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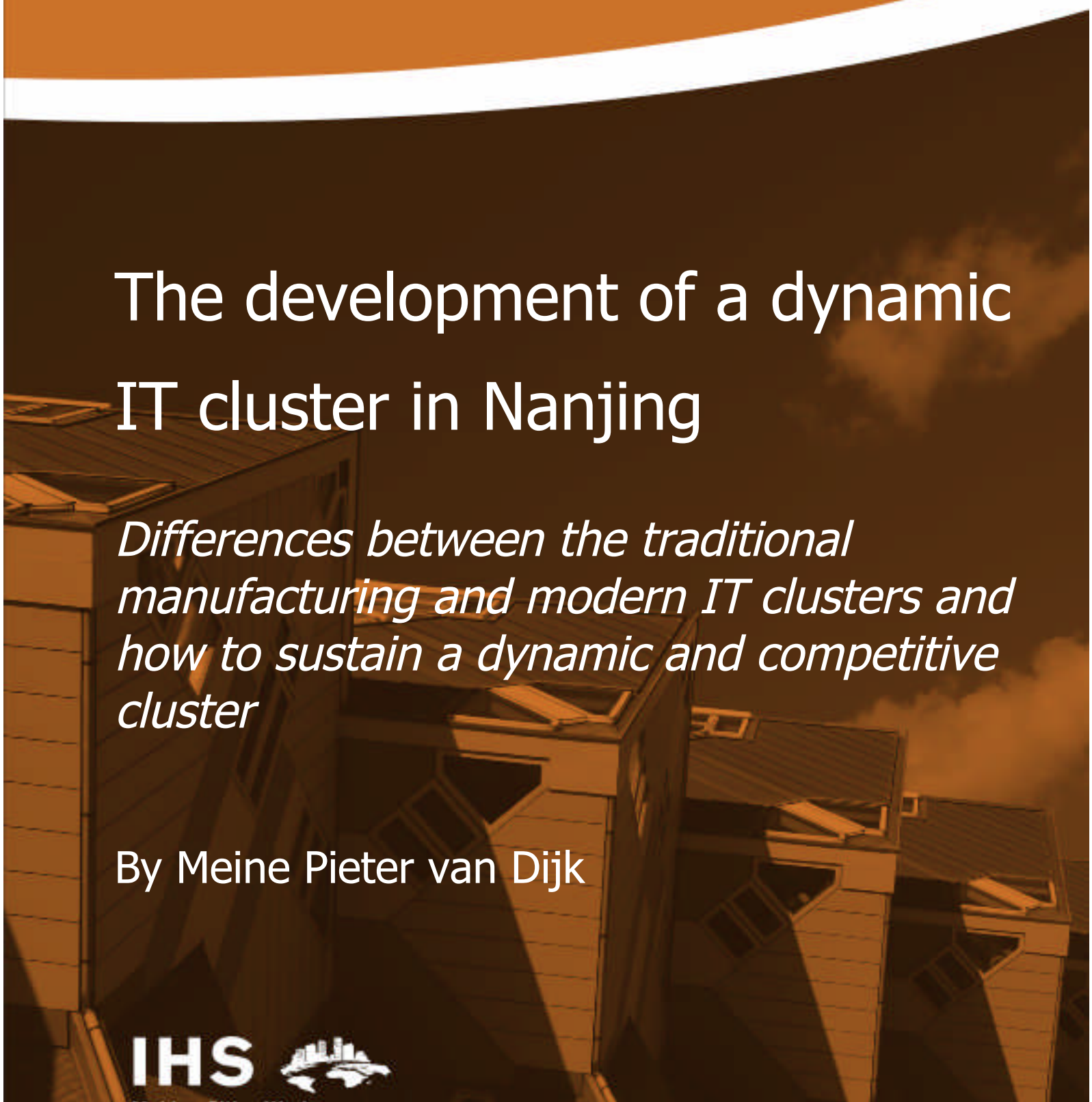
The development of a dynamic IT cluster in Nanjing

Differences between the traditional manufacturing and modern IT clusters and how to sustain a dynamic and competitive cluster

By Meine Pieter van Dijk



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Contribution to a seminar on clusters, Erasmus University Rotterdam (EUR) & Institute for Housing and Urban Development Studies (IHS) on 6-6-2007

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THE DEVELOPMENT OF A DYNAMIC IT CLUSTER IN NANJING,
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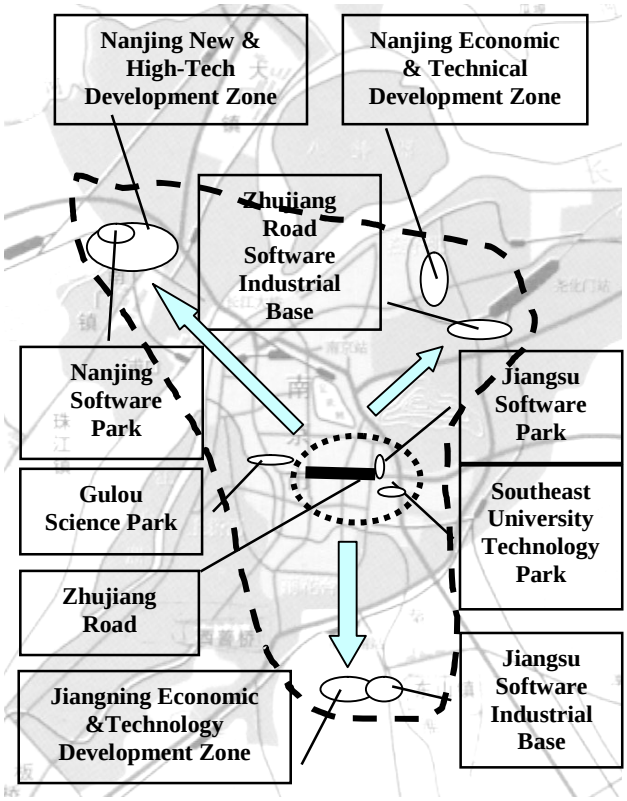
1 Introduction

Previous research (Van Dijk, 2005) suggests that China can also advance in non-traditional industries, such as IT and software production, although it goes at a high price in terms of investments dedicated to this and largely financed by the government. The first effort made to develop the IT sector in Nanjing was a cluster of hardware and software selling shops and workshops developed in the inner city (Van Dijk, 2002). These shops were not very innovative and mainly catering for the local market. We will first summarize in why the IT cluster on Zhujiang Road is currently not an innovative cluster. In a second wave a number of software producing companies located in different centrally located and suburban clusters developed rapidly under favorable local, national and international conditions. An international value chain is developing in the case of the software sector of Nanjing and China is trying to play a more important role in that chain (see the case of Lenovo).

The recent development of software activities in Nanjing has been extremely fast. We can no longer say that Nanjing is mainly a hardware-producing city, with a large number of outlets for computers and computer related activities at Zhujiang Road. The role of different layers of government in speeding up this growth process has been important and has not been analyzed in detail earlier. Other reasons for the rapid development of the software sector are the success of Software and Science Parks and the co-operation between software producers in what we call the emerging IT cluster governance structure (see map 1). This governance structure and the emerging IT cluster governance structure overlap in the Nanjing Software Industry Association.

Software producers of Nanjing are not only integrating in local value chains, they are also becoming more and more part of global value chains. This relationship goes in two directions. One through the supply chain and secondly because the world starts buying these software products. The software producers buy in the global market the more sophisticated equipment they need and advanced software that is not produced in China. They offer their software, either as part of joint projects, or tailor-made for a customer. Contrary to India a number of own products with trademarks have developed in Nanjing. These may eventually also be able to conquer a place in the world market under their own trademarks. We refer in particular to the security, power and telecommunication related software. It is, however, much more difficult for the smaller software enterprises to develop and market their own trademarks.



Map 1 Location of Nanjing IT Clusters (Based on Wang in Wang and Van Dijk, 2004)

The development of the IT sector in Nanjing in general and of the software sector in particular is government-led. However, there are a number of factors why this development is going so fast and has enormous consequences for the city. These will be discussed in section 2. Subsequently in section 3 and 4 we will look at the future development of the IT sector and the need for an innovative milieu. What can Nanjing's role be in the global software sector, where countries like India are considered to be currently years ahead of China? India is moving from developing software to rendering software-based services, such as project management for third parties. Then we will pull together the evidence with respect to the development of a citywide cluster of IT activities in Nanjing and the development of a corresponding innovative milieu (section 5). In the next section a theory will be developed that these IT clusters are fundamentally different from the manufacturing clusters we have known until now (section 6). In section 7 the role of global value chains will be summarized and some conclusions will be drawn about this IT cluster (section 8). Subsequently we will discuss the possibility to create an innovative milieu and draw some conclusions concerning the role of different levels of government in formulating and implementing policies to promote the development of this kind of clusters (section 9). Finally in section 10 a number of contradictions in the current Chinese economic system will be formulated, dilemmas that keep China watchers awake. Some are based on my research and some take a slightly broader perspective. In section 11 some general conclusions are formulated.

2 The currently limited role of the Zhujiang Road cluster

The inner city cluster turned out not to be innovative, while the traditional high tech zones in Nanjing mainly contain industries, which are not necessarily IT companies. Hence it was surprising to find that a dynamic cluster of software activities is springing up. Based on a survey of software companies we analyzed the factors leading to this highly dynamic city-wide IT cluster, analyzing in particular governance issues, the impact of policies by different levels of government and the role of the Nanjing Software Industry Association and of different software parks (Van Dijk and Wang, 2005).

The more than 1000 IT enterprises in Zhujiang Road certainly help to make available the latest technology to the people and firms in Nanjing, although at present they cater mainly for the local market (Van Dijk, 2002). The question is how much they will subsequently contribute to the dynamic further development of the larger urban and regional economy. At present this is not really the case. It will require more efforts by local governments to develop an innovative milieu in Nanjing. Secondly, information technology could contribute to the competitiveness of other enterprises, in particular if an urban enterprise network could be developed to exchange experiences, to foster partnerships in the IT field and to give enterprises the maximum benefit from current information technology (Wang, 2000).

The focus of the research changed from studying an inner city cluster, to trying to determine whether Nanjing is an example of a city-wide IT cluster. In the literature one can distinguish five different geographical levels for clustering: the national, the regional, the citywide, the inner city and the sub-urban (or peripheral) clusters. The question became: which actors have pursued which policies at different levels of government to promote Nanjing as an IT city and to what extent have they been successful. That has been the case because the five districts where IT activities are concentrated are indeed developing into a citywide cluster and contribute in this way to the further dynamic development of Nanjing. They would make up a citywide cluster if inter-linkages and complementarities between them are gradually developed and reinforced by these policies.

The survey of the software companies was used to determine the relations between the enterprises in the different districts and buyers and suppliers outside the district. Through the same survey the relations between the enterprises in the district and research and development (R&D) institutions in or outside the district were studied. Finally the impact of policies by different levels of government was determined. The analysis has pointed to the importance of a number of variables. The most important seem to be the occurrence of innovation to remain competitive and hence the need to stimulate all factors that could bring about new technologies and new ways of doing things. Concepts like flexible specialization and industrial districts rightly point to a number of non-economic variables that are extremely important in an analysis of the dynamics of small enterprises in developing countries: the importance of co-operation, trust building and using trade networks.

The real dynamics in Nanjing may come from the development of the software sector and the development of a full citywide and even regional IT cluster. In the software sector

products for security, the telecommunication and power sector have been developed in Nanjing and have become important products in the Chinese market. The development of this IT cluster, of the corresponding networks and the different forms of co-operation between IT enterprises and with research and development institutions should be stimulated to bring in new ideas in the IT sector in Nanjing.

3 Innovation requires an innovative milieu

Three aspects of the flexible specialization theory: 'innovative mentality', 'clusters' and 'networks' may be the more relevant concepts. The key words for government policies to promote flexible specialization would be: stimulate flexibility, start innovation centers, promote subcontracting, promote clusters of production activities and the creation of industrial communities and networks. The challenge will be to combine inter-firm co-operation with healthy competition.

To achieve cluster development we would recommend promoting existing clusters of enterprises of different sizes and working in different industries. For example, space may be reserved for smaller units in the existing industrial zones, where co-operative competition would be possible. Stimulate the development of clusters of economic activities, including, if an opportunity arises, the physical grouping of enterprises of different sizes. Use of networks and different forms of co-operation to introduce new ideas into this dynamic sector. Facilitate access to government orders and credit lines for entrepreneurs who are involved in co-operative arrangements and for participants in clusters and networks.

The experience with IT sector promotion policies so far is that the government thinks in terms of tax benefits and providing space, labels and certificates. When it gets more difficult and the discussion turns to innovation, exports, venture capital, cooperation between software companies and between software producers and R&D institutions, government officials don't always know what to do. Subcontracting and other relations between micro, small, medium and large IT enterprises need to be developed and different incentives could be provided for this purpose.

The creation of several software parks in neighboring districts by different authorities, but within metropolitan Nanjing turned out to be an example of uncoordinated activities of local and provincial government. It shows the absence of intervention or co-ordination by higher levels of government and it shows a conscious promotion of competition between different levels of government. However, this phenomenon has contributed to the dynamic development of a citywide IT cluster in Nanjing.

It is important to go beyond the currently overlapping governance structures of the government and the IT sector and to develop a hierarchical governance structure. The different levels of governance would engage in dialogues and can function as countervailing powers, as depicted in table 2.

Four factors stand out to explain the development of this dynamic software sector in Nanjing and were discussed in various chapters in Van Dijk (2006):

1.The investments in infrastructure financed largely by the government
2. The large number of engineers trained by the different educational institutes in Nanjing. The presence of all these universities and research institutes mean that there is a tremendous pool of high skilled professionals, even though the entrepreneurs complain that they find it sometimes difficult to employ the right people (Van Dijk and Wang, 2005).
3. The lack of a clearly defined other leading sector and
4. The strong belief that the government as well as the business community seems to have in technology as the key factor for the future success of the country in the global economy.

The software enterprises did receive real support from local government and this support was often more appropriate than what we found in the sample of small IT enterprises on Zhujiang Road. It should be noted that the local value added generated in this emerging software sector in Nanjing is probably much higher than what the shops and workshops on Zhujiang Road generate.

For the software sector, one also notes the positive effects of the Chinese government having a clear strategy and putting in place the resources necessary to implement it. The deputy mayor mentioned in 2004 that she expects Nanjing to count 1000 software companies in 2010! The government certainly wants this software cluster in Nanjing to take off and thinks about a citywide cluster and not just an inner city cluster. This requires some co-ordination between the different districts concerned, which was sometimes missing in the past. A strategic plan to develop the software cluster in Nanjing should be developed at the municipal level as well and should be implemented with the concerned districts.

What also helped the development of the software sector was the emphasis on Software and Science Parks and the creation of some incubation centers. There are currently at least three innovation centers for software producers: Gulou, Jiangsu Province Software Park and South East University. The government also has developed a new policy to keep or attract good people to settle in Nanjing. They can give them citizens' registration and their children can go to the good schools, while the wife can get a good job, plus the government will arrange a house and provide good living conditions. Plus 'we guarantee them to move out freely'. However, according to one official, if we pay 5000 RMB and Shanghai offers 6000 they will go! Plus we accept it when people have a second job. Only if he or she works for the government the second job cannot be a paid job.

4 The future development of the IT sector

The strong emphasis in China on developing the IT sector is based on three assumptions. In the first place IT is considered the basis for innovation and innovation is the driving force behind increased competitiveness. Secondly, China wants to become a modern and high-developed country and considers IT is a crucial element of being modern and developed. The country wants to compete with Japan and the US, which requires intelligent use of information technology. Finally, IT and software in particular has the image of being clean and being produced under ideal working conditions. Typically in

India the Brahmin caste, who were never interested in manufacturing because you would get impure, are leading in the software sector (Van Dijk, 2005). However, also in China the leaders seem to believe that IT will liberate the workers from their shackles.

What is the real situation in the international IT market? It is a very diverse and complicated market, which is highly volatile, fragmented and largely still in its formative years. The burst of the IT bubble December 2002 has led worldwide to a certain shakeout in the IT sector, but in certain subsectors bubbling has started again. The core of the sector is the semiconductor industry. Here a few international firms dominate, for example Intel (US), UMC (Taiwan) and Texas Instruments (also US). China has not yet been able to attract many of these first class companies or to build up its own semi-conductor industry, although there are a lot of smaller players such as Qualcomm (chips for telephones). The one chip factory in Shanghai rather seems to be the exception.

There are five other elements of the international IT market, which are presented in box 1. All are important for software applications, but not directly relevant in Nanjing.

Box 1 International IT market besides the semiconductor industry

1. Consumer electronics, where China is an important producer
2. Production of computer hardware, where China has a substantial part of the market.
3. Telecommunications equipment, where China is very important
4. Software, here India is more important, with six times as many engineers and the advantage of the English language and a much earlier start
5. Many companies in China are in the process of digitization in the midst of exploding use of software

It seems that China is good in most of the listed elements and may not need chips or software products so much, if it does the other four well. However, if there is a strongly increasing demand for software, there is also a lot of money to be made in the sector of introducing, adopting and adapting software in these specific situations in the local market, using Chinese character based software. This could be an important niche market for Chinese software producers. The question is whether China really needs to export software products at a large scale if the internal market is so big.

One of the problems mentioned during the interviews we conducted is that many people who make money in the software sector eventually want to invest their money elsewhere. They prefer to build houses and offices and make money in an easier and less risky way.

5 An emerging citywide cluster in an innovate milieu?

Is Nanjing an innovative IT cluster developing as part of a global value chain? The conclusion so far must be that this is a citywide IT cluster in the make, in particular if

more coordination would be achieved between the different levels of government and when the complementarities between the different software producers are fully developed. Nanjing seems to be far enough from Shanghai and to be big enough to develop its own dynamic IT sector, using the concentration of universities and R&D institutions and its important regional market. The export of software is happening at a much slower pace than we expected. The software sector seems to serve the local market in the first place.

Four different types of relations between IT companies in the five relevant districts were found. In the first place a number of companies have units at different locations. Panda is the clearest case of an industry located in the center of the city and at one of the economic development zones. The same applies for Ericsson, Siemens and Philips. Secondly, many of the products of these firms are sold in the center, reinforcing the impression that the central location is particularly important as a kind of electronic supermarket. More interestingly a number of companies are working with the universities and R&D institutions in the center of the city. This may range from sending employees to these institutions to embarking upon joint R&D projects. Finally, some of the companies located in the economic development zones in the north or the south have chosen to participate in the two major IT projects in Nanjing city, the Gulou Science Park with the Nanjing Software Park in Pukou District and the Jiangsu Province Software Park in the Xuanwu District.

We conclude that the emerging software sector makes a dynamic contribution to the economy of Nanjing. Their local value added is high and the companies have started to export. They have developed and are developing interrelations with universities and researches centers and cooperate more often with each other. Government policies seem to be more successful in this case and the high potential of the IT sector is linked to their increasing export achievements. Even if Zhujiang Road does not have the same growth potential, it is now part of a complex citywide IT cluster and contributes to the overall performance of this IT cluster. Clearly a community of software producers has developed and is negotiating with the local government to create the right environment for the further development of their company.

6 IT clusters differ from manufacturing clusters

In Nanjing there are several high tech zones and the linkages between these zones and the inner city network that we studied could be developed further, to turn the whole IT sector in Nanjing into a real city-wide dynamic high tech cluster. Suggestions for the relevant policies at different levels of government will be made at the end of the paper. The IT sector's growth is high, but the way different type of districts benefit differs widely. The characteristics of the IT clusters in Nanjing differ in many respects from the traditional manufacturing clusters. An average cluster is diversified, with a varied mix of IT business. With some exceptions, most firms in the cluster serve the local or regional market, as service provider or sales outlet, with a small proportion of the IT firms also linked to infrastructure provisions. Different trajectories of IT sector development in cities may be traced back to national circumstances and chance factors.

Although this citywide IT cluster is clearly developing, it is different from the more traditional manufacturing clusters we know from the literature. The following table tries to capture the essential differences.

Table 1 Differences between the traditional manufacturing and modern IT clusters

Characteristic	**Traditional manufacturing cluster**	**Modern IT clusters**
Importance of forward and back ward relations	Key element reflected in an advanced division of labor and much subcontracting	Not very important, given other ways of cooperation
Other ways of cooperation	Limited, captured under: collective action	Very important, ranging from joint projects to jointly influencing the government
Role universities and R&D institutions	Important to supply ideas	Important as a sparing partner and part of the innovative milieu
Governance structure	In relation to local government and through the Chamber of Commerce	Emerging through joint activities and associations
Importance of available labor	Indeed, presence of skilled labor is crucial	Important role for highly skilled and flexible workers
Role government	In particular local government plays a role	Deals with national and local levels of government
Innovation	Through subcontracting relations	Through relations with R&D institutions and joint projects

What we note is a transition from bringing about innovation through subcontracting relations to innovating in joint projects and in interactions with universities and R&D institutions. The governance structure is emerging through joint activities, such as undertaking projects, relations with R&D institutions and building up their own export alliance. Both types of clusters face a common problem in China, namely that it is difficult as a start up to gain access to credit. Venture capital is talked about, but in practice seems to be completely non existent, while venture capital played an important role in the development of the technology sector in the United States.

7 Integrating in global value chains

Due to changes in production systems, distribution channels and financial market and due to the spread of information technologies, local clusters in China are increasingly integrated in global value chains (GVCs). A distinction has been made between government governance structures and private sector cluster or sector governance structures.

Firms are under pressure to improve their performance and to increase their competitiveness. New and ever cheaper products are penetrating global markets and

intensify the competition in markets where labor-intensive manufacturers were dominant. Firms in developing countries can only react by upgrading. This means making their products more efficiently and increasing the value adding activities by making more sophisticated products and using more advanced production processes.

The cluster literature suggests upgrading strategies are facilitated by local level governance and that currently global chain governance issues are particularly important. Through its participation in the World Trade Organization (WTO), Chinese firms have better opportunities to market their products globally and to source in the world market. At the same time their share of the local market may shrink due to the entrance of competitors.

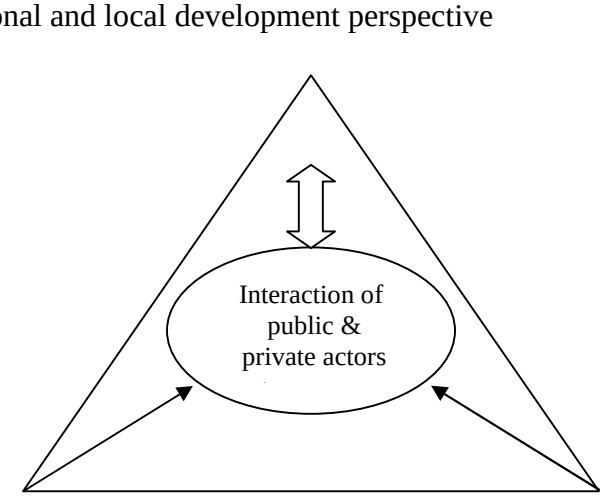


Figure 2 Cluster view: private and public interaction

Supply Chain Management (SCM) is also important to remain competitive. It means using techniques to improve competitiveness by improving efficiency at the level of the channel, rather than at the firm level. The real competition is not one firm against another, but rather one supply chain against another. In this competitive world differences in the political and social culture become important factors that need to be taken into account. The following figure shows the relation between the cluster, the GVC and the SCM view. On the top of the pyramid the cluster view emerges. Through networking between the private and public sector the cluster tries to influence regional and local development to its advantage.

8 Conclusions concerning the IT cluster in Nanjing

According to the English language newspaper China Daily China should change its image as a low-end manufacturer by increasing the technology content and controlling the patents of high–tech products (China Daily, 27-9-2001). Such changes would

contribute to developing a real high tech sector contributing to Nanjing's urban dynamics.

Concerning the competitiveness of countries, cities and clusters, we conclude that competitiveness is in the first place a question of the enterprise. However, different local territorial environmental variables influence, and are hence part of, the production and marketing function of small IT firms, hence contributing to competitiveness. Clustering results in various types of external effects, for which we used the umbrella term of 'collective efficiency'. Similarly, the city or region can contribute through a positive environment, which we would call `urban' or `regional efficiency'. Finally, certain factors at the national level also contribute to the competitiveness of the industry, and here Porter (1990) is relevant.

It can also be concluded that a high quality of the urban living environment will be more than ever a precondition for IT cluster development. Because of the increased mobility (and scarcity) of experienced IT professionals cities need to be attractive to attract and retain talent, the basic resource of the IT sector. This also means that investments in, for example, the environment and cultural provisions, may have a high return in the long run.

Theoretically we concluded that the rapid development of the IT sector in Nanjing is influenced by policies of different levels of government and the emerging governance structures. The developed strategies have certainly been effective, in particular the Software Parks and the incubator centers contributed to the rapid development of the IT sector in general and the software sector in particular.

The future is further integration in international value chains, but may not necessarily be increased exports of final products. Given the importance of its local market in China and the slow process of increasing exports and tying global value chains for IT and software, the sector may find important applications in China. Local language software will be an important future market, where the local IT sector has a certain competitive advantage.

9 The role of different levels of government

Different levels of government should do where they are good at, but can do more to develop IT clusters. They should provide an enabling environment for IT enterprises and in particular create a starter friendly environment. In particular the following policies would be recommended at the different levels of government distinguished: the national, the provincial, the municipal and the local level.

9.1 At the national level: over investment?

China is a full member of the World Trade Organization (WTO) since 2001 (Lardy, 2002). This will imply more respect for international property rights and requires less copying of software, but also more competition from imported goods. The government at the national level should support the IT sector to face this new situation in the near future among others by continuing its war on software piracy (announced in China Daily 9-9-2003). Secondly, it will be required not to subsidize industries that compete internationally.

The country has also been asked to abandon discriminatory taxes and regulations that are hurting foreign chipmakers (Financial Times, 17-3-2004). Finally, China will have to be careful with developing standards that deviate from international standards and may be considered a form of protection (China Daily 27-4-2004) and hence lead to complaints in the WTO framework.

It has been noted before that most (former) communist countries invest heavily in R&D and related technology activities (Gu, 1999: 62). It seems to combine the view of scientific socialism with the one that emphasizes the important role of government in the development process. The question is whether the state will turn out in the long run to know better than the market what is needed. Silicon Valley is clearly an example of market driven dynamic development. However, Singapore can be considered a successful example of government interventions to promote technological upgrading and the development of an IT sector (Wang 2000).

The impression is that the current level of government support in China is not sustainable in the long run. A coordinated action, with a real involvement of the private sector and foreign investors would have been more effective. The analytical framework helped to identify the initiatives of the government to develop the cluster and will eventually help to evaluate their effectiveness, efficiency and impact.

9.2 At the provincial level

At the provincial level it is recommended to develop a strategy, to promote cooperation between the different levels of government and to focus on policies and providing the necessary provincial infrastructure. The province can only indirectly help to provide space and appropriate infrastructure for IT companies, namely to the extent that this goes beyond the border of the cities.

Provincial level authorities in China can help to put in place an urban hierarchy that makes sense and they can also promote further economic integration with neighboring provinces like the initiative mentioned taken in the PRD. Finally, they can also develop export policies and provide incentives and support to increase export.

9.3 At the municipal level

To conduct an IT-policy oriented towards starting entrepreneurs is one way for cities to strengthen the local IT-sector. The local government can act as provider of generic support, such as (cheap) accommodation and venture capital, but also as purchaser of the products of new companies, or as broker and connecting factor between starters and both the existing private sector and the knowledge institutions.

Entrepreneurship development programs can be useful for this IT sector, also for female entrepreneurs and enterprises, who are blocked at a certain level and find it difficult to make the next step. Entrepreneurs in the IT sector tend to be technicians, who are not necessarily good managers or entrepreneurs. Access to credit and government orders should be facilitated for entrepreneurs who co-operate and for those who participate in

clustering and networking. It is also important to look at the larger picture. In the whole Nanjing area, there are a few IT clusters and the linkages between these suburban cluster and the inner city cluster that we studied could be developed further, to develop the whole IT sector in Nanjing and make it a real dynamic city-wide high tech-cluster.

The flexible specialization concept points to a number of factors, which explain the dynamics of small enterprises in an urban context, which can be promoted, and are also relevant in Nanjing. Specialisation is also important for small IT enterprises, because it means they become better in one product, which may help them to produce it cheaper and sell it easier. Flexibility is an asset and needs to be promoted, even if it means going for diversification in certain cases. Entrepreneurs sometimes find their optimum by moving from niche markets to broader markets and back. Moving to other locations is an important part of the dynamics of small enterprises and can be encouraged by the urban authorities.

At the municipal level it is also recommended to develop a vision and strategy. Muncipal authorities can provide co-ordination between the different levels of municipal government, for example as between the different plans of the different districts. Finally, they can stimulate entrepreneurs to organize their own networks and accept those in the discussions as the major private sector partners for the government.

9.4 At the district level

Local governments, districts in the big cities, can provide space and infrastructure for these economic activities, preferably at the same time for enterprises of different size. They can stimulate the creation of clusters of innovative IT entrepreneurs. Similar to many countries, start-up entrepreneurs and female entrepreneurs needed special attention because the latter tend to be rare in the IT cluster studied. As suggested by flexible specialization, multi-purpose equipment and common services can help entrepreneurs to become more innovative. The development of clusters of IT activities should be actively stimulated in Nanjing, including the physical grouping of enterprises of different sizes. Subcontracting and other relations between micro, small, medium and large enterprises need to be developed and different incentives could be provided for this purpose. Local governments can also promote the relationship between these firms and the existing universities and research institutions in Nanjing to develop the present cluster into an innovative one. Incubator centers, specifically for the IT sector, could contribute to the desired innovative milieu.

At the local district level the authorities could also consider these entrepreneurs or their organizations as the intermediary for the government to discuss policies, infrastructure requirements and other important issues. Local government can supply buildings and business support services and provide other incentives. They can help to attract foreign investments and provide the relevant information to entrepreneurs. Local governments can set up an enterprise network and promote links with local knowledge resources, such as R&D institutions.

9.5 At the cluster and enterprise level

The application of IT in normal production processes is a field where China still has a long way to go, but where substantial productivity improvements can be achieved. The development of clusters, networks and different forms of co-operation between IT enterprises and with research and development institutions should be stimulated to bring in new ideas in the IT sector in China. Innovation and inter-firm co-operation (in clusters or through subcontracting) are key words for this kind of development.

9.6 Countervailing powers: organizations at different levels

It is important to create countervailing powers as suggested in the following table.

Table 2 Hierarchical governance structures where private, sectoral and cluster organizations provide countervailing power

Government governance	**Versus Private, sectoral and cluster governance**
National Government	vs National, regional and sectoral Chambers of Commerce
Provincial Government	vs Provincial, Chambers of Commerce
Municipal Government	vs Municipal Chambers of Commerce
District Government	vs Business Associations
Nanjing Software Industry Association	vs Private IT Networks

Putting National Government organizations besides National, regional and sectoral Chambers of Commerce and Provincial Government organizations besides Provincial Chambers of Commerce may create the needed dialogue and adoption of creative solutions. In the same way at the Municipal Government level one can think of Municipal Chambers of Commerce and in certain districts the counterpart could be a local Business Associations. Finally, it would be good if even the Nanjing Software Industry Association, which was called the overlapping governance structure, would face competition with Private IT Networks.

10 China: some contradictions

There are a number of contradictions in the Chinese economic and political system that need to be discussed briefly to put the development of the IT sector in Nanjing in a long-term perspective. These contradictions became clear if the course of the research and will lead us to formulate reasons why China's high speed of economic development may not continue for ever.

10.1 The role of the State versus the private sector?

Although the different levels of government plan economic and urban development and implement the policies they have decided to implement, the entrepreneurs actually achieve the spectacular economic growth figures and they want a certain freedom. The picture becomes more complicated if one realizes that many IT entrepreneurs are former government officials, who know their colleagues in the government very well. The two groups help each other if necessary, for example through government orders, favorable loans or grants. The government wants to and does provide support to numerous

economic activities, including the IT sector. However, the government is mainly familiar with the tax cuts and providing business buildings as instruments for business development. It is not so much at ease with creating an innovative milieu, helping IT entrepreneurs to gain access to venture capital, or developing export markets.

The Chinese Government allows a more important role to the private sector, also IT companies, but at the same time it treats local software manufacturers in a preferential way. This was shown when Beijing did not give a software contract to Mircosoft as expected, but rather to some local firms. In terms of the WTO the government should help to create a level playing field. An regime used to command and control will have to learn to lean back and govern indirectly by putting the right regulation in place and by implementing it in a rigorous way.

10.2 Government led development, but are the expenditures well spent?

The different levels of government have a lot of money to spend and want to contribute to economic development, but may not always know what is the best way to spend the money. Hence the system has the inherent risk of over investment and investment in the wrong things. In particular popular topics like IT and high tech zones and Software Parks may have a limited absorption capacity. The National People's Congress meeting in 2004 has reflected this concern and decided that more often choices need to be made where to pursue certain activities, because not every city can have a booming software park for example.

10.3 Dedicated to reforms, but a weak legal system

The Chinese government is dedicated to economic development and willing to test reforms, but at the same time the legal system leaves to be desired. For example it is quite difficult for a joint venture partner to put a conflict with a local partner to an independent judge or to get a legal statement (cf. Clissold, 2004) on a piracy question as General Motors found out when it wanted to file a complaint about a model, which Chinese automobile producers seemed to have copied from their Korean partner (Financial Times, 2004).

We mentioned that the government regularly embarks on activities to capture and destroy videos or CD Roms, which have been copied illegally. At the same time it is known that China is at at a stage of development where it needs technology. For that reason A. Beattie in the Financial Times (7-12-2004) concludes: "Why would China be better off to comply with intellectual property rights"? Certain Japanese companies prefer to keep their advanced technology production units in Japan (Financial Times, 2004).

10.4 Knowing the importance of finance, but not being able to reform the banking sector quickly

The Chinese government is aware of the importance of a healthy financial sector for development, but the government-dominated financial sector is only gradually restructured and liberalized. Contrary to Silicon Valley, no venture capital sector is available in China. Hence it is extremely difficult for promising IT companies to obtain

loans, while all kind of government organizations can get loans which they often consider grants and are not paid back.

10.5 A convertible and realistically priced currency

The Chinese currency is not fully convertible, but fixed for obvious political reasons to the dollar. It means the Chinese government is depriving Chinese workers of a better salary, which is only possible in a system where the government determines the wages. If no changes occur the United States may be forced to take protective measures (as it has done in the case of textiles in 2005), or end up in a recession, which would have important negative consequences for other Asian economies as well.

It is also possible to look at the current pattern of foreign direct investment (FDI) in a different way. The foreign companies may not come to carve out their share of the internal Chinese market, but rather they benefit from the cheap parts or components they export from China and which are partially used to make their own products back home more competitive. In that case the current rate of exchange would greatly benefit these companies.

10.6 Centralist coordination versus uncoordinated decentralized decision making

Finally, it is hard to understand that a system that could coordinate easily, because of its centralist character and because there is limited participation to fear from stakeholders, still lacks coordination at the district level. This can be illustrated by the case of Nanjing. This city is a regional capital, but may also have an interest in looking at the Yangtze River Delta potential, instead of trying to become its own pole of regional development in a megapolitan or provincial context.

As mentioned these ambiguities have been brought up by many authors, but they have not stopped most entrepreneurs to enter the Chinese market, with lots of money and sometimes unrealistic expectations. The same wage policy allows the government to to keep is expenditure high while creaming off the economy through taxes, duties and selling the countries resources. Different levels of government subsequently spend this money on infrastructure, participation in a joint venture and influence trade negotiations

10.7 Special but also very normal

Table 3 lists some of the particular aspects of China’s economic development, but also gives the side of the coin by listing the favorable conditions.

Table 3 Particular aspects of China's economic development

Factors not in place	Positive factors
Not a normal functioning financial system No 100 percent convertible currency with a rate of exchange determined by the market No Chambers of Commerce in the western sense of the word Not a very well functioning legal system Most foreign firms make little or no profit in China No normal functioning labor market: the minimum wage is artificially low	Development based on vision and strategy Clear choice for private sector development Government makes a real effort to support economic development Reforms are locked in in WTO membership A context of rapid economic growth Necessary restructuring of state-owned enterprises provides opportunities Hardworking population and highly productive labor force

Some of the factors mentioned in table 3 are clearly positive, also for foreign investors, but most factors not yet in place would make them think twice if it would be another country than China.

There are certainly many reasons why the high speed of economic development may not continue forever in China:

1. Environmental issues and limits (Zhang, 2002)
2. Congestion leading to higher transport cost. The PRD is praised for its strong transport network. At the same time we note increasing congestion, for example on the High road from Nanjing to Shanghai.
3. Labor unrest leading to higher wages (Financial Times, 23-9-2004)
4. The age composition of the population: graying of the population due to the one family one child policy
5. Prices of energy/energy shortages
6. Inflation
7. Never before a longer than 40 year period of continuous growth was found. Japan achieved this between 1950 and 1990
8. Influx of migrants in urban areas
9. Political unrest is increasing
10. Income differential between rural and urban areas is not sustainable (FT, 15-11-5)
11. War against Taiwan may erupt
12. Declining FDI, because at the current rate of exchange the FDI is relatively cheap, while buying from foreign enterprises is relatively expensive for Chinese companies

However, in table 4 we will limit ourselves to those reasons, which come directly from the current research.

Table 4 Reasons why China's high speed of economic development may not continue

Reason	Indication
1. The dominant role of government may not longer be accepted	1. Private sector organizations are becoming more important
2. Government investments in the IT sector may not be well spent	2. Government finds it difficult to identify the good investment opportunities in the IT sector
3. Weak legal system leads to an increasing number of conflicts in joint ventures and over copy right infringements	3. Clissold (2004)
4. Government is unable to reform the financial sector	4. Debts are huge and access to loans is not easy for private companies
5. Unrealistic currency resulting in an economic recession	5. International Herald Tribune (P. Krugman, May 21-22, 2005)
6. Pressure to regional autonomy by larger than provincial units which are coming to existence	6. For example initiative in the Pearl River Delta

11 General conclusions

What more can cities do to strengthen their IT cluster? A first thing could be to exploit more the local knowledge resources embedded in universities by stimulating industry-university co-operation. Furthermore, rather than attracting just any type of IT-companies cities could make well-considered efforts to attract specific IT-companies that fit their economic structure. Another frequent mistake is to focus one-sidedly on the construction of IT-infrastructure and facilities, in the belief that once the infrastructure is there, economic activities will follow automatically. There is a risk that optimistic growth expectations lead to ill-considered policies. Salomon (1998) saw many regions make mistaken efforts to become another Silicon Valley by attracting high-tech industry without understanding the ingredients of real success. An example from the 1980s and early 1990s is the investment by many cities in teleports, assuming that in the 21st century these teleports would have economic relevancy comparable to airports and seaports. However, the one-sided emphasis on providing the infrastructure and technology and the lack of integration and economic judgment have caused many a teleport project to fall through.

A more promising strategy is the coordinated investment in infrastructure, technology and human capital. That is the strategy pursued by Singapore (Warf, 1995; Corey, 1991). That city-state has, in close co-operation with the private sector, invested on a massive scale in IT-infrastructure as well as in people and training courses. The efforts were directed not only to stimulating IT as an independent growth sector, but also, explicitly and consistently, to making capital of IT's potential for enhancing the existing strong points of the economy: the trade function, the port and the financial sector. Integrality is yet another strong point: much money is invested not only in infrastructure but also in education, on the assumption that the presence of human capital can tip the scales in investment decisions.

Public-private co-operation is a prerequisite to develop effective and efficient cluster-policies. "Interactive policymaking" is needed in the marketing of the cluster, in attracting new firms, in helping start-ups and in all other aspects of cluster policies, to make optimum use of the knowledge and resources of the existing actors in the cluster. This also implies that civil servants involved in cluster policies need to be well educated and have sufficient "feeling" with the cluster.

Will China be an economic juggernaut on the world stage in this century (Studwell, 2002), or do we consider China's High-tech success story is pure fiction (FT)? It is certainly not pure fiction, the question is what it costs were and whether the sector will continue to be competitive in a global economy or should it rather focus on the rapidly expanding Chinese market? The role of cities and good urban management in these cities is striking and stresses the importance of training good urban managers to achieve fast national economic development! However, we pointed out that there are also limits to the role of government and China is doing more than most countries to develop its IT sector. The limits can be reached soon, given the number of contradictions listed and the ensuing implications presented in table 4.

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