolution of innovation networks by Joel Baum, Robin Cowan and Nicolas Jonard

2009-23 Multinational enterprises, development and globalisation: Some clarifications and a research agenda by Rajneesh Narula and John H. Dunning

2009-24 Why Rural Rich Remain Energy Poor by Bilal Mirza and René Kemp

2009-25 Compliance with the private standards and capacity building of national institutions under globalization: new agendas for developing countries? by Michiko Iizuka and Yari Borbon-Galvez

2009-26 The Impact of the Credit Crisis on Poor Developing Countries: Growth, worker remittances, accumulation and migration by Thomas H.W. Ziesemer
2009-27 Designing plans for organizational development, lessons from three large-scale SME-initiatives by Tinne Lommelen, Friso den Hertog, Lien Beck and Raf Sluismans

2009-28 Growth with imported resources: On the sustainability of U.S. growth and foreign debt by Thomas H.W. Ziesemer

2009-29 Innovative Sales, R&D and Total Innovation Expenditures: Panel Evidence on their Dynamics by Wladimir Raymond, Pierre Mohnen, Franz Palm and Sybrand Schim van der Loeff

2009-30 Malthus’ Revenge by Luc Soete

2009-31 Preparing for the Next, Very Long Crisis: Towards a ‘Cool’ Science and Technology Policy Agenda For a Globally Warming Economy by Paul A. David

2009-32 Innovation and Economic Development by Jan Fagerberg, Martin Srholec and Bart Verspagen

2009-33 Attracting and embedding R&D by multinational firms: policy recommendations for EU new member states by Rajneesh Narula

2009-34 Student Network Centrality and Academic Performance: Evidence from United Nations University by Ying Zhang, Iman Rajabzadeh and Rodolfo Lauterbach

2009-35 Reverse knowledge transfer and its implications for European policy by Rajneesh Narula and Julie Michel

2009-36 Innovation for the base of the pyramid: Critical perspectives from development studies on heterogeneity and participation by Saurabh Arora and Henny Romijn

2009-37 Caste as Community? Networks of social affinity in a South Indian village by Saurabh Arora and Bulat Sanditov

2009-38 How productive are academic researchers in agriculture-related sciences? The Mexican case by René Rivera, José Luis Sampedro, Gabriela Dutrénit, Javier Mario Ekboir and Alexandre O. Vera-Cruz

2009-39 Alliance-based Network View on Chinese Firms’ Catching-up: Case Study of Huawei Technologies Co.Ltd. by Ying Zhang