THE SUSTAINABILITY OF TOILETS IN HANOI, VIETNAM

Sasha Fink
School of Economics and Finance
Curtin University of Technology

Abstract

Sustainable development must utilize the social infrastructure already in place. Community groups and organizations already present in Hanoi, Vietnam, should play a major role in developing sanitation infrastructure.

In Ancient Chinese the words Ha and Noi mean 'contained by rivers', so with 1.6 million people living on a former rice paddy, water drainage and wastewater disposal are major problems. This paper explores the situation for toilets, septic tanks, sewage and drainage. This paper proves that a large proportion of human waste in Hanoi goes directly to the waterways untreated. Compounding this problem is the inadequacy of joint sewage/drainage pipelines, resulting in the spillover of untreated waste into the streets and onto the footpaths during heavy rain.

A significant component of the research was in-depth interviews conducted in 41 households. Survey answers revealed that most people were concerned about pollution in their area from the septic/sewage system, and many people were actively involved in improving the situation in and around their house.

The Situation in Hanoi

The French colonial power installed the original joint sewage/drainage pipelines in Hanoi 50 years ago, but they did so for 400,000 people. There are now at least 1.6 million people living in central Hanoi and they are still using the same pipelines, which crumbling and in serious need of repair. Almost all wastewater goes into a combined system of storm water and wastewater.

International Journal of Economic Development,
3(3), 2001.

Infrastructure provision and maintenance in Vietnam are still centrally controlled and supply based. Government revenue is well below that of other countries with similar income levels, hence the limited provision of sanitation infrastructure and services.

Table 1
Vietnam sanitation and clean water for Ho Chi Minh City, Haiphong and Hanoi

Indicator	HCMC	Haiphong	Hanoi
Total Untreated Waste Discharge (million cu/m/yr)	240-300	70	120
Population Serviced with Sewage systems (percent)	60	20-35	20-35
Sewage Treated (percent)	0	0	0
WHO Drinking Water Quality Standards Met for Piped Water	yes	no	no
Solid Waste Collected (percent)	80	70	<50
Number of Motorized Vehicles	775,000	235,000	420,000

Source: International Development Research Centre (July 1995) "Vietnam National Environmental Action Plan"

The Existing Sewage System in Hanoi City

Hanoi City is located in the Red River delta, the terrain is flat and there are five rivers and around 111 lakes and ponds within the city. Wastewater is conveyed through a joint drainage and sewage system, most of which was constructed before 1954, to the water bodies throughout the city. This waste is not treated, and since the hydraulic gradient of the sewers is small the sewers are prone to heavy silting. As a result there is also serious pollution in the city's many lakes, ponds and rivers and the city is prone to flooding.

The only proper septic tanks in Hanoi are those that were installed more than 50 years ago by the French colonialists. These are the full septic tank systems with two or three tanks, a filtration system and an auto purification process for wastewater to be

discharged into the sewage pipelines. These were only installed for rich French colonialist families.

In most cases individual toilets are connected to the sewage system and the waste is usually discharged via a retaining chamber, septic tank or similar styles of pit (bomb shelters not excluded). The distinction therefore between septic and sewage is ambiguous. All liquid waste, that is, human waste products, grey water, hospital waste, industrial waste, flood water and any other liquid waste, go to the same pipelines, which lead to the Kim Nguu and To Lich rivers (interview with Project Officer, Sanitation WATSAN Programme, UNICEF, Hanoi, 7 July 1999).

Cost Recovery for Sanitation Infrastructure

As in many developing cities there is a scarcity of capital for investment in urban infrastructure in Hanoi. Investment in infrastructure in Hanoi is also below that of other cities with similar demographics. Refer to table 3 for a comparison of capital investment in waste and water connections in Hanoi to other cities of similar population sizes, wealth and circumstances.

Table 2
Sanitation demographics

Country	City	Pop/n (000s)	Inc per cap. (1993 est.)	Water connec/n (%)	Waste water connec/n (%)
Sri Lanka	Colombo	4,390	1036	64	60
Vietnam	Hanoi	1,100	695	80	40
Peru	Callao	1,100	673	70	69
Brazil	Curitiba	1,300	2400	96	75

Source: World Bank report, The Tale of Two Cities, 1999, p. 47.

A Japanese sewage and drainage project underway in Hanoi has been establishing a sewage levy-based system. In 1995 the average operation and maintenance cost for centralised treatment plants was estimated at 5,934,000 USD per year. The sewage levy should at least partially secure finances for the operation and maintenance costs.

Household Sanitation in Hanoi: Household Interviews

Methodological approach

In-depth household interviews were conducted to obtain information about the demographics, housing and sanitation situation, and residents' perceptions of these. These interviews were conducted in 41 households between 11 July and 11 August 1999. The survey was divided into three sections, personal information, housing, and toilets and waste disposal. The third section was the most involved part of the survey, with a range of open-ended and probing questions. Households were randomly selected from a broad range of income and education levels.

The demographics of the survey sample typified Hanoi City. The average household size was 4.1 people, with two generations in most households and three generations in two fifths of the households. Interviewees ranged from 16 to 66 years of age.

Interview results

Septic Tanks

Half of the households interviewed had a septic tank that they did not share with other neighbours, while the remaining households that had toilets shared a septic tank.

Several cases of inadequate septic tanks were found at the houses of interviewees. One of the worst septic tanks, and the families living conditions was Anh's family. To enter Anh's house one must crawl over a large stack of wooden planks. Anh is a carpenter, living and working in an old limestone brick house in central Hanoi. His house was built before the current roads and wastewater drains were constructed, consequently the floors are lower than the road and any rains flood directly into his musty smelling, windowless

workshop. He has built barriers across the bottom of the doorways but in heavy rains he has some tiles that he takes out of his workshop floor to allow the dirty water to drain out.

Anh says he wants to build a new toilet because the septic tank is actually an old bomb shelter that they connected to the sewage pipelines ten years ago. He knows that the toilet is not hygienic and he often needs to pour chemicals into the toilet to breakdown the waste in the septic tank, as it is too small.

Septic Waste Removal

One of the best ways to significantly reduce the level of pollution from septic waste in Hanoi is to empty the septic tanks regularly, and dispose of the raw sludge properly. There is enormous potential for sludge to be treated (buried underground for three months) and then sold as fertiliser in rural Vietnam. Instead the household interviews found that almost 50 percent of respondents did not know how their septic tank was emptied, if they needed to do this, or how they would go about it. Less than 20 percent of respondents had URENCO or a small private company come and clean out their septic tank. (URENCO commonly takes the waste to a rubbish ground, close to where people live and scavenge through rubbish, rather than recycling it.)

Just over 20 percent of respondents were using bio-powder and considered this to be a modern approach and effective to sewage disposal, although it is relatively expensive (20-30,000 Vietnam Dong per treatment). Bio-powder is a new product in Vietnam, it is marketed as a low cost alternative to pumping out septic tanks or cleaning out pipelines. It is constituted of biological products such as cellulite, pectin, protein, flour and lipids that digest the organic waste blocking the sewage system, breaking it down and allowing it to be flushed through into the joint sewage/drainage pipelines with a large amount of water.

There is little awareness about how a septic system should be emptied and the environmental impacts. It is becoming increasingly popular to flush the system out with bio-powder, the side effects of which are not researched and not understood.

Householders Views on their Wastewater Disposal Systems and

other Infrastructure

Almost 60 percent of households interviewed in the present study said that they experienced choked up sewage pipelines that affected their everyday living. Over 70 percent of interviewees said there was a bad smell and pollution in their area at some time during the year.

In the general questions where comments and suggestions were requested, more than half the respondents stated that the sewage/drainage system should be larger and blockages should not occur. One third of respondents wanted an increase in the angle between the road and the drainage/sewage and improved access to sewage pipelines. Several interviewees said they felt that the human waste should just be closed off and away from the population and more than 10 percent wanted waste to be treated and filtered so it would not have a negative impact on the environment.

Householders Willingness to Improve their Situation

At the end of the interview respondents were asked to indicate how much they would be willing to pay to upgrade and maintain their wastewater removal system. The purpose of this question was to gather if householders had considered it possible to have some input into upgrades to their sewage system. None of the interviewees said they were not willing to pay to upgrade and maintain their wastewater removal system. Less than half the respondents (46 percent) could estimate an amount that they were willing to pay, most of these householders said it was up to the people to decide together. The remaining respondents said that the people (24 percent), the State (7 percent) or the State and the people (20 percent) should decide how much to pay to improve the sewage system (one person did not know). This shows that there is considerable reliance on collective action for decision making and many people do not feel it is within their power as individuals to change their sanitation situation.

Several respondents talked about how they attended regular meetings with their neighbours, to discuss housing problems, many of which were sanitation related, and the possible solutions. In some cases the groups of householders would write letters to lobby the government to change the situation, in other cases they would

nominate a group leader and combine their resources (money and time) to bring about a change, or maintain their local infrastructure. An example was a formal household group in Thanh Xuan district, with a group leader and deputy group leader, who all contributed a set amount to pave the laneway they lived on. When septic tanks were shared, householders often nominated a volunteer resident to manage the maintenance and they contributed regular payments for that maintenance.

Summary of the Problems with Sanitation in Hanoi

Clearly more revenue needs to be raised and allocated to sewage, drainage and wastewater treatment in Hanoi. More government revenue would mean more capital could be invested in infrastructure maintenance and operation, or upgrades if funds are sufficient. This raises issues of governance in Vietnamese cities, as at present authorities are unable to regulate income and tax collection well enough to raise a level of revenue proportionate to the level of income. By the same token, in Vietnam's cities, governments are able to plan but are not yet able to enforce policies or protect the environment. Local, provincial and State governments still plan infrastructure provision and maintenance depending on projected availability of supply, demand is not yet recognised or included in these plans (Campbell 1999: p.29).

In most developed countries taxation revenue funds sewage pipeline systems and local taxes pay for the services. In Vietnam, as in many developing countries, most taxes are collected nationally as it is too costly to decentralise tax collection and it affords the national governments of these countries more control over the fiscal affairs of the country (Ostrom, Schroeder and Wynne 1993: p.51). The cost of collecting income, sales and property taxes is also very high in developing countries, often rendering them nonviable, so larger scale tax revenue is primarily collected, from sources such as import taxes (Ostrom, Schroeder and Wynne 1993: p.51).

Only in the long term is it feasible that the taxation system could be renewed and taxation revenue could support the construction and maintenance of sewage and drainage infrastructure.

Possible Solutions to the Sanitation Problem in Hanoi

Emission Charges

Emission charges are a way of reducing negative externalities by employing the market to achieve efficiency. It is feasible to impose emission charges in Hanoi in the form of a sewage surcharge on water use and donor efforts to this end are already underway. Japanese ODA has outlined ways in which revenue for sewage upgrades and maintenance can be raised through the sewage levy on water consumption (JICA 1995: pp.57-58).

For this to be effective the administrative capacity of the providers of water must be strengthened so they have the power to enforce payment for water use. This would require that water provision could be sanctioned if people do not pay and that all houses are installed with good quality water metres. For sewage levy collection to be sufficient, it is also required that all water supply organisations are transparent, so profits cannot be filtered out of them. There should also be measures to ensure that the full sewage surcharge component of the water charge is directed to the sewage surcharge.

These measures assume that institutional changes can be made to the organizations providing sanitation infrastructure, rather than utilising the social infrastructure already in place.

Utilising Social Infrastructure in Hanoi

Septic treatment in Hanoi takes place essentially in the householder's individual septic tanks before the waste is discharged into the joint sewage, drainage pipelines. The issue is how to ensure that wastewater is treated well enough in order to not be harmful to people or the environment. This is where the social infrastructure that is already present can be utilised to ensure that septic tank wastewater treatment is effective in the short and long-term.

In Hanoi groups of households form together because of individuals' desires to improve the standard of living in their local areas. Transactions that take place could be the hiring of the local labourers to collect the night soil from public toilets for a particular housing group (often the labourers are friends or relatives of the

residents in the housing group); or the friend or relative who plans out the construction of a new shared septic tank for a particular housing group.

The social norms are usually more important than laws for these housing groups (Ensminger 1992: p. 18). If it is socially unacceptable to construct a toilet that flushes waste into the kitchen sink of the residents living below, and if these social norms are validated by the government and people are allowed to voice the social opinions, then this is likely to be a more effective way of preventing such actions than using a police force.

The problem is specific to each distinct local area, in that the situation in one block of apartments may be entirely different to that in a street of houses next to the apartment block. It is recommended that these problems could be solved by taking advantage of the social infrastructure already present in the lanes, streets and sub-districts of Hanoi. In the household survey it was found that many small areas, particularly those areas with poorer sanitation or more environmental problems, had already formed a “group” and had a “group leader”, a “deputy group leader” and had organised regular meetings to discuss problems and find solutions. Solutions may involve the households grouping together to pay for a new laneway to be paved or, as was the case with a group of houses in Thanh Xuan district, a new septic tank to be constructed.

There should be a system of coproduction whereby the groups of householders are recognised as local authorities and are encouraged to produce their own sanitation infrastructure and services. The groups that householders have already formed to find ways to help themselves should be formalised. This will not only validate the initiatives they have already taken, thereby personally empowering them, but it could also be a low cost method of governance.

Suggestions for ‘Sanitation Co-operatives’

As Clague (1997: p.35) stated, collective action is most likely when a group of people have a common interest and are willing to act together to achieve that interest because they stand to gain significantly from doing so. “Groups are more likely to form when the number of individuals concerned is small, when they interact frequently and can communicate easily with one another, and when

they share common values and beliefs" (Clague 1997: p.36). There is now ample evidence to suggest that institutions (such as those providing health, irrigation or infrastructure) in developing countries function better and ultimately are used by more people if the local people had a role in planning, design and management, and if the operations of the institution are inherently linked with other local operations (Altaf 1993, Whittington 1993, Briscoe et al 1990, Cairncross, 1992, Ostrom 1997, and Ostrom, Schroeder and Wynne 1993).

There have been many examples, in Vietnam and other developing countries, of government or donor intervention to achieve productive forms of collective action. Effective intervention or guidance requires a deep understanding of the social infrastructure and of the sophistication of practices already in place.

There is already a model of collective action in rural Vietnam. New-style co-operatives were introduced in Vietnam from 1996 onwards, prior to this the entire country had been encouraged to form many communist style co-operatives. The credibility of the old-style co-operatives was largely undermined as they were poorly managed and members were given few incentives to improve the performance of their co-operative under the command economy (CECARDE 1998: p.5).

Since 1996 there have been a number of successful new-style co-operatives, many of which were guided by non-governmental organisations (NGOs) such as the Konrad Ardeneur Foundation (KAS) and the Centre for Consultation on Investment in Rural and Agricultural Development (CECARDE). Successful co-operatives have strong management, voluntary members who willingly pay their fees to support the co-operative and they successfully improve the standard of living of their members, by providing them with access to different varieties of rice seedlings, irrigation, or farming machinery. The reason why the co-operatives help people improve their situation is because it affords them more economies of scale than if they operated as individual households or farms.

This same co-operative model that operates in areas of production throughout Vietnam could be applied to the sanitation situation in the cities. This paper argues that urban 'sanitation co-operatives' would reinforce the social infrastructure already present

and furthermore, it could be used to improve the sanitation situation in Hanoi.

The 'Sanitation Co-Operative'

In many cases, householders gather together for regular meetings to discuss matters such as constructing a communal septic tank if the households cannot connect to a public sewage pipeline because their land lies too low, or regulating the construction of toilets or washing of floors if it causes leakages in apartment blocks. In many areas small groups have formed, with group leaders, marked out boundaries and group meetings.

The first step that could be taken to form 'sanitation co-operatives' is the formation of a group of households, from the same area, with similar housing and sanitation problems, management appointed and a regular payment structure established. Householders should be encouraged to join through improved awareness about how they can benefit from collective action for improved sanitation. All 'sanitation co-operative' membership should be voluntary and the group structure should be determined by members to ensure that it suits their custom.

Sanitation co-operative formation could be facilitated by an international donor, such as JICA, or it could be designated to an international NGO and guided by the appropriate government ministries and departments. At first, only a few co-operatives would be pilot tested, the eventual goal would be to include as many residents as possible in a co-operative, and to establish many co-operatives all over the city. The formation of the co-operatives should be constrained within local government boundaries, the idea being that eventually local government will take over at least part of the role of the co-operatives. This method of intervention in collective action has been effective in a number of cases for KAS and CECARDE, examples include the sugar cane co-operative in Thanh Hoa province and tourism co-operatives in Binh Thuan province (CECARDE 1998: p.12).

'Sanitation co-operatives' could initially address issues such as the provision of toilets and septic tanks for all householders. Some septic tanks could be shared between a number of houses to take advantage of economies of scale. In the cases where people cannot afford these because they lack sufficient employment opportunities,

the author suggests that the sanitation co-operatives could assist in creating jobs such as, septic tank emptying and the cleaning of joint sewage/drainage pipelines. These are services that are demanded by the residents in the survey, there is evidence that URENCO does not have the resources to fill the demand. All of the participants in the household interview stated that they were willing to pay for such improvements (except one who did not know), and that it was up to 'the people' to make decisions about these improvements.

When the 'sanitation co-operatives' are better established they could reach into areas such as improving awareness about solid waste disposal so that the joint sewage and drainage pipelines are not choked up as frequently. Concern about this issue was voiced many times during the interviews. Some of the residents in areas with more specific problems, such as the illegal building of toilets, could use the co-operative to encourage better practices, such as the sanctioning of services to offenders. Awareness about ways to use septic tanks in order to minimise environmental impact (as a vessel for treatment, filtration and purification of wastewater) could then be a feature of the 'sanitation co-operatives', under the guidance of the international donor or NGO. This is important, because it would ultimately result in reduced environmental pollution in the streets and waterways and a more sanitary living environment.

A limitation to the formation of 'sanitation-co-operatives' in Hanoi is that people living in the city have less time to devote to this activity than do those in the rural areas. This limitation could be overcome if people are convinced that their investment of time will substantially improve their quality of life.

Another obstacle preventing people from upgrading their local sanitation system in Hanoi is the relative immaturity of the present system of house and land ownership. (People have only been able to own or transfer their land since the Land Law was introduced in 1993 and amendments were made in 1997.) There is still a significant amount of uncertainty as to who is responsible for which infrastructure upgrades. Approximately half of the interviewees still claimed that it was the government's responsibility to upgrade their septic/sewage system, and some even believed it was the State's responsibility to upgrade the household toilet. In cases where houses are still being rented from the State this perception is highly relevant.

It is suggested that an essential component of the formation of 'sanitation co-operatives' is an awareness programme. This could help people understand the ways they would benefit from upgrades to their sanitation infrastructure and services, and moreover, ways in which they are able to act collectively to initiate this. Any awareness programme should compliment JICA plans to improve awareness about waste disposal. There should also be an investigation into affordable sanitation, that is, sanitation that is low-cost and will function well with little extra cost for a long period of time. In some cases training may be required to show people better ways to maintain their sanitation systems.

Conclusion

The most important findings of this paper were that it is possible to improve the sanitation infrastructure in Hanoi, by utilizing the social structures already in place. A series of household interviews revealed that most householders were concerned with the pollution emitted from poor septic and sewage systems, and the compounding effect of floodwater. All householders interviewed were willing to participate to help improve the sanitation situation in their area.

The major problem is that the discharge of untreated wastewater into rivers, lakes and ponds poses the threat of environmental disaster in both the waterways and the streets of Hanoi. This environmental problem affects the lives of all who live in Hanoi and must endure the smells and sights of the untreated wastewater.

The primary objectives for improvement in the sanitation situation in Hanoi should be firstly, that all residents have access to toilets with septic tanks. The second objective should be that all septic tanks in Hanoi are properly maintained. This requires that the solid waste is regularly removed from the septic tanks and disposed of hygienically.

In order to reach these objectives the present social infrastructure should be reinforced and people encouraged to join 'sanitation co-operatives', accompanied by an awareness programme to improve knowledge about the benefits of collective action and the

need to improve the sanitation situation. The emphasis should be on user participation and identifying and strengthening the social infrastructure and institutions already in place.

References

Achour, Dominique 1998, 'Market Liberalisation and Local Finance', Managing Economic Liberalisation in South Asia: Directions for the 21st Century edited by C. Jayachandran, N. Balasubramanian, S.M. Dastagir, Macmillan, New Delhi, India.

Altaf, M.A. 1994 'Household demand for improved water and sanitation in a large secondary city: findings from a study in Gujranwala, Pakistan', Habitat International, 18(1), pp. 45-55.

Altaf, M.A. et al. 1993 'Rethinking rural water supply policy in the Punjab, Pakistan', Water Resources Research, 29(7), pp. 1943-1954.

Asian Development Bank 1997, Key Indicators of Developing Asian and Pacific Countries 1997, Volume XXVIII, Economics and Development Resource Center (Asian Development Bank), Oxford University Press, Manila Philippines.

Bender, B., Gronberg, T.J. & Hwang, H. S. 1980, 'Choice of Functional Form and the Demand for Air Quality', Review of Economics and Statistics Vol. 62, pp. 638-643.

Blaug, Mark 1992, The Methodology of Economics or How Economists Explain, Cambridge University Press, Cambridge.

Bird, R. 1994, 'Threading the Fiscal Labyrinth: Some Issues in Fiscal Decentralization', National Tax Journal, pp 207-226.

Bohm, R.A. & Essenburg, T.J. & Fox, W.F. 1993, 'Sustainability of Potable Water Services in the Philippines', Water Resources Research, 29(7), pp. 1955-1964.

Briscoe, J. et al. 1990, 'Towards Equitable and Sustainable Rural Water Supplies: A Contingent Valuation Study in Brazil', World Bank Economic Review, 4(2), pp. 115-134.

Cairncross S. 1992, 'Sanitation and Water Supply: Practical Lessons

from the Decade', UNDP-World Bank Water and Sanitation Programme, Hanoi, Vietnam.

Campbell, Tim 1999, 'A Tale of Two Cities in Vietnam: Towards a Strategy for Growth, Poverty and Environment in the Cities and Regions of Vietnam', World Bank, Hanoi, Vietnam.

Canadian International Development Agency 1993 report Q061, January 1993 (unpublished document).

'Capital Drainage System on Course' 1999, Vietnam News 25/11/99, p.2.

Carl Bro International a/s and Crone & Koch VKI 1998, 'National Rural Water Supply and Sanitation Strategy: Action Plan Implementation 2000-2005' final report, Vol. 3, Hanoi, Vietnam.

CECARDE (The Center for Consultation on Investment in Rural and Agricultural Development), 1998, 'International Conference of Co-operatives Under the New Co-operatives Law in Vietnam', November 1998, Hanoi, Vietnam (unpublished document).

Clague, Christopher 1997, 'The Institutional Economics and Economic Development' Institutions and Economic Development: Growth and Governance in Less-Developed and Post-Socialist Countries, The Johns Hopkins University Press, Baltimore and London, pp. 56-72.

Cointreau-Levine S. 1994, Private Sector Participation in Municipal Solid Waste Services in Developing Countries, Vol. I. The Formal Sector, WB, Washington DC.

Cronbach, L.J. 1963, 'Course Improvement Through Evaluation', Teachers College Record, Vol. 64, pp. 672-683.

DiPasquale, D. & Wheaton, W.C. 1996, Urban Economics and Real Estate Markets, Prentice Hall International, Inc., New Jersey, USA.

Ensminger, Jean 1992, Making a Market: The Institutional Transformation of an African Society, Cambridge University Press, Canada.

Fischer, D. 1999, Urban Land Economics, lecture notes week 11 www.cbs.curtin.edu. au/units/ef/pe102/11 (1999, 12 December).

Friedman, D 1999, Septic System Additives and Chemicals, http://www1.mhv.net/~ dfriedman/septic/septadds.htm (1999, 30 October).

Guba, E.G. & Lincoln, Y.S. 1981, Effective Evaluation, Jossey-Bass Inc. Publishers, California, USA.

Guba, E.G. & Lincoln, Y.S. 1989, Fourth Generation Evaluation, SAGE Publications, Inc.

Haarmeyer, D. & Mody, A. 1998, 'Tapping the Private Sector: Approaches to Managing Risk in Water and Sanitation', Journal of Project Finance, Summer 1998, Vol. 4, no. 2, pp. 7-23.

Hai Phong Water Supply and Sanitation Programme 1998, 'The Awareness and Evaluation of Customer and Supplier on the Present Water Supply Service in Hai Phong City' February 1998 (unpublished document).

'Hanoi to Breath New Life Into Polluted Kim Nguu River' 1999, Vietnam News, 12/05/99 pp. 5.

Hanoi Water Drainage Project 1997 (unpublished document).

Hanoi Water Drainage Company 1997 'Investigating and Building the Solutions to the Environmental Pollution of To Lich River System' Dec 1997, Hanoi City People's Committee, Department of Science and the Environment (unpublished document).

Haughton, D., Haughton, J., Bales, S., Truong, T.K.C. & Nguyen, N.N. (Eds.) 1998, The Vietnamese Household: Explorations Using the Living Standards Measurement Survey, 1992-1993, ISEAS, Hanoi, Vietnam.

Hausman, D. M. 1984, The Philosophy of Economics, Cambridge University Press, Cambridge.

Hausman, D. M. 1989, "Economic Methodology in a Nutshell." Journal of Economic Perspectives 3(2), pp. 115-127.

Hoover, M.T. 1998, 'Soil Science Facts, Septic Tank Systems', Dept. of Soil Science, Hygienic Regulations, Administrative Penalty in Health Services (Code No. 23/HDBT), Council of Ministers, January 1991, North Carolina State University, Raleigh, SS 86-4.

Kuhn, T. 1970, The Structure of Scientific Revolutions, University of Chicago Press, Chicago.

Kummerow, Max 1998, 'Escaping Newtonian Mechanics: Philosophy and Methods for Applied Social Science Research', Curtin University of Technology (unpublished document).

Kummerow, Max 1999, 'Graaskamp on Research Methods', Curtin University of Technology (unpublished document).

Jacobs, Jane (1964) The Economy of Cities, Penguin Publishers, Harmondsworth.

Japan International Cooperation Agency (JICA) & HPC, Socialist Republic of Vietnam 1995, 'The Study on Urban Drainage and Wastewater Disposal in Hanoi City', Hanoi Vietnam (unpublished document).

Liu, A. & Chu, Y. 1996, What Children in Vietnam Do and Why: Children's Time Use and Household, paper presented for the AusAID/NCDS workshop on 11-12 July, 1996, Ho Chi Minh City (unpublished document).

Lockwood Dietershagen Associates Licensed Professional Engineers, Clifton Park, NY 1999, Septic Systems - An Engineer's View, http://www.inspect-ny.com/septic/ lockwood.htm#1gray (1999, 6 November).

McIntosh, Arthur C. & Yniguez, Cesar E. 1997, Second Water Utilities Data Book, Asian and Pacific Region, Asian Development Bank, Manila Philippines.

Martin, A. & Lewis, A. 1956, 'Patterns of Public Revenues and Expenditures', The Manchester School of Economic and Social Studies 24, pp. 203-244.

Oates, W.E. 1972, Fiscal Federalism, Harcourt, New York.

Ostrom, Elinor 1997, 'Investing in Capital, Institutions, and Incentives' Institutions and Economic Development: Growth and Governance in Less-Developed and Post-Socialist Countries, The Johns Hopkins University Press, Baltimore and London.

Ostrom, Elinor, Schroeder, Larry & Wynne, Susan 1993, Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective (Theoretical Lenses on Public Policy Series), Westview Press Inc., Boulder USA and Oxford, UK.

Riviera, D. 1995, 'Private Sector Participation in the Water Supply and Wastewater Sector: Lessons from Six Developing Countries', Directions in Development Series, World Bank, Washington DC.

Singh, B. et al. 1993, 'Rural Water Supply in Kerala, India: How to Emerge From a Low-level Equilibrium Trap', Water Resources Research, 29(7), pp. 1931-1942.

Spradley, J. 1979, The Ethnographic Interview, Holt, Rinehart and Winston, USA.

Stake, R.E. 'The Countenance of Educational Evaluation', Teachers College Record, 1967, 68, pp. 523-540.

State Planning Committee - General Statistical Office 1994, Vietnam Living Standards Survey, 1992-1993, (VIE/90/007), State Planning Committee/GSO: Hanoi, Vietnam.

Tyler, R.W. 1949, Basic Principles of Curriculum and Instruction: Syllabus for Education 360. University of Chicago Press, Chicago.

Vietnam Living Standards Survey II (1997/98 VLSS II) Government Statistical Office, draft copy 2000 (unpublished document).

Water Engineering and Development Centre (WEDC) 1999, Plenary Session: Summary of Discussion 25, http://nt1.ids.ac.uk/cgi-bin/dbtcgi.exe (1999, 25 November).

World Bank Water Demand Research Team 1993, 'The Demand for Water in Rural Areas: Determinants and Policy Implications', The

World Bank Research Observer, 8(1), pp. 47-70.

Worthen, B.R., & Sanders, J.R. 1973, Educational Evaluation: Theory and Practice. Charles A. Jones, Worthington, Ohio.

Biographical Sketch

Sasha Fink has lived, worked and studied in Vietnam for three years. She has completed a Masters in Urban Economics, focussing on Vietnam. Sasha worked on the World Bank/Government of Finland Hai Phong Water Supply and Sanitation Programme, as well as consulting on various rural and urban water and sanitation projects. Sasha now resides in Sydney, Australia, where she is developing her business skills, so she will have more to offer the developing world in the future.

Mail address: Sasha Fink
554 Mowbray Road
Lane Cove, NSW 2066
Australia

Email address: sasha_fink@yahoo.com