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Emerging Epistemic Landscapes:

Knowledge Clusters in Ho Chi Minh City and the Mekong Delta

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Emerging Epistemic Landscapes:

Knowledge Clusters in Ho Chi Minh City and the Mekong Delta[1]

Hans-Dieter Evers and Tatjana Bauer

Abstract

Vietnam is embarking on a path towards a knowledge-based economy in which the emergence of knowledge clusters in Ho Chi Minh City and the Mekong Delta are playing a decisive role. As our paper suggests, clustering appears to have a positive effect not only on the increase of knowledge output, but also on the economic growth of these regions. Using a GIS-based mapping method, we can identify two major knowledge clusters – Ho Chi Minh City and Can Tho City. Both areas create hubs in the south of Vietnam, with favourable conditions for knowledge production and a large pool of skilled people and an advanced infrastructure. Our own survey data as well as an analysis of databases and economic statistics show that productivity is higher and innovation in terms of knowledge spillovers and cooperation are more likely to take place in knowledge clusters. On the other hand, geographical clustering without knowledge sharing has tended to reduce the effectiveness of knowledge production and knowledge output in the south of Vietnam. This preliminary result is further pursued in a larger research project on scientific knowledge management systems in Vietnam. In this project the extent to which proximity or clustering have led to inter-organisational networking and knowledge sharing are further explored.

Introduction: Knowledge Clusters as Centres of Development

Knowledge has been identified as one of the major factors of production, driving economies and societies towards a post-industrial stage of development. Countries around the globe, including several ASEAN nations, have adopted policies to encourage the growth of a knowledge-based economy. Building an ICT (information and communication technology) infrastructure has usually been one of the leading policy measures, in addition to developing universities and research institutes. Vietnam embarked on these policies later than Singapore and Malaysia, but appears to be on the way to building a knowledge-based economy.

Building a knowledge infrastructure means initially creating knowledge-producing and disseminating organisations such as research institutes, universities and colleges. To be effective, these have to be located closely to make use of common types of infrastructure such as laboratories, libraries and computing facilities. The geographical clustering theory assumes that proximity increases an organisation's innovative capacity when employees – especially researchers – can share ideas, products and services (Evers 2009).

Our paper will focus on the southern Vietnamese city of Ho Chi Minh City and the adjacent Mekong Delta, which are both destined to play a major role in Vietnam's effort to build a knowledge economy. First we are going to analyse how research is organised and trace the foundation of knowledge-producing institutions since the reunification of Vietnam. Based on own field research data we shall then map and analyse the building of knowledge clusters and, finally, evaluate the impact of cluster formation on knowledge production. Given the importance of the water sector in the Mekong Delta, we shall pay particular attention to research in this field. We shall also emphasise the importance of knowledge sharing and networking and discuss the hypothesis that a lack of knowledge sharing diminishes the positive impact of knowledge clusters on social and economic development.

Knowledge Clusters as Centres of Innovation and Development

As the respective terminology is not yet standardised, we have to clarify the central terms used in our empirical research (Evers 2008).

The most general concept is 'agglomeration', whereby clusters are agglomerations with 'proximity' as a crucial variable. Henry and Pinch use the terms 'agglomeration' and 'cluster' synonymously "to refer to geographical groupings of firms (both large and small but often SMEs), broadly in the same sector, but extending beyond to incorporate greater parts of the value chain" (Henry and Pinch 2006). Following an earlier publication, we shall use a more precise definition (Evers 2008).

Knowledge clusters are agglomerations of production-oriented organisations, which primarily direct their efforts toward knowledge as an output or input. Knowledge clusters have the organisational capability to drive innovations and create new industries, and are central places within an epistemic landscape, i.e. in a wider structure of knowledge production and dissemination. Common examples of organisations found in knowledge clusters are universities and colleges, research institutions, think tanks, government research agencies, and knowledge-intensive firms.

The knowledge clusters in a particular region or urban area – in our case Ho Cho Minh City, the former Saigon of Vietnam – form what is referred to as an 'epistemic landscape', i.e. the geographical distribution of knowledge-producing organisations, their research staff and other knowledge workers and their output. We regard an epistemic landscape as a subcategory of the more general term 'knowledge landscape'. In this usage we allude to Karin Knorr's concept of "epistemic culture, the culture of knowledge production" (Knorr-Cetina 1999) and refer to the geographical space of knowledge production.

Epistemic landscapes develop over long periods of time. They are seldom shaped by individual actors, but more often by the collective action of strategic groups (Evers and Gerke 2009). Firms connected by a

common interest to capitalise on the competitive advantage of clustering have an impact on epistemic landscapes through their location decisions. Moreover, government strategies to develop knowledge-based societies and economies have often been decisive in shaping epistemic landscapes, the relevant development policies of which have been assessed in detail elsewhere for Malaysia and Indonesia (Evers 2003), Singapore and Germany (Hornidge 2007). Developing industrial regions, clusters or knowledge hubs is, indeed, standard practice in many regional planning departments around the world. The allocation of human and financial resources creates knowledge-producing and disseminating organisations that can be measured, mapped and made to depict the contours of an epistemic landscape.

The assumption underlying these policies is that the clustering of knowledge-producing organisations increases knowledge output. In other words, isolated knowledge-producing institutes in knowledge-intensive industries are detrimental to innovations and economic growth. Clustering knowledge organisations is the most effective policy on the way towards a knowledge-based economy and society.

The Epistemic Landscape of Ho Chi Minh City and the Mekong Delta

Our field research mainly covers the south of Vietnam. With Vietnam's first future megacity, Ho Chi Minh City, and "Asia's corn house", the Mekong Delta (Chong 2002: 25), we have chosen a region that currently plays a decisive role in the development of Vietnam. Ho Chi Minh City is not only considered to be the financial centre of Vietnam, but also as an important cultural and industrial centre for the entire Southeast Asian region (Truong 2007: 24). The Mekong Delta, directly situated to the south of Ho Chi Minh City, is one of the world's most productive areas in terms of agriculture and aquaculture and ensures food security for the whole country. Given this background, we will show throughout this paper the importance of knowledge production for the region's socio-economic development[2].

In this section we will give a descriptive analysis of what we refer to as the epistemic landscape. As the respective terminology is not yet standardised, we have to clarify the central terms used in our empirical research (Evers 2008).

In the literature, we do not find any comprehensive elaboration on the composition and allocation of knowledge-producing organisations, particularly from the points of view of Ho Chi Minh City and the Mekong Delta. Thus, an original data set had to be compiled to acquire an overview of the status quo of Ho Chi Minh City's research environment.[3]

All data sets are based on an intensive listing of knowledge-producing organisations in Ho Chi Minh City, and were completed during a one-year field research study in Vietnam from April 2008 to March 2009.[4] This listing was finalised by means of various sources such as Ho Chi Minh City's Yellow Pages (Yellow Pages 2007), directories of scientific organisations published by the city's Department of Science, Technology and Environment (DOSTE 1998) and MoST (2004, 2008). Through an extensive internet search and telephone campaign, every knowledge-producing organisation was verified and crosschecked.

Knowledge-producing Organisations in Vietnam

In Vietnam, scientific knowledge is produced at various levels (Figure 1). Firstly, there are large government research institutes such as the Vietnamese Academy of Science and Technology (VAST), the Vietnamese Academy of Social Sciences (VASS) and the National Political and Administrative Academy

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[2] Even though the largest concentration of knowledge-producing organisations is located in Vietnam's capital Hanoi, this paper will focus mainly on the south of Vietnam, as our field research is an innovative investigation in this area. Certainly, knowledge production as such has led to the overall development of Vietnam contributing to different regions.

[3] A detailed analysis of the Vietnamese science and research community will be presented in the forthcoming dissertation by Tatjana Bauer.

[4] The field research was carried out by Tatjana Bauer, with occasional input by Hans-Dieter Evers. So far, there is no single source that has an overview of every organisation. Most likely, the Ministry of Science and Technology (MoST) has a list, but this not available to researchers or other users.

(NPAA)[5] located in Hanoi, the capital city of Vietnam. Secondly, research is also conducted by research institutes and centres of universities under the administration of the Ministry of Education and Training (MoET). Thirdly, research institutes and ministries other than MoET are responsible for research activities related to the function of the head ministry; some of these universities are directly under the administration of the respective line ministries. Fourthly, there are a number of research centres administrated by the provincial authorities, namely the Department of Science and Technology (DoST). Finally, we have international organisations and privately run companies involved in science and research.

Figure 1: Overview of knowledge-producing organisations in Vietnam
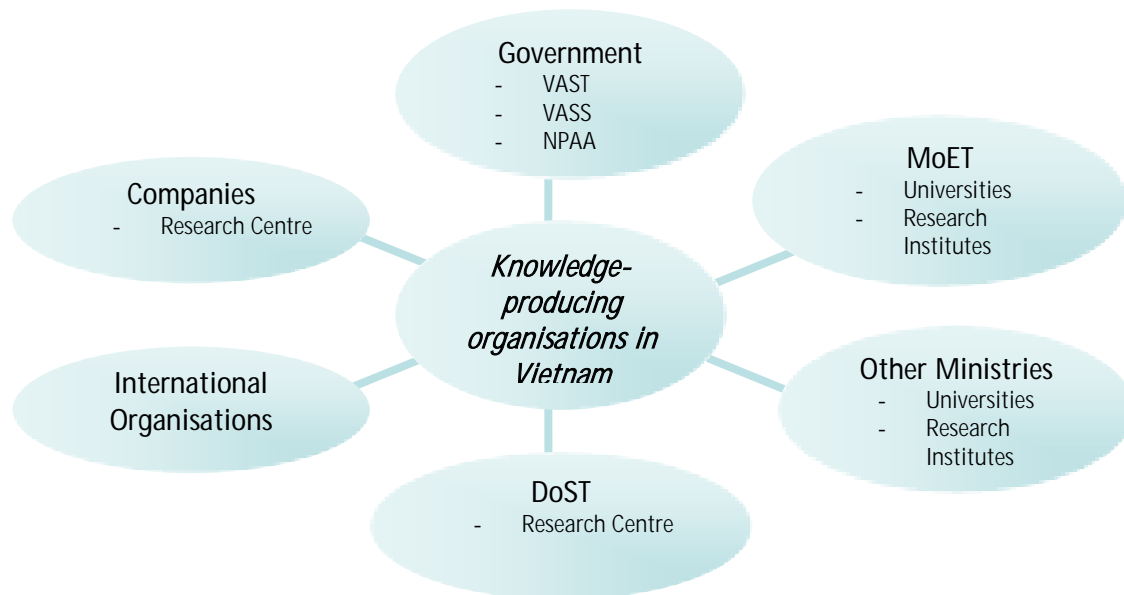
For practical reasons, knowledge-producing organisations will be distinguished according to their main function[6], classed as either education (academies, colleges, universities) or research (companies, centres, sub-institutes, research institutes). The affiliation to the respective head organisations will be ignored in the context of this paper.

Historical Development – the Boom of Educational and Research Organisations in Ho Chi Minh City and the Mekong Delta after 1975

The epistemic landscape of Ho Chi Minh City is in its infancy (Pham 2006: 238); highlighted by the fact that 78% of all currently operating knowledge-producing organisations were founded after 1975, at a time when the north and the south of Vietnam were united (see Figures 2 and 3). In contrast, only 8% existed before 1975. For the remaining14%, no data was available[7]. These figures indicate that

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[5] Similar to the former Soviet Union model, the term 'academy' referred exclusively to state research organisations, which led to the adoption of the system in Vietnam. Using the term 'academy' as the official translation of these organisations shows the strong connection between Vietnam and the former Soviet Union. However, in this case, the correct translation for 'viện' is 'institute'. Nevertheless, other types of academies later appeared in the form of educational organisations, e.g. Vietnam Aviation Academy, Academy of Posts and Telecommunications in Ho Chi Minh City. The term 'academy' used in the latter case is translated to 'học viện' which literally means a 'learning institute'.

[6] This formal distinction according to the key task of these organisations does not have to exclude the other. As our field research has shown, in practice researchers of research organisations normally have teaching assignments at universities and university staff can also be involved in research projects.

[7] It can be assumed that a small number of organisations have been dissolved, merged and renamed, indicating that these organisations are not all newly established.

knowledge-producing organisations in Ho Chi Minh City and the Mekong Delta have developed merely within the past thirty-five years.

Figure 2: Number of knowledge-producing organisations in Ho Chi Minh City and the Mekong Delta (1891-2008)
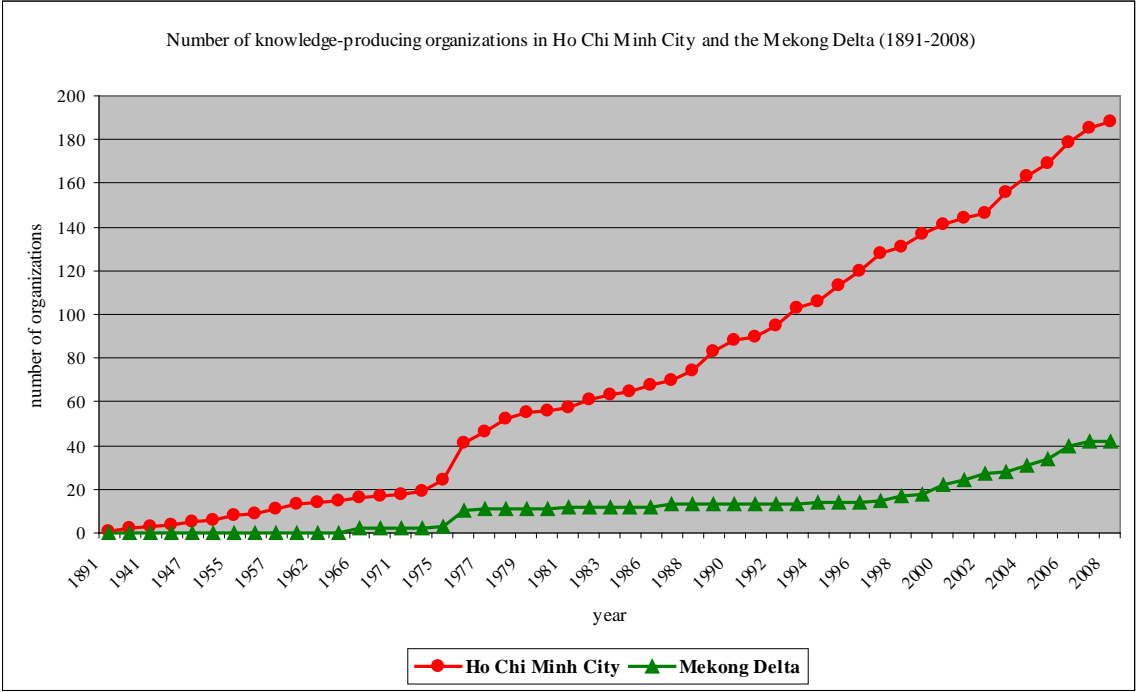
A second peak was reached after 1986 with the introduction of the 'Renovation policy', otherwise known as 'Đổi Mới'. During Vietnam's subsequent transition to a market economy, local or provincial authorities, ministries and universities were allowed to create R&D centres, without compulsory registration with the government, as had been the case before Đổi Mới (Annerstedt and Nguyen 1996: 246). Although, as a consequence, the establishment of research and technology service centres has accelerated immensely, no reliable data relating to existing Vietnamese knowledge-producing organisations in Vietnam has been available until today.

Figure 3: Foundation of knowledge-producing organisations in Ho Chi Minh City and the Mekong Delta (per year)

Foundation of knowledge-producin organizations in Ho Chi Minh City and the Mekong Delta (per year)
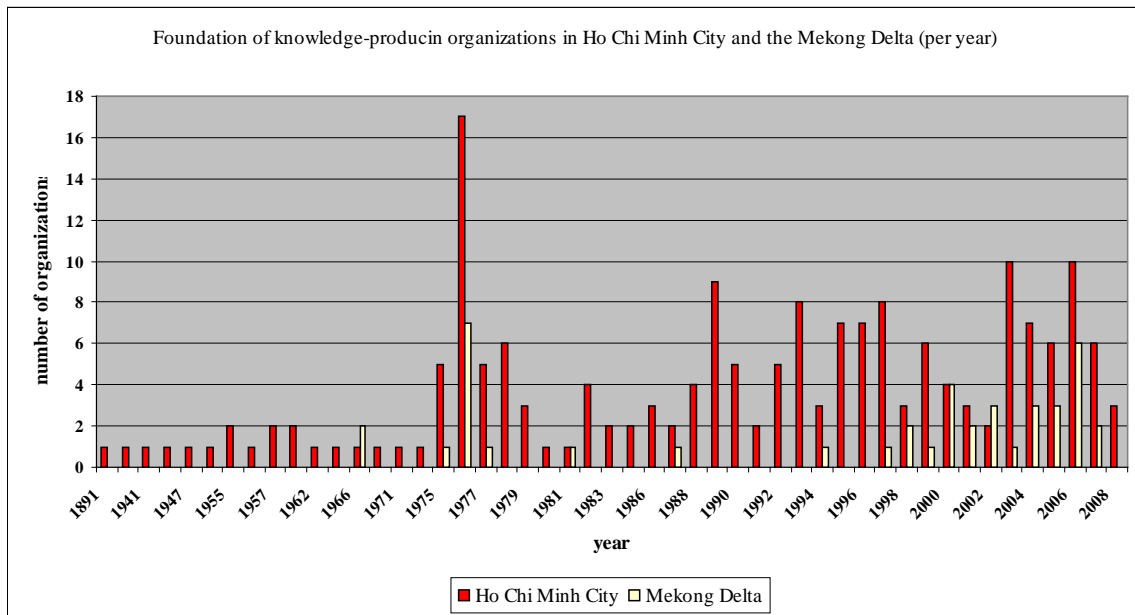
Turning to our own compiled data set, 218 knowledge-producing organisations were identified, comprising 93 educational and 125 research organisations in Ho Chi Minh City (Figure 4), broken down further into 49 universities (trường đại học), 48 centres (trung tâm), 44 institutes (viện), 34 colleges (trường cao đẳng), 29 sub-institutes (phân viện), ten academies (học viện) and four companies (công ty). In contrast, the Mekong Delta accounts for merely 42 knowledge-producing organisations (Figure 5), of which there are 20 colleges, 11 universities, seven research centres and four research institutes.

Figure 4: Distribution of knowledge-producing organisations in Ho Chi Minh City
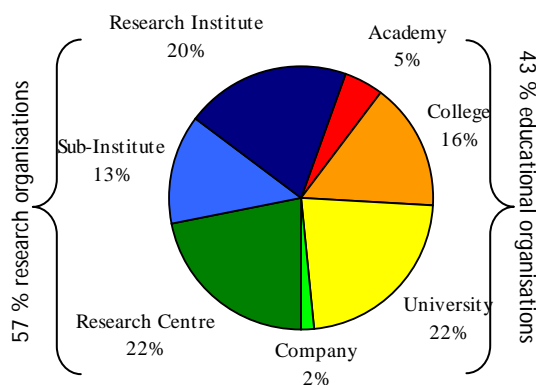
Figure 5: Distribution of knowledge-producing organisations in the Mekong Delta
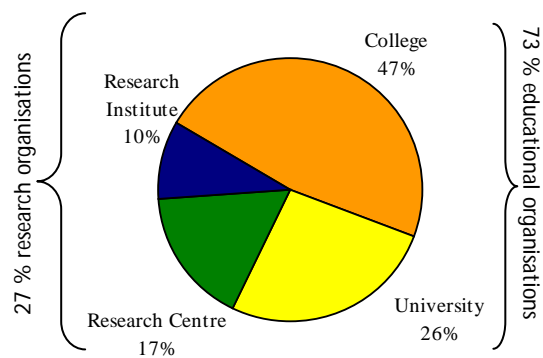
The term 'research organisations' is designated to all research institutes under ministries or directly under the government, sub-institutes belonging to parent organisations in Hanoi or to a functional ministry, research centres under the administration of research institutes or universities, and companies involved in privately run research projects.

In contrast, 'educational organisations' comprise musical, military or political academies, colleges where students can get a degree after three years' study, and universities where students have to study for four

to six years to obtain a degree. Every one of these educational organisations is under the control of the Ministry of Education and Training (MoET) or a functional ministry such as the Ministry of Agriculture and Rural Development (MARD).

According to the data collected in the field, 7.736 staff members work for research organisations and 26.970 staff members for educational organisations (Figure 4)[8]. The number of staff working for knowledge-producing organisations in Ho Chi Minh City and the Mekong Delta is rather high compared to other Southeast Asian countries such as Thailand, which, for instance, has only one-third of the capacity but has developed much faster than Vietnam. Due to the constraints of this paper the question of staff qualification will not be discussed, even though it is obvious that scientific research in Vietnam results in limited scientific outcomes (Dang 2006; Gerke and Evers 2006:17).

In reality, universities have the largest number of employees in comparison with all other knowledge-producing organisations, which is of little surprise because of the size of these organisations and the additional teaching capacity undertaken by university staff, besides their research activities. Grouping organisations according to their size illustrates a tendency toward smaller-sized research organisations, with relatively large educational organisations being the exception to the rule.

Figure 6: Staff distribution of knowledge-producing organisations in Ho Chi Minh City and the Mekong Delta
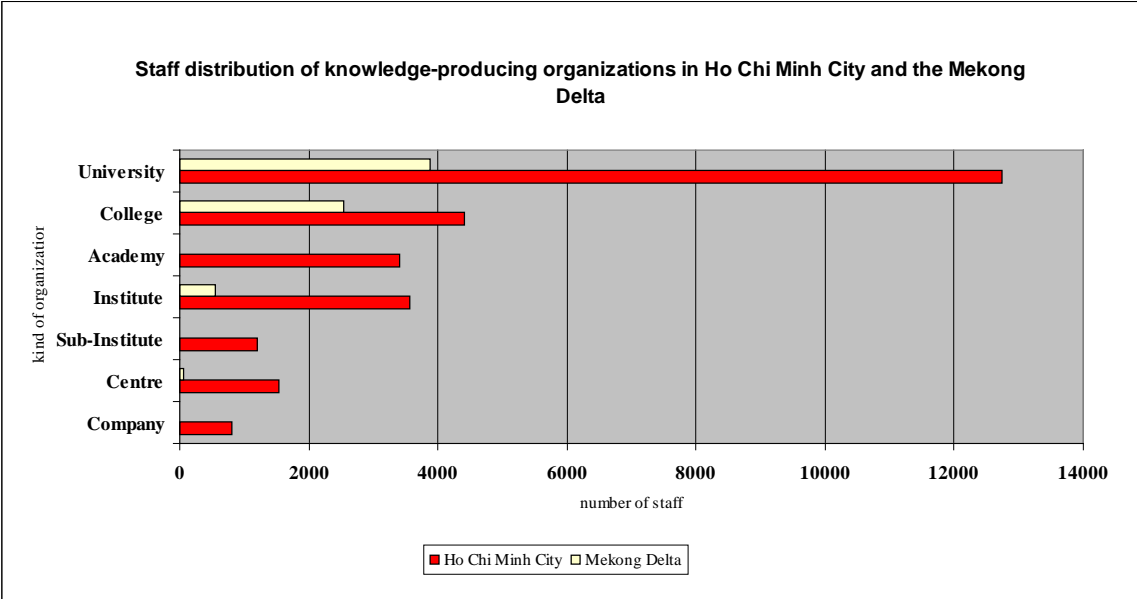
Figure 6 reveals a large gap between the staff numbers of organisations in Ho Chi Minh City and the Mekong Delta, which would be expected due to the much lower amount of knowledge-producing organisations in the Mekong Delta. Nevertheless, this difference turns out to be even bigger when considering the populations of each area – Ho Chi Minh City with 6.4 million inhabitants and the Mekong Delta with 17.5 million (GSO 2007) – revealing an immense concentration of highly qualified staff in Ho Chi Minh City.

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[8] The data set includes only 80% of all identified knowledge-producing organisations. For the remaining 20% of organisations, staff numbers could not be ascertained and therefore will be ignored in the following analysis. Our data shows that approximately one-sixth of the staff accounts for support staff, e.g. drivers, security guards and other service personnel.

Knowledge Cluster Building in Southern Vietnam

These initial considerations will assist in determining a more precise overview of knowledge clusters in Ho Chi Minh City and the Mekong Delta. Thanks to the GIS-based mapping method (Evers, Genschick and Schraven 2009) we can identify two major knowledge clusters – Ho Chi Minh City and Can Tho City – considering the proximity of these organisations as the determining factor (Map 1).

Map 1: Knowledge-producing organisations in Ho Chi Minh City and the Mekong Delta[9]
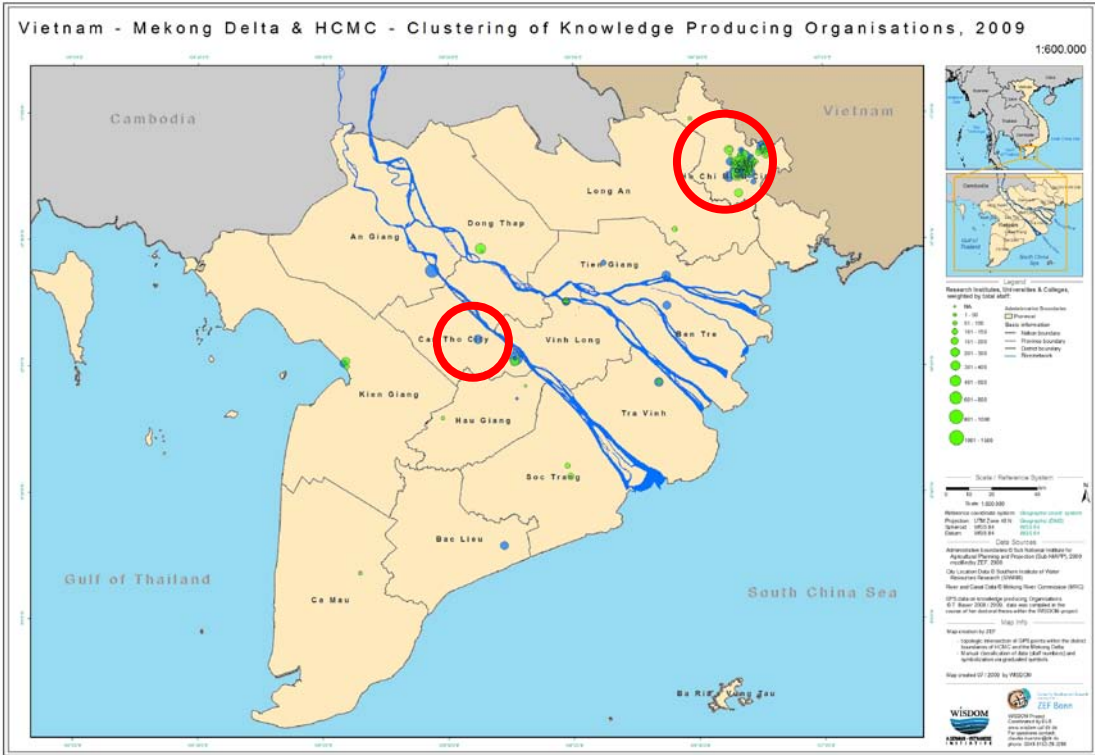
Cluster building in Vietnam has its roots in the early 1980s, when the Soviet model of 'science and production complexes' was introduced. Two of these complexes operating in the south of Vietnam were the Dyestuff complex and the Chemistry complex. In the late 1980s, this model was upgraded by the introduction of "education, research and production complexes", which incorporated academic staff into industry (Annerstedt and Nguyen 1996: 236ff). Even though both models were unsuccessful because of the centralised planning system that led to administrative barriers in the Vietnamese economy, these developments can be seen as a starting point for today's epistemic culture in southern Vietnam.

In the next sections, we will demonstrate how Ho Chi Minh City and Can Tho City were able to not only become knowledge clusters, but also important economic locations.

The Nature of Knowledge Cluster Building

Further to the fact that economic activities tend to cluster, our paper exposes similar trends in respect to research and educational activities. As indicated above, knowledge clusters are agglomerations of production-oriented organisations. Having the ability to share knowledge assets such as laboratories or libraries reduces costs and enables a knowledge-sharing environment. The reduction of transaction costs,

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[9] All maps in this paper have been designed and produced by Sven Genschick on the basis of data generated within the WISDOM project.

emphasised by classical industrial agglomeration theorists, is less important for knowledge-intensive production as transaction costs are extremely low. Conversely, however, a concentration of researchers and the sharing of tacit knowledge is facilitated by proximity (Evers, Gerke and Menkhoff 2010). By virtue of the proximity of organisations, the recruitment of highly qualified staff and knowledge exchange can be enhanced and higher productivity achieved which points to the important role of cluster building.

Movements towards Clusters

Clusters are attractive not only to companies and organisations due to tax incentives and enhanced infrastructure, but also because of the accumulation of highly qualified staff in these areas.

Qualified people move to organisational agglomerations as the result of a better job market and opportunities for multiple jobs, e.g. in the consultancy business, because, as stressed by interviewees, salaries for academics and scientists are exceptionally low which means that they very often rely on auxiliary income. Nevertheless, the job market is not only important with regard to job opportunities, but also in terms of physical proximity. The important roles of personal relationships and networking activities for career development were affirmed during interviews. Evidence is mounting that, through the logistical proximity of clusters, opportunities accumulate and advantageous conditions are provided.

Two Vietnamese studies demonstrate the dynamics of student movement. Can Tho City and Ho Chi Minh City are the favoured locations in southern Vietnam for those seeking a promising career and a raised standard of living. Can Tho City, home to the most important university in the Mekong Delta, attracts most of the students in the region, although it is the home province of only 20% of the city's university students; the remaining 80% come from the other twelve provinces within the Mekong Delta.[10] The fact that more than half of Can Tho's university students remain in the city after graduation points to the unbalanced development of the Mekong Delta. Can Tho City therefore functions as a hub, attracting people from the whole region and particularly graduates, who give the three main decisive factors when looking for a job as salary, secure work and promotion opportunities (Luu et al. 2002: 209). In this sense, these criteria are likely to be fulfilled in clusters.

We find a similar situation in Ho Chi Minh City. According to a study on 1,243 students from Ho Chi Minh City's largest university, the Vietnamese National University, just 30% stay with their families while studying. In the Vietnamese context, students normally live with their parents until they get married and find a job; however, from the perspective of the present study, the only reason for not living with their families is that they have left their home provinces to obtain higher education elsewhere. The study implies that about 70% of the students come from outside and thus have to rent a room, stay with acquaintances or live in a dormitory. Similar to Can Tho City, Ho Chi Minh City is a magnet point for qualified people[11] (Nguyen 2003: 46).

Development due to Cooperation, Exchange and Competition

Companies and organisations are attracted by cluster advantages for practical, economic reasons. State investments are made into creating an efficient infrastructure including excellent road networks or airports such as Vietnam's largest airport, the Tan Son Nhat International Airport in Ho Chi Minh City, or the Tra Noc Airport of Can Tho City, operating since December 2008. Moreover, IT infrastructures are enhanced and the application of modern technology facilitates exchange as well as efficient management and production processes.

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[10] Data refers to the time period from 1995 to 2008 and was provided by the Academic Affairs Office of Can Tho University.

[11] Additionally, Ho Chi Minh City seems to be attractive not only for students from every part of Vietnam, but also for returning overseas Vietnamese who have investment capital and management knowledge as well as contacts with foreign investors (Chong 2002: 101).

In addition to the supply of a transportation infrastructure, clusters have a second significant advantage by virtue of the fact that face-to-face communication is highly likely to take place, ensuring the transfer of valuable 'tacit knowledge'. Highly skilled staff is available on the spot and therein approachable for organisations in terms of consulting services, sharing experiences and elaborating new ideas with these experts.

Our survey, carried out among a selection of Vietnamese researchers, provides important data than can be utilised to verify the cultural and social environments that shape staff work routines and the ways in which they interact. The analysis shows that informal personal meetings and the telephone are by far the most important means of communication in Vietnam. It should be noted at this point that the effective usage of the telephone as a communication tool is only viable when the contact person is known beforehand, which also applies to email communication. The reasons for this are deeply embedded in the Vietnamese cultural suspicion of impersonal interactions, which are regarded as wholly untrustworthy. As personal relationships are inherent in professional life and the key to a project's success, they can involve high transaction costs, as explained previously. The crucial advantage of clusters, therefore, is that people can meet over short distances, which saves a lot of wasted time and related travel expenses. Another advantage is the ease and comfort of attending seminars, workshops or conferences taking place in the same city, rather than travelling many hours to the countryside to visit perhaps only one organisation or workshop. Time and costs are too high to be beneficial, but by reducing these costs and time constraints through proximity, it is possible to build networks with many organisations working in the same field. Collaborations, meetings and face-to-face interactions take place actively as a result of advantageous facilities nearby such as coffee shops and recreational after-work establishments where people can invest in valuable personal relationships that inevitably spill over into business.

From an economic perspective, the Vietnamese government shares only a small part of the knowledge-producing organisations' budget. Since the mid-1980s, technology service contracts have become a major source of funding for many Vietnamese research organisations (Annerstedt and Nguyen 1996: 230). Today, external funding through international research and development cooperation, as well as foreign investment in industry and business, constitute an important part of a research organisation's budget and therefore secure staff salaries and help to promote career opportunities.

Under these circumstances, clusters provide a platform not only for Vietnamese industrial companies, research organisations and skilled people, but also as a main access point for international companies and organisations. It is understandable that international organisations prefer to find as many convenient conditions as possible if they are to pursue business connections in other countries. Facing inconvenient or impassable roads, long distances, unclear procedures, as well as language and culture barriers will make transaction costs too high and render projects economically unviable. Furthermore, organisations located outside cluster areas are less ambitious in terms of innovation; they lack updated information about new technologies and management systems, while innovation seems to be non-profitable in a static environment that itself discourages change. Located away from clusters in the way they are isolates such companies from a network of organisations that interacts almost exclusively with the main customer base and potential collaboration partners. In this sense, regions without clusters risk being cut off from development and innovation processes and tend to lack capacity.

The survey[12] confirms a high international influence on organisations in Ho Chi Minh City and Can Tho City. Both areas create hubs in the south of Vietnam, with favourable conditions and a large pool of skilled people and advanced infrastructures.

A positive effect of international cooperation is the fact that large-scale international projects bring together different Vietnamese partners, which otherwise would never have collaborated. This intervention can be traced in the analysis of international publication output, as provided by the online academic database ISI Web of Knowledge – the majority of scientific articles with at least one

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[12] In total, 282 questionnaires were answered by Vietnamese staff members from seven different universities, colleges, research institutes and local authorities, in which water-related activities take place. In total, 95% of all respondents have a BA degree, 28% have graduated from an MA programme, 7% have obtained a PhD, and 1% holds a professorship. It is remarkable that nearly half of the interviewees with a BA degree are currently involved in an MA programme.

Vietnamese author are joint-products. Many contributions involve Vietnamese authors from different institutes, indicating an exchange of ideas and information in terms of the joint-publication as well as a learning effect among the authors. In addition to the enhancement of collaboration activities among Vietnamese scientists, knowledge exchange within the international research and science arena is also encouraged. Interacting with international experts gives Vietnamese academic and research staff the opportunity to improve their skills and methods, and to work according to international standards in order to be recognised internationally. Business trips and study programmes abroad strengthen the capacity of Vietnamese organisations and likely maintain contacts for further projects. Our survey shows that 41% of all respondents have already participated in an international conference.

Another factor for measuring the international influence on the Vietnamese science and research community is the number of staff participating in study programmes in foreign countries (table 1). Thirty-one per cent of the respondents in Ho Chi Minh City and Can Tho City[13] have already studied abroad, which is quite a high percentage when taking the low income of Vietnamese researchers into consideration. On average, they spent 1.6 years abroad to obtain a higher education.

Table 1: Number of respondents spending time abroad for scientific training and research[14]

Period of time	Number of respondents
1 year or less	47
1-2 years	11
2-3 years	6
3-4 years	6
5-8 years	5
more than 8 years	1

The data from Table 1 produces an interesting result when taking into account Vietnam's closure to international development for a long time, indicating the recent focus on opening up the country on the international stage. There are also many national programmes attempting to reduce over-capacity issues by sending PhD students abroad, the efforts of which enhance networking opportunities with international research institutions.

Cluster Building Leads to Innovation

As the paper demonstrates, cluster building reduces transaction costs, enables the dissemination of knowledge and promotes a high mobility of highly qualified labour and other resources that can be exploited more flexibly. Consequently, productivity is higher and innovation in terms of knowledge spillovers and cooperation are more likely to take place. Innovation can be achieved when organisations obtain updated information about research findings facilitated by a supportive economic environment so, from this point, costs can be saved and the duplication of research activities avoided. Operating in a cluster creates the necessary opportunities for exchange, cooperation and, indeed, competition (see also Sölvell 2008).

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[13] The rate of Can Tho University staff is much higher due to the strong investment in human resources by the World Bank.
[14] 76 out of the 269 respondents have studied abroad.

Achievements of Knowledge Cluster Building

In the previous section we discussed the specific nature of clustering in southern Vietnam in order to understand the dynamics underlying this concept. To advance this argument further, we will show the implications cluster building has in terms of achievements for regional development.

Rise in Scientific Outcome

The quantity and quality of scientific output is a means by which the productivity and innovation of a region can be measured. In terms of knowledge clusters, it is a common standard to use international publications by Vietnamese authors. However, most knowledge output is produced in the Vietnamese language, which is often very roughly translated at best; with international publications, very few Vietnamese authors write directly in English. In general, there is still a lack of recognition of the vast Vietnamese knowledge output; nevertheless, the list of journal articles in the ISI[15] is a measurement indicator.

Figure 7: ISI journal articles published by Vietnamese authors (1977-2008)
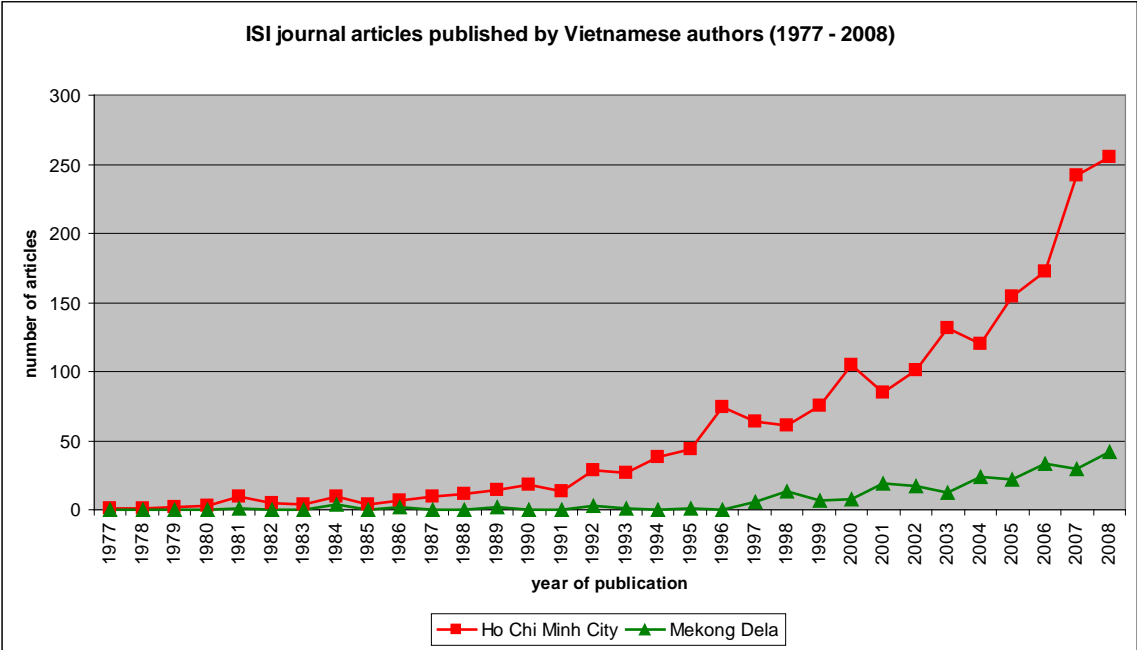
The amount of Vietnamese knowledge output acknowledged internationally has increased significantly over the last twenty years (Figure 7). Compared to the Mekong Delta, Ho Chi Minh City's output production is almost ten times higher, which shows the superior role of Ho Chi Minh City in the development of southern Vietnam. Considering the Mekong Delta with only thirteen provinces, Can Tho City plays a crucial role for the region because its output accounts for 72 % of the whole delta. Obviously, there seems to be a correlation between the number of knowledge-producing organisations and international publications – the more organisations located in an area, the higher the output.

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[15] "ISI Web of Knowledge" is an online academic database that only considers scientific articles published in English.

Table 2: Total number of ISI journal articles published by Vietnamese authors (1977-2009)

Province/Region	Number of published articles
Ho Chi Minh City	2001
Mekong Delta	265
- Can Tho City	190
- Dong Thap	27
- An Giang	11
- Tien Giang	12
- Hau Giang	8
- Long An	6
- Kien Giang	5
- Bac Lieu	2
- Ca Mau	2
- Ben Tre	1
- Soc Trang	1
- Tra Vinh	0

A more complicated method is to measure Vietnam's national output, which until now has been difficult to access. Table 3 gives the example of Can Tho University, indicating that the ISI includes a bias by virtue of the fact that English language journals dominate this database. These statistics are provided on the website of Can Tho University, and show that they have more scientific articles published internationally than ISI counts – within four years, CTU published 261 articles in international scientific journals whereas the ISI only counts 190 (see Table 2). Nevertheless, the ISI gives an opportunity to compare different countries and provides a window on the development stages of particular regions.

Table 3: Number of published articles by Can Tho University (2005-2008)

Year	No. of published articles – Can Tho University Scientific Journal	No. of published articles – National Scientific Journal	No. of published articles – International Scientific Journal
2005	54	33	57
2006	46	74	74
2007	46	42	77
2008	45	22	53

Source: www.ctu.edu.vn

It should not be surprising that Can Tho University publishes more articles internationally than nationally. For the past decade, the university has strongly focused on international cooperation that supports and shapes knowledge production according to international science and research standards.

Unfortunately, international researchers often neglect Vietnam's national scientific output due to language and administrative barriers. There are numerous ways for the staff of knowledge-producing organisations to publish in Vietnam. According to our survey, 99 out of the 282 respondents gave

specific details about their publications, listing in total 429 national publications since 2000. Two-thirds of the 99 respondents had produced only one to four national publications, while 11 % had no national publication. Conversely, one quarter of them had published in an international journal. In total, 112 international publications were specified. On average, most of the respondents had published one or two international articles. The figures show that even though the national output is much higher than on an international scale, Vietnamese scientific publications are less recognised by international scientists.

Furthermore, most knowledge-producing organisations provide in-house publications such as annual reports, newsletters or scientific journals particular to an institute's speciality. In addition, since 2008, twenty-three national scientific journals have been uploaded onto the internet. Such an online databank[16] is a first step for national as well as international readers to gain insight into updated Vietnamese research findings.

Successful Economic Performance

Clustering has an effect not only on the increase of knowledge output, but also on the economic growth of these regions[17]. Bearing in mind that the strategic locations of Ho Chi Minh City and Can Tho City originate in the flourishing development of southern Vietnam, the importance of the emergence of knowledge clusters in these regions is evident.

Statistical data shows that the GDP of Ho Chi Minh City contributes one quarter of the country's GDP, even though the city holds just 7.8% of the total national population (see Table 4).

Table 4: GDP and population of Ho Chi Minh City at the ratio of Vietnam

Year	Ratio GDP HCMC-Vietnam (%)	Ratio population of HCMC-Vietnam (%)
2001	17.6	6.7
2002	18.0	6.8
2003	18.4	7.0
2004	18.5	7.0
2005	20.2	7.5
2006	22.1	7.6
2007	24.3	7.8

Source: www.hochiminhcity.gov.vn

More significant is the comparison of the GDP per capita of Ho Chi Minh City with that of Vietnam as a whole, the former being much higher for a long time with $2100 against $835 in 2007 (Table 5). This proves that Ho Chi Minh City has enjoyed a far higher level of economic development than any other region in Vietnam. One of the contributing factors of this rapid development may be the positive effects of clustering. It is, however, difficult to assess whether this clustering was the outcome of a deliberate policy or merely a function of population distribution and the urban land market.

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[16] VJOL – Vietnamese Journal Online is an initiative of INASP, the International Network for the Availability of Scientific Publications, based in Oxford, Great Britain. In April 2009, the management of VJOL was transferred to the Vietnamese side and is based at NACESTI, the National Centre for Scientific and Technological Information under the administration of MoST.

[17] An attempt to measure the economic growth of Vietnam's provinces is the Provincial Competitiveness Index (PCI), which was introduced four years ago. Developed by USAID and the Vietnam Chamber of Commerce and Industry (VCCI), the PCI gives the opportunity to compare the economic development of each province in Vietnam and promotes local competition in order to improve the area's economy (www.pcivietnam.org). This index is based on surveys conducted in privately run companies and allows only educated guesses.

Table 5: GDP per capita of Ho Chi Minh City and Vietnam

Year	GDP per capita of HCMC (USD)	GDP per capita of Vietnam (USD)
1980	384	n. a.
1985	444	251
1990	583	98
1995	937	289
2000	1365	402
2004	1720	554
2007	2100	835
2008	n. a.	1040

Sources: www.imf.org, www.pso.hochiminhcity.gov.vn

Alternatively, the distribution of industrial parks is another indicator of cluster building and economic development. In total, there are fifteen industrial parks and export processing zones alone in Ho Chi Minh City, with another fifteen located in the Mekong Delta. Compared to the other Mekong Delta provinces, Can Tho City has, with four industrial parks, the highest number of industrial parks (GSO 2009). The advantages are evident: companies get assistance in the licensing process and local affairs, there is a reliable source of electricity, the infrastructure is well-developed, and staff recruitment is concentrated amongst a highly qualified pool of potential applicants (Chong 2002: 11). Furthermore, the parks are embedded in a region populated by knowledge-producing organisations that will guarantee the education of skilled people and scientific exchange with other industries.

Relevance of Ho Chi Minh City and Can Tho City as Knowledge Clusters

Our data shows two prominent cases of knowledge clusters: Ho Chi Minh City and Can Tho City.

We have demonstrated the importance of location for knowledge production and economic growth; nonetheless, this development would not have been possible without the strategic location of these regions. The Mekong River not only enables ships to enter the inner city of Ho Chi Minh City, but also provides cheap and effective transportation routes into the Mekong Delta. The subsequent strategic value of the region lies in economic advantages and opportunities for traders and manufacturers alike (Chong 2002: 21), and has transformed the region into a modern hydraulic society (Evers and Benedikter 2009). Today, Ho Chi Minh City is the focus of foreign investment in Vietnam, with half of all foreign investments flooding into the metropolis (Chong 2002: 22).

Can Tho City is following closely on the heels of Ho Chi Minh City and fast becoming the economic, political, cultural and technological centre of the Mekong Delta (Le 2006: 118). In 2002, a World Bank loan was approved to restore waterway routes and ports in the Mekong Delta. Interestingly, the 600km waterway network links Ho Chi Minh City with Can Tho City and Ca Mau, the most southerly part of Vietnam, on the one hand, and Ho Chi Minh City with Can Tho City and Ha Tien, which is close to the Cambodian border, on the other (Chong 2002: 93). Recently, construction work for the largest seaport in the region, the Cai Cui seaport, has started, and will boost Can Tho City's position as a hub in the Mekong Delta's network of waterways[18]. In addition, Can Tho City is located at the crossroads of the highway network that interlinks the Mekong Delta, and another advantage is the recently opened Tra Noc Airport in Can Tho City, which will most likely become one of the main international airports in Vietnam in the near future (Le 2006: 119). Given that this development would not be possible without qualified people, Can Tho City took the initiative of opening the first university in the Mekong Delta.

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[18] Information taken from a newspaper article from 13 July 2009: "Work starts on Cai Cui Seaport" "http://vietnamnews.vnagency.com.vn/showarticle.php?num=03ECO130709 (accessed on 15 July 2009).

Consequently, science and research are now able to develop with the assistance of international cooperation, which is vital if the region is to interact on a global level.

Vietnam is on the path towards a knowledge-based economy in which Ho Chi Minh City and the Mekong Delta are playing decisive roles. Our data shows that the number of knowledge-producing organisations is continuing to grow. Still, although there is a great deal of potential in improving the epistemic landscape of this region, it can be nevertheless assumed that the education and research sectors will develop in line with economic prosperity, since it is more likely that wealthier families – especially in urban areas with suitable facilities – will invest more in the higher education of their children.

Conclusion - Limited Economic Growth due to Insufficient Knowledge Sharing

Looking at Vietnam's southern provinces within the Mekong Delta and adjacent areas, our data shows that Ho Chi Minh City harbours one of Vietnam's major knowledge clusters, followed by the much smaller cluster of Can Tho City. The distribution of knowledge-producing organisations within Ho Chi Minh City also shows clustering, in the sense that universities and research institutes are concentrated in adjacent urban districts (Map 2).

Map 2: Clustering of knowledge-producing organisations in Ho Chi Minh City
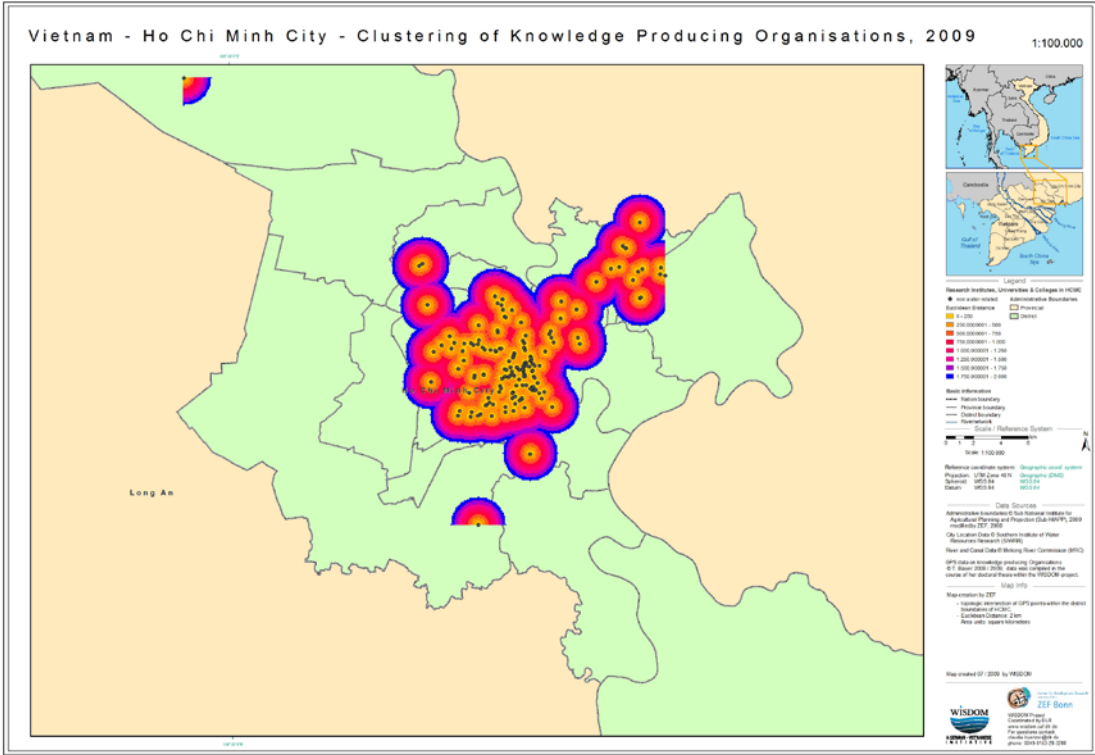
Clustering in these two urban areas is, to a large degree, a function of population density, or 'urbanism', i.e. the availability of urban institutions and of government policy.

As part of our further investigation, we shall analyse different aspects of clustering, e.g. to what extent proximity or clustering have led to inter-organisational networking and knowledge sharing. Through our interviews and survey data, we establish that the situation can be adequately described as one of hierarchical or bureaucratic sharing, insofar as research results are primarily channelled into either government departments or international donor agencies. Intra-organisational knowledge sharing still

seems to be in the embryonic stages of development and horizontal research cooperation and knowledge sharing between knowledge-producing organisations hardly take place[19]. In our terminology, outlined in the introductory section of this paper, the 'knowledge hubs' of networking and knowledge sharing are yet to be fully developed – the epistemic landscape has still to be completed.

Geographical clustering without knowledge sharing has greatly reduced the effectiveness of knowledge production and knowledge output. It remains to be seen whether the attempts by some Vietnamese researchers bear fruit, when they start to work toward more intensive knowledge sharing between organisations. Knowledge clustering needs to be supplemented by networking and the building of knowledge-sharing, epistemic communities to produce new knowledge and economically viable innovations.

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[19] An ongoing qualitative data analysis will be elaborated in the coming months and appear in a further publication.

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