

## Urban environmental health challenges in China's villages-in-the-city

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China's villages-in-the-city are a typical form of marginal settlement that mushroomed in Chinese cities in the course of booming economic development, rapid in-migration and urban expansion processes after economic opening. Based on fieldwork in Guangzhou, the central aims of this contribution are, firstly, to analyse the exposure of the rural-urban migrants living in these settlements to environmental health threats, and secondly to discuss the emergence of these threats, taking into account the role of various actors at local and municipal levels and their impact on the environmental health situation. Data was obtained from expert interviews with representatives of village collectives and the urban administration in Guangzhou, from systematic field observations in 19 villages-in-the-city and from a quantitative survey of 450 rural-urban migrants. The findings presented here show that the environmental health situation in villages-in-the-city reflects the complex interplay of diverse forces and players in the Pearl River Delta. Environmental health conditions vary according to density, economic structure, the level of commitment of street offices to their management tasks, and the financial resources of the village collectives.

### Herausforderungen für die Umweltgesundheit in Chinas Dörfern-in-der-Stadt

Chinas Dörfern-in-der-Stadt sind eine für chinesische Städte typische Form von Marginalsiedlungen, die sich im Zuge boomender ökonomischer Entwicklung, rasanter Zuwanderung vom Land und urbaner Ausdehnungsprozesse in der Folge der Öffnungspolitik entwickelt haben. Auf der Basis von Feldarbeiten in Guangzhou sind die zentralen Ziele des Beitrags erstens, die Exposition der Migrantenbevölkerung in den Dörfern-in-der-Stadt gegenüber Risiken für Umweltgesundheit aufzuzeigen und zweitens, die Entstehung dieser Risiken im Kontext der Rolle verschiedener lokaler und städtischer Akteure zu diskutieren, die einen Einfluss auf Umweltgesundheit nehmen. Datengrundlage sind Experteninterviews mit Vertretern von Dorfkollektiven und der Stadtverwaltung Guangzhous, systematische Feldbeobachtungen in 19 Dörfern-in-der-Stadt in Guangzhou und eine quantitative Befragung von 450 Land-Stadt-Wanderern. Die Ergebnisse verdeutlichen, dass die Umweltgesundheit in Dörfern-in-der-Stadt das komplexe Zusammenspiel verschiedener Einflüsse und Akteure im Perlflussdelta widerspiegelt. Die Bevölkerungs- und Gebäudedichte, die ökonomische Struktur, das Maß, in dem die Straßenbüros ihre Managementaufgaben erfüllen, und die finanziellen Ressourcen der Dorfkollektive bedingen Unterschiede in Umweltgesundheitsfaktoren zwischen verschiedenen Dörfern-in-der-Stadt.

#### *1 Global change and urbanisation in China*

During the last 30 years China's cities have experienced booming industrialisation and in-migration closely associated with urban expansion processes. The cities not only underwent

substantial internal restructuring but also experienced a huge expansion of their built-up areas into the previous urban fringe and agricultural belts in the peripheral vicinities (cf. Figure 1 for the example of Guangzhou). Local government policies aimed at stimulating growth and at-

tracting external investors were crucial for these developments (Wu et al. 2007a). Large-scale green field development projects on the urban fringe and infrastructural construction for industrial development, especially for export-oriented industries in the special economic zones, open cities and open development regions, as well as concentrated capital investment in real estate development promoted by urban land reforms have led to an immense urban sprawl (Cartier 2001, Cartier 2002).

The massive influx of rural-urban migrants is not only a consequence of urbanisation in China, but has also become an important driving force for urbanisation and urban economic growth. According to a recent estimate, 225.4 million Chinese people have left their rural homes to look for jobs, mostly in the cities (National Bureau of Statistics 2009). This process is closely connected to two almost parallel developments: a) national reforms of the early opening policy under Deng Xiaoping which released agricultural workers and b) the influence of global processes of change, especially the new international division of labour, that have led to a rising demand for labour in Chinese cities as a consequence of a globalised world market. Marketisation and rapid urbanisation as well as migrant influx have led to social polarisation and spatial segregation in Chinese cities (Gu/Shen 2003) as well as to an immense loss of arable land and biodiversity, pressure on water resources, inadequate supply and disposal systems and the rapid spread of infectious diseases (Seto 2004).

These processes have been especially profound in the Pearl River Delta (PRD), also known as the "world's workshop" (Sun et al. 2006, 28), which is located in the south-eastern province of Guangdong and which became an open economic region in 1985. Of primary significance for the PRD's position in the global economy is its long-standing tradition of trans-boundary economic relations (cf. Cartier 2001). Urbanisation in the PRD has been more strongly affected by the influx of foreign direct investment than other urban regions of China (Sit/Yang 1997). Unlike other Chinese development zones,

the provincial and state governments have reduced their influence on regional planning in the PRD, allowing local and regional socio-political networks as well as economic interests to extend their important influence on urban and regional planning and development over the last decade (Xu/Yeh 2005, Seto 2004). Thus urbanisation was characterised by the simultaneity of state-led and spontaneous development (Shen et al. 2002). Local governments competed vigorously for contracts with foreign investors, resulting in redundant industrial structures as well as the acceptance of negative externalities of growth (Sun et al. 2006). Seto (2004, 56) comments: "human activity has changed the face of Earth, and nowhere is it more evident than in the PRD".

Large areas that were formerly intensively used for farming, gardening and livestock breeding, and that were densely settled with myriads of rural villages, were rapidly transformed into new highly urbanised and industrialised areas. As a result, the former traditional villages were rapidly replaced by hundreds of so-called *villages-in-the-city* (VITC), which housed the majority of the migrant workers in the PRD. In order to address the challenges of national transformation and global change, an improved "understanding of the interactions and feedbacks between megacities and global change at local, regional and global scales is needed" (Kraas 2007, 81). Based on field-work in Guangzhou, this article provides a detailed account and discussion of environmental health issues in VITCs. The central aims are, firstly, to identify the level of the inhabitants' exposure to environmental health threats, and secondly, to analyse the emergence of these threats by examining the roles of various actors who have an impact on the environmental situation at different levels.

## 2 The development of villages-in-the-city in the Pearl River Delta

*Village-in-the-city* is derived from the Chinese term *chengzhongcun* and describes formerly rural communities that are surrounded by ur-

ban land, or which are currently in the process of being engulfed by urban development due to massive urban sprawl. Their development is closely linked to the dual Chinese system of land-use rights and administration, both of which distinguish between urban and rural areas. While urban land is owned by the government, rural land is owned collectively by the village committees.

In order to have as much land as possible at their disposal for economic or residential uses, urban governments buy agricultural land from the villages. In accordance with land compensation regulations, built-up land, together with 'land for the future use of economic collectives' or 'allowance land' (*liuyongdi*), is left to the villages, mainly because village committees would otherwise be entitled to high compensation payments for built-up land. In accordance with the traditional legal registration and welfare system (*hukou* system), a piece of land (*zhajidi*) within the village boundaries was allocated to each farmer, who was registered with so-called rural *hukou*. On this land, farmers could build themselves a house.

In reaction to the loss of their original source of income, and facilitated by compensation payments, local villagers in southern China started to demolish their one-to three-storey houses and replace them with cheap, basic, multi-storey apartment buildings, which they rented out to rural-urban migrants. Since villagers maximised the base area of the houses during the construction process, hardly any space was left between buildings, creating settlements with a very high building and population density and leading to a series of environmental and infrastructural problems. In contrast to the southern Chinese VITCs, existing building structures or provisional shelters are used to host the migrant population in northern Chinese cities (Gu/Shen 2003, Zhu 2004).

Further reasons for the emergence of VITCs in their current form are: (1.) the massive influx of migrants, which is a spontaneous reaction to the new economic opportunities in the cities (Gransow 2007); (2.) the persistence of the *hukou* system which excludes the great major-

ity of migrants from the mainstream housing system so that no alternative affordable housing is accessible to them (cf. Wu 2004); (3.) the prime locations of the VITCs within the urban area (Ma 2008); (4.) local villagers' attempts to maximise their income by renting out apartments to migrants (Ma 2008); (5.) overstretched urban planning and management as well as a lack of interest in dealing with these marginal settlements on the part of the urban administration (Taubmann 2002).

In Guangzhou the municipal government records 138 VITCs (07/Guangzhou/42A/E<sup>1</sup>). However, the estimate made by Zhang et al. (2003, 919) seems to be more realistic, counting 277 VITCs, as successive incorporations of new districts and further expansion of the urban area have added to the original number of villages located within the area of the city's jurisdiction.

There is a growing number of publications on VITCs. However, due to the limited availability of data and a marked lack of inter-urban comparisons (Gransow's (2007) comparison of VITCs in Beijing and Guangzhou is an exception) there are still many research gaps. Among the few articles that give a broad overview of different topics in VITCs are Li's (2002) report on villages in southern China, Yan and Wei's (2004) and Zhang et al.'s (2003) publications focusing on Guangzhou, and Zheng et al.'s (2009) article about Beijing's VITCs.

Other publications focus, for example, on the overtaxed urban administration in Guangzhou, which is unable to manage and control housing construction in VITCs (Taubmann 2002), or discuss how to effectively transform these settlements and extend the authority of the urban administration in order to integrate them into it (Wei/Yan 2005). Song et al. (2008) analyse migrants' choice of housing in the VITCs in the broader context of general access to housing for migrants in China's urban areas. Qi et al. (2007) address informal elements influencing the development of housing in VITCs, using two villages in Ningbo as examples. Wang et al. (2009) do this for Shenzhen. Ma (2008) examines informal economies in VITCs in Shenzhen.

Lan (2005) sheds light on the economic and social characteristics of a community of local villagers, taking the example of Shipai village in Guangzhou. Guo and Zhang (2006) deal with social transformation and social stratification in these settlements. Siu (2007) looks at processes of social exclusion in VITCs from the perspective of social anthropology. Other publications have touched upon the issue of VITCs, e.g. when dealing with urban management and land reforms, urban sprawl and the formation of migrant enclaves (Deng/Huang 2004, Wu et al.

2007a, Zhu 2004), illegal land use and construction in rural-urban transition zones (Tang/Chung 2002) and urban poverty (Gu/Shen 2003).

So far, only a few scholars (e.g. Bork et al. 2010) have analysed the health situation in VITCs. However, most of the articles mentioned above touch upon issues related to environmental health in their general description of housing or living conditions in VITCs. Wehrhahn et al. (2008) discuss issues related to social and water-related vulnerability in-depth, using the example of Xincun village in Guangzhou.

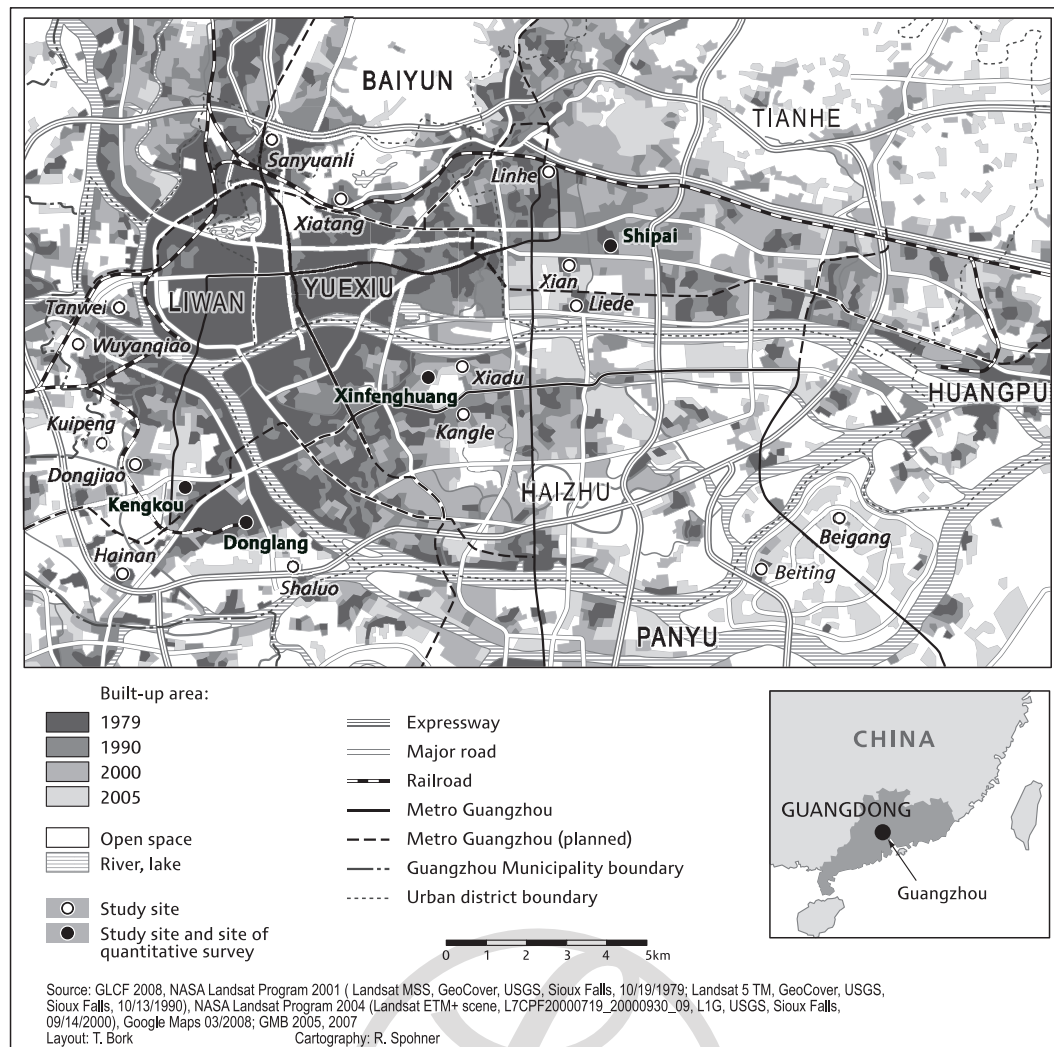


Fig. 1: Urban land expansion in Guangzhou, 1979-2005, and location of the sample villages

### 3 A theoretical framework for urban environmental health

Urbanisation has played a major role in human health (Freudenberg et al. 2005, Moore et al. 2003). The effects of the urban environment on health are multiple and ambivalent: While offering opportunities for livelihood, services and education, urban environments – especially in developing and transition countries

– present numerous health hazards and health risks, linked for example to outdoor air pollution, contaminated drinking water, inadequate sanitation and solid waste disposal, noise etc. Furthermore, they are characterised by major socio-economic disparities (Bork et al. 2009, Vlahov et al. 2005).

Despite improvements in public health, including the reduction of general exposure to ‘traditional’ environmental health risks (e.g.

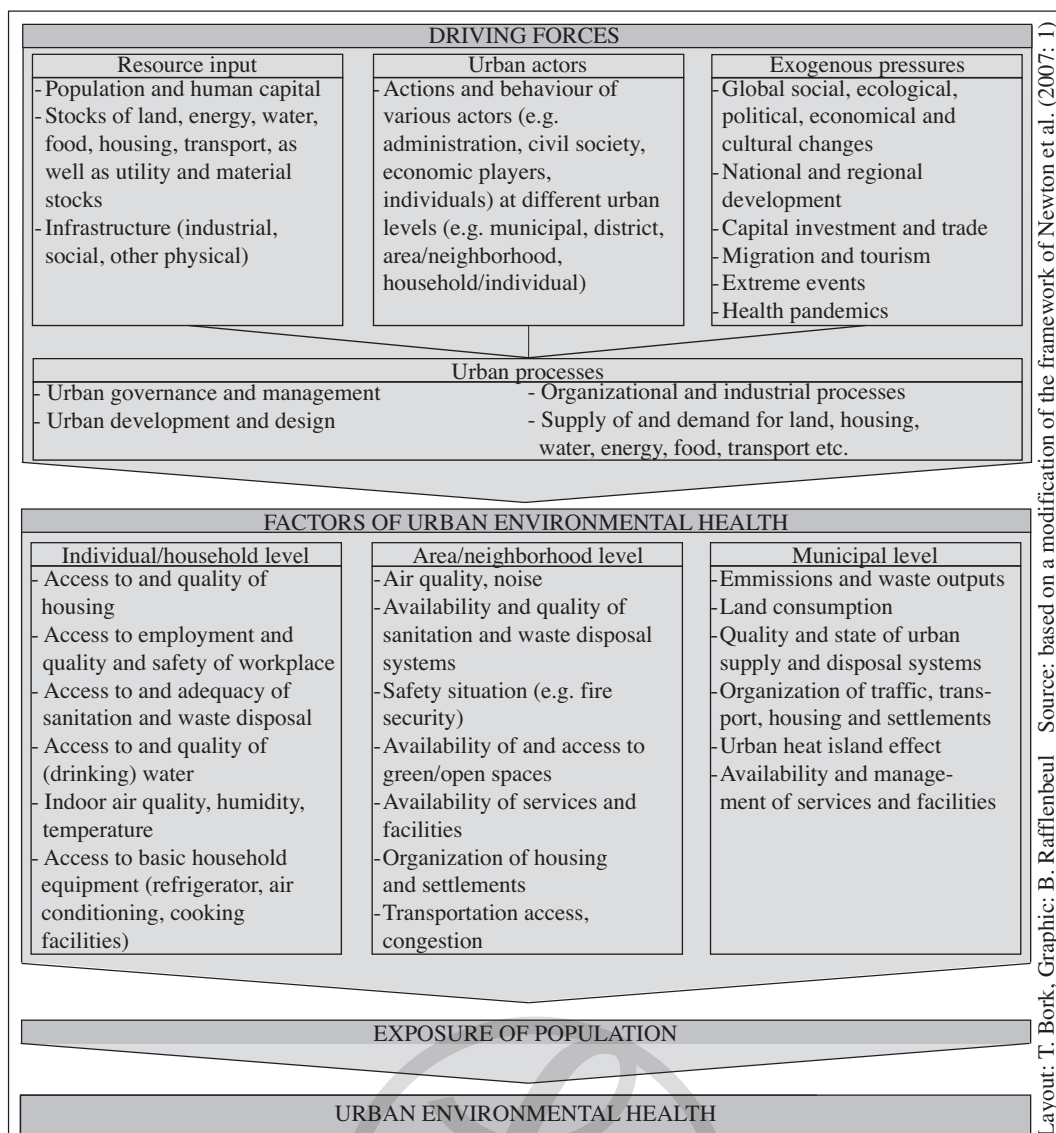


Fig. 2: Framework for urban environmental health



through improvements in sanitation and access to clean drinking water), and an increase in life expectancy over the last three decades, figures on mortality and morbidity in China indicate that the influence of environmental aspects on urban health is still much higher than the global average (cf. Zhang et al. 2010, WHO 2005). In Chinese urban areas, poor population groups are particularly affected by environmental health hazards (Zhang et al. 2010, Yang et al. 2006).

Research on urban environmental health seeks to improve our understanding of how the residential environment in cities affects human health (Kjellstrom et al. 2007, McMichael 2000). Although there is a growing number of publications dealing with the connections between urban environment and health, widely accepted definitions of key terms and a model of interconnections are lacking so far. The WHO (2007) gives a definition of the broader field of environmental health that includes the multifaceted and complex links between environment and health in general: "Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the environment". There has been abundant research on the broader concept of environmental health from the perspective of different disciplines, such as medicine, epidemiology, public health, geography of health, toxicology, chemistry, ecology, and physics (cf. for overviews Parkes et al. 2003, Knol et al. 2010). However, consistent indicators for environmental health have not yet been defined (cf. Hancock 2000, Prüss-Üstün/Corvalán 2006).

For the purposes of this article we refer to a modified version of the urban metabolism model of urban settlements that was first developed by the Australian State of the Environment Advisory Council (1996) and was later expanded by Newton (2007) (cf. Figure 2). With the perspective of the various urban actors we added a third dimension to the original two dimensions (exogenous pressures and resources input) influencing urban systems and processes. The actor perspective takes into consideration

the fact that the actions and behaviour of various actors – including individuals, households, and the various levels of administration, as well as economic organisations, companies, and civil society – are of primary significance in defining how resources are used in cities, how urban land is developed, what development paths are taken etc. (for a more detailed discussion see Bork et al. 2011). These forces lead to differences in the state of urban environmental health factors at different scales in cities. Finally, the effect of these factors on environmental health depends on the different levels and types of exposure of individuals and population groups to health risks.

Our analysis is focused on two elements of the framework: the exposure of rural-urban migrants living in VITCs to environmental health threats, and the role of the various actors influencing environmental health conditions. In view of the data sources available (cf. section 4), our analysis of the population's exposure is restricted to the following aspects.

1. Individual and household level: housing conditions including residential crowding; household hygiene conditions, i.e. access to sanitary and other basic facilities (e.g. cooking facilities), water supply and drinking water sources, indoor air pollution and dampness.
2. Area and neighbourhood level: factors related to the built environment such as building density, air circulation, local air pollution, safety issues and the number of open spaces.

We utilise the "Housing-Health Indicators" of the WHO (2004) for the assessment of residential crowding and household hygiene conditions, as well as for the discussion of issues linked to air circulation, dampness and safety. We will focus on aspects related to the migrants' general living conditions as occupational health issues as well as migrants' access to health care and their health care utilisation were previously analysed for the same sample in Bork et al. (2010).

#### 4 Methodology and data

The data was obtained between 2007 and 2009 in the framework of a broader joint research project<sup>2</sup> which involves the cooperation of researchers from the fields of the geography of health, urban geography and urban planning, public health, and sinology from China and Germany. Various methods (qualitative interviews with representatives of the administration and VITC cooperatives, a quantitative survey with rural-urban migrants, field observation and mapping) were combined with the aim of complementarity, i.e. achieving an improved understanding in breadth and depth of the subject of research through the use of several methods each of which have different strengths (cf. Johnson et al. 2007, Morgan 1998).

Field visits and systematic field observations were undertaken in 19 VITCs in Guangzhou (cf. Figure 1). Through interviews with the heads of the village cooperatives or other key representatives and/or the responsible street office managers it was possible to obtain data on the basic characteristics of 10 of these VITCs (cf. Table 1). Three expert interviews with personnel of the Guangzhou city administration are included. The qualitative fieldwork was undertaken by joint research teams with Chinese and German project participants. In addition, a quantitative survey of 450 rural-urban migrants was conducted in four VITCs in Guangzhou (Donglang, Kengkou, Shipai, Xinfenghuang) with an estimated total migrant population in all villages of 90,000. The survey was implemented by 20 Chinese students from Sun Yat-sen University, Guangzhou, who had previously received several training sessions on conducting surveys. It proved to be a major advantage that the students were migrants themselves, from various provinces in China, which considerably reduced the problems associated with social distance and served as a 'door opener' at the beginning of the interview.

For the quantitative survey, the VITCs were selected using a complex directed sampling strategy according to their development stage, so that one representative village was included for each

defined stage of development (cf. chapter 5): Shipai in Tianhe district, representing stage III, Kengkou in Liwan district, representing stage II, and Donglang in Liwan district, representing stage I. The development of the fourth VITC, Xinfenghuang in Haizhu district, is currently between stages II and III. The units of analysis are rural-urban migrants, who live in the selected VITCs and who were selected through a quota sampling procedure.

#### 5 Findings

##### *Rural-urban migrants' exposure to environmental health risks in villages-in-the-city*

According to the WHO (2004, 16), crowding is a threat to the individual's mental well-being and healthy development. It is conducive to the spread of infectious diseases and increases the risk of accidental household injuries. According to the 'space availability' indicator, which is used as a measurement for crowding, less than 8 m<sup>2</sup> of floor space per capita is unacceptable. Between 8 m<sup>2</sup> and 14 m<sup>2</sup>, comfort problems related to acoustical, environmental and functional aspects can occur, while a per capita floor space of over 14 m<sup>2</sup> increases general satisfaction (WHO 2004, 16-18). The floor space available per person in China increased from 7.2 m<sup>2</sup> (1980) to 27.1 m<sup>2</sup> (2006) per capita in urban areas and from 9.4 m<sup>2</sup> (1980) to 32.4 m<sup>2</sup> (2008) per capita in rural areas in China (NBS 2009, 351). The migrant population surveyed had much less available floor space than the general population of Guangzhou (cf. Table 2). Of the Guangzhou sample, 39.1 % reported living in a dwelling with less than 8 m<sup>2</sup> per capita, 33.8 % recorded between 8 m<sup>2</sup> and 14 m<sup>2</sup> available floor space, and 27.1 % claimed to have over 14 m<sup>2</sup> per capita. Nevertheless, per capita floor space is higher here than in VITCs in Ningbo and Beijing.

While building density may be higher in Guangzhou's VITCs, the vertical extension of available living space in the form of multi-storey apartment buildings offers the population a higher per capita floor space than the old build-

Table 1: Aggregation of information on selected VITCs in Guangzhou (source: interviews with heads and/ or employees of economic collectives or key persons in the administration of the VITCs in 2006 and 2008, data for Shipai from Wu et al. (2007b, 293) and Lan (2005, 29), field observation).

Location	Inner City					Suburban area				
	III Linhe	III Shipai	(II)-III Xiadu	II Kengkou	(D)-II Dongjiao	I-(II) Wuyuanqiao	I-(II) Kuipeng	I Donglang	I Shalou	I Hainan
<b>Development stage</b>										
<b>Indicators/ VITC</b>										
<i>Villagers</i>	1,800	9,181 [1]	800	3,200	2,600 [2], 3,000 [3]	3,000	3,393	n.d.	2,000	5,800
<i>Migrants</i>	5,000	42,000 [1]	9,000	11-12,000	3,000 [2], 12-15,000 [3]	6,000	6-7,000	12,000	10,000	8-10,000
<i>% of migrants</i>	73.5	82.1 [1]	91.8	78.2	53.6 [2], 81.8 [3]	66.7	65.7	n.d.	83.3	60.8
<i>Area (km<sup>2</sup>)</i>	0.13	0.32	0.07	2.5	1.91	n.d.	1.57	1.7	0.45	4.5
<i>Amount of farmland left</i>	1	1	1	5	“several”	11	4	6	n.d.	12
<i>Share of multi-storey apartment buildings [6]</i>	very high	very high	high	middle	middle	low	low	low	low	low
<b>Economic specialisation of VITC</b>	none	services sector	none	light industry (DVD, cameras, stoves)	chemical industry, light industry (binoculars, cameras)	mainly horticulture, and related industries	textile industry, partly horticulture	heavy industry, agriculture	heavy industry, agriculture	textile industry, horticulture market, shopping center planned
<i>Employment sectors of migrants working within VITC</i>	services	services	services	mainly industrial	mainly industrial	horticulture industrial	mainly industrial	mainly industrial	mainly industrial	mainly industrial
<i>Revenue of collective (million RMB)</i>	n.d.	200 [1]	n.d.	30	32	14.6 + ?	20	“poor”	6.08 + ?	60 (only land rents) + ?
<i>Revenue share per villagers (RMB) [7]</i>	<1,000	n.d.	1-2,000, 3-4,000 [5]	8,000	4,800	n.d.	n.d.	n.d.	640	n.d.

n.d.: no data; [1] source: Lan (2005, 29), [2] source: Wu et al. (2007b, 293) [3], [4]: numbers differ according to years with low or high revenues; [6] estimates according to field observation; low: <25 %, middle: 25-50 %, high: 50-90 %, very high: >90 %; [7]: calculated through revenue village/ number of villagers, (bench mark: not all villagers receive revenues)



ing structures in Northern China. Moreover, housing units are larger in Guangzhou, though they are shared by a greater number of inhabitants. Hence, housing in Guangzhou's VITCs is less crowded than it is in VITCs in Northern China. However, other issues related to building density, e.g. lighting conditions, are worse in Guangzhou. In general, housing is considerably more crowded in VITCs than it is in other urban areas, which is evident from a comparison of the data obtained in VITCs with average values for China and for the city of Guangzhou.

The WHO housing-health indicator defines "housing units without a. safe and continuous water supply in the dwelling, and b. the exclusive use of a toilet, shower or bath, cooking facilities, and a fridge" as "inadequate household hygiene conditions" (WHO 2004, 30). The indicator takes into account the availability and quality of facilities. As the information obtained in field observations on issues associated with the quality of facilities (e.g. proper construction and maintenance) is very limited, the focus is on the availability of facilities, using the data collected in the household survey as a basis. 77.4 % of the sample had access to a private tap, which 44 % used as a source of drinking water. Of these 44 %, almost all (97.2 %) boiled the water before drinking it. The other main source of drinking water was bottled water. Wehrhahn et al. (2008) analysed the quality of tap water in Xincun village in Guangzhou and found significant contamination with coliform bacteria and ammonium, entailing health risks such as gastrointestinal diseases. A major problem in villages with underground sewers is the contamination of drinking water with waste water caused by the proximity of sewage pipes to water supply pipes. Water pipes sometimes even run through sewers. Leakages can cause infiltration of waste water and raw sewage into the water supply system, leading to the pollution of tap water.

In terms of access to sanitary facilities, the Guangzhou VITCs ranked much better than VITCs in Ningbo and Beijing (cf. Table 2). The great majority of the Guangzhou sample had access to private facilities. Of the migrants

surveyed, only 12.9 % reported using public toilets and 15.6 % stated that they used public bath and shower facilities. 14.3 % said they used toilets and 12.2 % that they used bath and shower facilities shared by several households. 6.8 % reported not having access to a shower or bath and therefore washed in their bedroom, compared to 55 % (mostly women) in Ningbo (Qi et al. 2007, 37). However, the percentage with access to private sanitary facilities in the VITCs is still much lower than the Guangzhou average (cf. Table 2). For two VITCs in Ningbo, Changfeng and Jinjiacao, Qi et al. (2007, 38) report that the great majority of the migrant population shares public latrines with a ratio of 54 households per latrine. Of the Guangzhou sample, 90.8 % reported access to flush toilets and only 8.1 % said they used latrines.

60.4 % of the migrant sample in Guangzhou declared that they had access to cooking facilities, of which very few reported a separate room for the kitchen. Thus, in terms of the percentage of households with private cooking facilities, migrants in Guangzhou and Ningbo ranked better compared to the Beijing migrant population, where most people used public cooking facilities. However, the quality of the cooking equipment was quite poor, and many people cooked in their bedrooms or living rooms. Very few migrants in both Guangzhou and Beijing had access to refrigerators and air conditioners.

The aggregated score of inadequate household hygiene conditions<sup>3</sup> is 204.8 for the Guangzhou sample for which figures for all necessary factors were available. The score was also calculated for the Beijing sample<sup>4</sup>, although one factor (access to private tap water) was absent. The score for the Beijing sample is 360.8. In order to compare the two scores, we excluded the factor "access to private tap water" for the Guangzhou sample, which led to a lower score of 182.4, showing a much better score than the Beijing sample.

A comparison of environmental health issues in different VITCs in Guangzhou shows that certain conditions deteriorate with increasing building density and thus with increasing

Table 2: Comparison of basic indicators of living conditions for China's urban and rural population, Guangzhou's urban population and the population of VITCs in Guangzhou, Ningbo and Beijing

Indicator	China urban population	China rural population	Guangzhou urban population	Guangzhou VITCs survey	Ningbo VITCs survey	Beijing VITCs survey
Year of data	2008 unless indicated otherwise	2008	2007	2008	2004	2008
Floor space: m <sup>2</sup> /capita	27.1 (2006)	32.4	20.0	11.4	6.8	8.2
Ø household size (persons)	2.9	4.0	3.1	4.2 (incl. dorms) 3.2 (excl. dorms)	2.5	n.d.
Access to private bathroom	n.d.	n.d.	99.0 %	72.3 % (toilets)	5.0 %, majority uses public latrines	4.2 %, majority uses public bathrooms
Access to private cooking facilities	n.d.	n.d.	n.d.	60.4 %	majority cooks in bedroom	8.1 %, majority cooks in public spaces
Access to private tap water	94.73 %	n.d.	97.74 %	77.4 %	n.d.	n.d.
Air conditioning units per 100 households; access to air conditioning	100.3 air conditioners (per 100 households)	9.8 air conditioners (per 100 households)	232.7 air conditioners (per 100 households)	15.2 %	n.d.	6.7 % (14 % heating)
Refrigerators per 100 households; access to refrigerators	93.6 refrigerators (per 100 households)	30.2 refrigerators (per 100 households)	103.0 refrigerators (per 100 households)	19.3 %	n.d.	22.6 %
Source	NBS (2009, pp. 319, 351, 376)	NBS (2009, pp. 337, 349, 351)	GMSB and GSONBS (2008, pp. 231, 240, 254)	Own survey 2008: sample size: 450 migrants in 4 VITC	Qi et al. (2007, p. 37): sample size: 506 migrants in 2 VITC	Zheng et al. (2009, pp. 434-435): sample size: 756 migrants in 50 VITC

proximity to the core areas of the city, where the high-density VITCs, Linhe and Shipai, as well as Xiadu and Xinfenhuang, are located. In these villages, the distance between buildings is often less than 30 centimeters. Alleys are on average 1 to 2.5 metres wide. Local air pollution is mainly caused by the numerous restaurants and, to a certain extent, also by street food vendors, who sometimes use charcoal as fuel. It is greatly aggravated by the lack of ventilation in the narrow alleys.

Between the buildings, which are on average five to six, and sometimes up to eight storeys tall, day turns into night, and lower-story apartments receive no daylight at all. This is aggravated by the fact that in these villages the first floor windows, and sometimes those in the next few floors above, are bricked up. Thus neither light and nor fresh air can reach the apartments on these floors. Only a small proportion of the migrants interviewed in the quantitative survey reported owning a functioning air conditioner, which generates at least

some air circulation (cf. Table 2). Due to the high levels of humidity in this part of Southeastern China, especially during the rainy season when alleys are often flooded for several days, apartments are damp. According to the WHO (2004, 26), indoor humidity can be conducive to the growth of fungal spores and household dust mites, both of which are known to be respiratory allergens. Furthermore, discomfort, skin conditions, and hypothermia can be caused by moist clothing and furnishings. If local villagers remain in the villages and stay in the houses on their *zhajidi*, they usually move to the upper floors. Thus it is mostly members of the migrant population who are affected by dark and damp living conditions. Of these, the poorer groups suffer most from such conditions, since they cannot afford the higher rents for apartments which are situated next to open spaces or on higher floors.

Most houses are connected to sewers. All inner city villages have covered sewers, but those located near the fringe have some open sewers. If covered, sewers are usually located beyond the alleys of the villages. A high degree of surface sealing combined with inadequate sewers running beyond the alleys cause rainwater to accumulate in the narrow streets in the rainy season. This often does not run off for several days or even weeks and is an ideal breeding ground for vectors.

The impact of local pollution caused by industrial compounds is dominant in VITCs located outside the city centre, the CBD and the areas surrounding them, since industrial land use is prohibited in these areas. Furthermore, very few open spaces remain in the high-density villages located closer to the core of the city. They are either used for recreational purposes – e.g. parks or playing fields, and sometimes also for temple areas – or they serve as a market place. Interviews revealed that use of the recreational areas is sometimes restricted to local villagers, excluding migrants from entering some of these areas. Thus migrants who already suffer from dark and crowded living conditions rarely have access to compensating spaces within the villages, which also excludes them from recreational activities.

With regard to safety issues, various problems appear when the high-density VITCs are compared with those located closer to the urban fringe. In villages located closer to the inner city, most of the safety issues are related to building and population density, such as the inaccessibility of the their narrow lanes for fire-engines. In the villages located at the urban fringe some streets are accessible for cars. Illegal tapping of electricity lines was found to be more common in the villages with a higher building and population density, with electricity lines sometimes hanging down into the narrow lanes.

#### *The migrant population's perception of the environmental health situation*

Interviewees were asked to rank their satisfaction with certain environmental features relating to health, e.g. density, cleanliness, waste management, air quality, lighting condition and noise levels. Satisfaction with 13 environmental factors in VITCs was surveyed, using a five-point scale (very satisfied to very dissatisfied). An overall scale was calculated by adding single scores for all items using Likert's (1977) technique for the measurement of attitudes. With an average score of 44.1 points (mean = 3.4 per item), interviewees had on average a medium to high level of satisfaction with environmental indicators. Overall, satisfaction with waste disposal was highest, and medium for security, sanitary facilities and cleanliness in the village, while poor air quality, density, and noise caused the greatest dissatisfaction among interviewees.

This result is not surprising as a high percentage of people in Chinese rural areas still do not have proper access to sanitation, private sanitary facilities, and sometimes also piped water. Thus VITCs rank better in this regard. Issues related to the high building and population density in the villages are new to the migrants and are therefore more often perceived as problematic. 35.3 % of the interviewees stated that they felt that the environmental and overall living conditions in their VITCs had a negative impact on their health and 29.1 % felt that this was true of housing conditions. When asked to compare housing

and environmental conditions in VITCs with the situation in their places of origin, 29.8 % of the sample perceived them to be at least somewhat, if not much better, 15.1 % stated that they were about the same, and 55.2 % said that they were somewhat or a lot worse.

Table 3 shows results for the interviewees' perception of selected environmental indicators in detail. In Shipai, which is one of the villages with the largest population in Guangzhou, density, lighting conditions, air quality, and noise rank much worse than the sample's average. Donglang also ranks worse than the average, with an especially low rating for air quality, which is probably due to the heavy industries located nearby. Xinfenghuang, which is located near Sun Yat-sen University and dominated by the services sector, and Kengkou, where the economic cooperative is comparatively prosperous and many high-tech firms are located, rank better.

*The influence of various actors on environmental health conditions in villages-in-the-city*

Various actors influence environmental health conditions in VITCs. The following analysis has two foci: firstly, the role of different actors in the organisation of supply and disposal systems and the management of hygiene issues as well as the effects of these measures and, secondly, actors'

roles in the development of land and building structures. The analysis concentrates on the role of local and municipal actors.

The municipal government's strategy with regard to the villages is equalled by the "villages-in-the-city transformation movement" (*chengzhongcun gaizao yundong*), which has been introduced in 138 VITCs. The programme comprises four steps (07/Guangzhou/42A/E): (1) the transformation of the rural *hukous* of the local village population into urban *hukous*, (2) the transformation of the village committees into residents' committees, i. e. transition from rural to urban administration<sup>5</sup>, (3) the transformation of collectively-owned land into municipally-owned land, and (4) the transformation of economic collectives into capital joint-stock companies, which distribute their revenues to shareholders (local villagers) according to the percentage of stock they own in the company.

The movement was planned to be completed in 2005, but actual achievements lagged behind the initially planned goals. In the villages considered in this paper (cf. Figure 1), steps 2 and 4 have been fully completed (step 2 at least on paper); step 1 has only partly been carried out. Step 2 in particular has major relevance for the issue of environmental health, as villages have been integrated into the urban administrative

Table 3: Comparison of inhabitants' satisfaction with selected environmental health factors (shown are the percentages of the surveyed population that were satisfied or very satisfied with the indicators, source: authors' survey 2008)

Village	Population & housing density	Noise	Light condition	Air quality	Clean- liness	Waste disposal	Sanitary facilities	Security
All (n <sup>^</sup> = 434)	34.9 %	40.4 %	52.3 %	35.4 %	56.0 %	70.9 %	54.3 %	58.7 %
Donglang (n <sup>^</sup> = 101)	32.3 %	35.6 %	57.7 %	26.0 %	52.9 %	72.1 %	54.0 %	49.1 %
Kengkou (n <sup>^</sup> = 112)	50.5 %	52.2 %	61.1 %	47.4 %	60.5 %	70.8 %	59.7 %	69.3 %
Shipai (n <sup>^</sup> = 120)	23.3 %	27.1 %	39.2 %	22.0 %	42.6 %	61.1 %	45.5 %	50.0 %
Xinfenghuang (n <sup>^</sup> = 101)	34.3 %	48.0 %	52.9 %	48.0 %	69.9 %	81.4 %	68.0 %	67.0 %

<sup>^</sup> Totals may vary because of missing values; *italic* values indicate satisfaction levels below one-third (33.3 %)

system through reforms of district boundaries and the incorporation of new districts into the city area. This implies that – at least officially – village management has been transferred from the village committees to the street level of the urban administration, which includes the tasks of organisation and maintenance of supply and disposal systems and the management of other hygiene issues. As a result, the power of the former village committees has been restricted and is now confined to managing the economic interests of the local villagers' community.

Interviews with representatives of these economic collectives revealed that administrative change can result in an improvement of waste disposal systems and their integration into the city infrastructure, i.e. converting open sewage canals into covered sewers and, in some cases, the connection of sewage systems and waste disposal systems to the city's infrastructure system. However, interviews showed that such measures often only bring short-term success, with the new systems rapidly becoming overstrained again. This can be due to a lack of consistent management and orientation towards official population figures instead of actual numbers, i.e. the unregistered migrant population is neglected when the infrastructure systems are established. Their share of the migrant population is estimated to be around 50 % (Taubmann 2002, 81).

There are major gaps in terms of the official transfer of management tasks from the former village committees to the street offices. The economic collectives often continue with some or all of their former management tasks. Kuipeng economic collective, for example, spends 3 % of its yearly revenues on cleaning services (08/ Kuipeng/104A/E/L). Likewise, in Xiadu, the collective looks after a lot of management issues that are officially the responsibility of the state agent but are not carried out properly (07/ Xiadu/38A/E/L). However, according to our findings, the involvement of the economic collectives in management tasks depends firstly on the revenues that the collectives bring in and, secondly on the willingness of the shareholders to allocate money for these tasks. Therefore not

all collectives take on management or maintenance tasks. For example, the village collectives of Shalou, Kengkou and Dongjiao report that they do not have enough revenue to improve hygiene, leading to a general deterioration of public facilities and infrastructure since the official administration has not allocated any funds for maintenance (08/ Shalou/108A/E/L, 08/ Kengkou/105A/E/L, 08/Dongjiao/106A/E/L).

One of the reasons for a lack of management is the malfunctioning of the collection system for the hygiene fee which is used to finance the management system. Officially, the system requires tenants to pay a hygiene fee to their landlords who then have to transfer this fee to the street office. However, the urban administration does not receive the hygiene fee from illegal migrants who officially do not live in the villages. Moreover, Ma (2008) has pointed out that in the VITCs in Shenzhen, collectives and landlords circumvent the management legislation and avoid paying the fees.

Organisational problems also affect the success of management tasks. One example is waste collection. Although 93.1 % of the migrants interviewed in the four VITCs reported that their waste was collected once to several times daily, we observed the following problems: (a) inhabitants either dispose of their waste directly on the street, from where it is collected without using any kind of container or (b) if dustbins are provided they are too small and overflow or (c) regardless of the existence of dustbins, inhabitants dispose of some of their waste in spots where it is not collected. As a result, litter accumulates in the streets and in the gaps between the houses, leading to an increase in the population of rats and stray dogs and cats, all of which feed from litter and increase the risk of mechanically spread zoonoses. Furthermore, the litter causes unpleasant smells. The negative effects of littering are aggravated in villages with high building and population densities. Our observations also show that as well as problems in the organisation of solid waste collection, a lack of public acceptance of waste disposal schemes is also a problem.



With regard to the second focus of the analysis – the development of land and building structures – some aspects were introduced in section 2 of this article. The development of the residential and commercial areas of the VITCs is dominated by migrants' demand for cheap housing, farmers' search for alternative income sources following the loss of their agricultural land, resulting in the replacement of farm houses with apartment buildings. Other development factors include the illegal extension of buildings and a general disregard of building guidelines as well as the dominance of the economic collectives' interest in accumulating profits for reinvestment in development projects and for the distribution of revenues to individual shareholders.

In the former agricultural areas, the economic collectives try to claim as much land as possible, while the municipal government's interest in using the areas of the villages to create new spaces for economic and residential development facilitates the activities of land developers. The distribution and development of land often take place independently of official urban regulations. In theory, while most former agricultural land has been bought by the municipal government, a certain share is allocated to each economic collective (on average 10%), which it may use or rent out (cf. chapter 2). Rents from the residential, commercial and industrial use of built-up areas that were collectively owned by the village committees before their integration into the urban administration and the allowance land are sources of income for the economic collectives. Since the economic collectives were transformed into joint-stock companies, a certain share of the revenues is distributed to those local villagers who hold stock. This leads to marked disparities in the amount of profits paid out to villagers (cf. Table 1).

While the economic collectives are obliged to adhere to building standards, including the proportion of public spaces and land-use allocation in accordance with the development plans, these guidelines are often ignored in the attempt to make a profit. For the same reason, some village collectives claimed land for development

beyond the 10% allowance. The profits of each individual economic collective depend on the amount of collective land which the village managed to keep when the agricultural land was bought by the government and on the success of the collective's development strategies as well as its commitment to these strategies.

Interviews with representatives of the village collectives located at the urban fringe and in the built-up urban areas around the city core show that village collectives try to take a very active role in land development, hoping to attract large investment projects. Some are very successful, e.g. the collective of Kengkou village which makes high profits from developing areas for light industry and is currently planning to build a second industrial park (08/Kengkou/105A/E/L). In Hainan village, where textile factories, market gardens, a printing works and a large car dealer have been established, the village collective allocated land for the construction of a new shopping centre and there are plans to redevelop old factory sites for new commercial and industrial uses (08/Hainan/109A/E/L). Other collectives are less successful, e.g. in Kuipeng village, where the collective decided to develop horticulture in addition to the textile industry, which are less profitable (08/Kuipeng/104A/E/L). In Shalou village, which is still dominated by farming activities and has very small revenues from renting land to factories, the collective shareholders prefer to keep their small revenues instead of reinvesting them (08/Shalou/108A/E/L).

Although some representatives of economic collectives have expressed concern about environmental issues related to development projects, these concerns are generally disregarded when it comes to implementation, because economic development is the collectives' primary interest. For example, at the time of the interviews the economic collective in Kengkou village was debating with the urban planning administration about the allocation of the last pieces of land left for development. The head of the collective claimed that an area of fallow land that was originally farmland was highly polluted, making it an ideal place to establish the village's

second industrial park (08/Kengkou/105A/E/L). Especially high pollution levels were cited in Donglang and Shalou villages, due to the nearby iron and steel factory as well as a shipyard (08/Donglang/107A/E/L; 08/Shalou/108A/E/L). The only collective which was planning to take steps towards improving the environmental situation at the time of the interviews was the Dongjiao village collective, with plans to implement environmental protection guidelines for the reconstruction of an industrial park (08/Dongjiao/106A/E/L).

Most former agricultural land is bought by municipal governments. The lease of land-use rights is administered by local officials. The transfer of land-use rights requires the payment of a fee that is increasingly determined in auctions and is usually much higher than the compensation payments to the collectives. Economic and governance reforms have increasingly encouraged local officials to use their position as land developers to foster economic development and to obtain additional earnings to compensate for the overstrained municipal treasuries; industrial uses are often regarded as most favourable for economic growth, while environmental considerations are mostly secondary (this issue has been discussed in detail by Lichtenberg/Ding 2009). The economic collectives have voiced the criticism that the activities of land developers violate municipal development plans, and sometimes even parts of the allowance land are appropriated by land developers for the construction of factories (08/Wuyanqiao/103A/E/L, 08/Kengkou/105A/E/L).

#### *6 Discussion: environmental health in villages-in-the-city*

According to Taubmann (2002, 85), “crowding, inadequate infrastructure or poor living conditions seem to be even more severe” in Guangzhou compared to northern Chinese VITCs. However, in the light of the findings presented here, this statement has to be reassessed. Our findings underline the poor living

conditions in Guangzhou’s VITCs. Nevertheless, in terms of infrastructure the picture is more diverse. In Guangzhou’s VITCs access to sanitary facilities, cooking facilities and tap water is better, and per capita living space is larger. Crowding, measured by floor space per capita, is an even more severe problem in the northern Chinese examples. However, despite inter-urban differences the migrant population is generally disadvantaged in terms of environmental issues and living conditions when compared to average urban conditions for Guangzhou and China.

It appears that the following factors have a substantial influence on the overall environmental conditions in the villages: density, economic structure, commitment of the street offices and the wealth of the economic collectives. Some conditions generally tend to deteriorate with increasing building density, e.g. living conditions, light and ventilation/dampness. Furthermore, perceived crowding is higher in high-density villages, as has been shown in the migrant survey. In terms of economic structure, health risks caused by air pollution are more prevalent in villages with industry, especially those with polluting heavy industries. The state of public hygiene infrastructure depends on the quality of management and maintenance, e.g. waste disposal management and the condition of sewage channels.

This study has shown that the condition of public hygiene infrastructure depends, firstly, on the level of street offices’ commitment to fulfil their tasks, which in many cases is not high, and secondly, – depending on this commitment – whether the economic collectives informally take over management tasks. The extent to which collectives are able to invest in these fields depends a lot on the profits they make and the willingness of the shareholders to reinvest this money for the improvement and maintenance of public hygiene infrastructure. The role that economic collectives play in managing hygiene issues in some positive examples shows that these grass-roots organisations are highly flexible and that they have sufficient resources to take on management issues. Our findings sug-

gest that a transfer of management tasks back to the economic collectives under the supervision of the urban administration is advisable. As a precondition they should also receive the fees collected for these tasks.

While the scientific literature (Siu 2007, Deng/Huang 2004) has suggested that environmental health conditions are worst in the VITCs with the highest densities, which are located near the inner city areas, our investigations indicate that the reality is more complex. As industrial plants are prohibited in Guangzhou city centre, local air quality seems to be worse in VITCs closer to the urban fringe. Furthermore, administrative integration into the city at some point usually leads to the improvement of disposal systems. However, in some interviews it was suggested that improvements in infrastructure and management had had only short-term effects since official population numbers served as the basis for planning, and in most cases, the actual population, including the unregistered migrants, was much higher than official figures suggested.

Some simplified characteristics of VITCs and related environmental health factors are shown in Table 4. Three types of villages can be distinguished, according to three development stages on the basis of which ten VITCs were classified (shown in Table 1).

The findings question the extent to which Guangzhou's strategy of transforming the VITCs is in fact a viable solution under current conditions, since there is no alternative living space for migrants, local villagers lack alternative income sources, and tearing down and reconstructing the recently built residential houses would be very costly. Song et al. (2008) even fear that if residential buildings are demolished in VITCs they might be replaced by illegal, sub-standard housing units, which would result in a severely worsened sanitary situation, obstructing access to water etc. for the population concerned. In addition, the campaigns only target the 138 VITCs officially recognised by the municipal government and neglect all other villages. Furthermore a series of campaigns has been launched by the municipal government in recent years to improve

living conditions as well as the hygiene and sanitation situation in VITCs, now showing the first positive results. However, as the campaigns include measures such as the displacement of street vendors, new problems are created in other parts of the city. All measures implemented so far tend to ignore the causes of the developments described above.

In order to improve environmental health in the short term, waste collection has to be organised more effectively, information campaigns aimed at changing the population's waste disposal behaviour should be implemented, and sewage channels must be renewed and adapted to actual population numbers. In those villages which are just beginning to become VITCs, socially and economically sustainable development alternatives should be found which respect villagers' dependence on income from rents and migrants' need of affordable housing. For example, a certain share of the available land intended for development could be allocated for the construction of housing units for the migrant population, and this housing should be in accordance with urban building guidelines (e.g. in terms of building height, floor area ratios, width of corridors, distance between buildings, existence of stairways and exits).

Migrants, who are already facing higher health risks (cf. Bork et al. 2010), are much more exposed to dark, damp and crowded living conditions than the local village population. In the interviews conducted in the course of our fieldwork, migrant workers also indicated that the local living environment increasingly plays a role in migrants' choice of a specific migration destination. Since migrants are a main force of regional development (cf. section 1), local governments and employers in the PRD now face the challenge of keeping and attracting more migrants in order to counteract the emerging shortage of migrant labour and growing global competition, even between Chinese cities.

Table 4: Classification of VITCs according to basic characteristics and resulting environmental health factors

Develop- ment stage	Locality	Characteristic features of VITC		Environmental health factors	
III	New “CBD” and fringe of old city centre	Tianhe district around the new devel- opment axis and CBD and fringe of the old city center in Liwan and Yuexiu dis- tricts	<i>Agricultural land</i>	No land left	– Very high building and population density (also due to higher rents)
		<i>Share of multi- storey apart- ment buildings</i>	Very high (~ 90-100 %)	– Worst living conditions – Worst safety conditions due to high build- ing densities, illegal tapping of electricity lines etc.	
		<i>Economic structure: dominance of</i>	Services sector	– Only isolated open spaces, access some- times restricted to local <i>hukou</i> population – Growing deterioration of disposal sys- tems (sewage and waste) with increasing population – Air pollution caused by traffic rather than industry	
II	City area	Built-up area of Liwan, Tianhe, Bai- yun and Haizhu districts	<i>Agricultural land</i>	Residual land left	– High population and building densities – Growing deterioration of sewage waste disposal systems with increasing popula- tion, but possibly short-term improve- ments through management changes
			<i>Share of multi- storey apart- ment buildings</i>	Majority (~ > 50- 90 %)	– Several open spaces
			<i>Economic structure: dominance of</i>	Industrial & services sec- tors	– Higher levels of local air pollution through nearby industrial plants than in stage III
I	Urban fringe	Fringe of Tianhe, Liwan and Haizhu districts, most parts of Baiyun district and the whole Panyu district	<i>Agricultural land</i>	Some land left	– Medium population and building densi- ties
			<i>Share of multi- storey apart- ment buildings</i>	Parts (~ < 50 %)	– Possibly significant improvement of sewage (through connection to urban underground disposal system) and waste disposal systems after mandating admin- istration to city
			<i>Economic structure: dominance of</i>	Industrial & agricultural sectors	– Higher local air pollution through nearby industrial plants than in stage III – A lot of open spaces

### 7 Conclusion

The findings presented here show that the environmental health situation in VITCs reflects the complex interplay between diverse forces and actors. These include the global economy as a driver of economic development, the municipal administration which follows the strategy of redeveloping and reconstructing VITCs in the context of broader intra- and inter-regional and transnational competition, and diverse layers

of local interests. Of special importance at the local level are the village community organisations, which show surprising social coherence and persistence under marketised conditions. Furthermore, selective interests of urban administration units at lower levels, land developers and individual local villagers play a role in the development of the settlements and therefore in their environmental situation. This shows how gaps in official systems result in flexible and effective local self-administration. However,

at the same time it makes clear that the urban administration must increase its influence in order to implement (better) environmental health standards as this is not a primary interest of the other local players, for the most part.

The specific environmental health situation is different in each village, depending on its location in the city, its building and population density and its economic structure. In the short term, new guidelines which target the emerging VITCs at the urban fringe – where intervention is still possible – should be developed, with the goal of directing construction and the development of physical infrastructure along an ecologically and socially more sustainable path. Without affordable housing alternatives for the migrant population, the demolition of residential buildings in the consolidated VITCs can only lead to a spatial relocation of housing units and related environmental health problems within the city and its periphery.

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- 1 Interviews conducted during our own fieldwork are indicated by a code with the following sequence: year (e.g. "09"), location (mostly the name of a VITC), the number in our interview list and the status of the interviewee (A = administration, E = expert status of the interviewee, L = local villager, M = migrant). "08/Kengkou/105A/E/L" means that this interview was conducted in 2008 with a local villager in Kengkou who is a representative of an administrative unit, and that the information is classified as expert information.
- 2 Some of the data was obtained within the framework of the research project "Informal migrant communities and health strategies in villages-in-the-city of Pearl River Delta/China" funded by the German Research Council as part of the Priority Programme SPP 1233 "Megacities – Megachallenge: Informal Dynamics of Global Change".
- 3 The score is computed as follows:  $((WS + T + SB + CF + F) / PD) * 100$  with WS = number of dwellings/ people living in dwellings without water supply, T = number of dwellings/ people living in dwellings without toilet, SB = number of dwellings/ people living in dwellings without shower/bath, CF = number of dwellings/ people living in dwellings without cooking facilities, F = number of dwellings/ people living in dwellings without fridge, PD = total number of dwellings/ total residential population (WHO 2004: 31). As too many measures were missing for the other population groups compared and as the total population of each of the scores from the Statistical Yearbooks varies and/or is unavailable, the aggregated score could not be calculated for these groups. The higher the score, the worse the household hygiene conditions.
- 4 As access to toilets and shower/bath were not differentiated in the Beijing sample, the figure for access to private bathrooms was used and included twice instead, which should give an approximate value.
- 5 The basis of the hierarchical administrative system in rural areas is the village population clustered in village committees at the local level of self-administration. This is subordinate to the township and county. The urban population with an urban local *hukou* is subsumed in residents' committees at the local level of self-administration; the committees are subordinate to the street office, the district and the city administration.