URBAN HARVEST

Farming in the city

An Annotated Bibliography of Urban and Peri-urban Agriculture in Vietnam with Emphasis on Hanoi

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Ta Thi Bich Duyen, Tran Thi Bich Ngoc

Prepared for Urban Harvest, the CGIAR System-wide Initiative on Urban and Peri-Urban Agriculture

Annotated Bibliography Series

March 2007

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Urban Harvest is the CGIAR system-wide initiative on urban and peri-urban agriculture, which aims to contribute to the food security of poor urban families, and to increase the value of agricultural production in urban and peri-urban areas, whilst ensuring the sustainable management of the urban environment.
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Urban Harvest Annotated Bibliographies on urban and peri-urban agriculture contain a list of citations from articles, books, documents, theses and reports followed by an annotation or brief description. The material has been selected from a variety of sources and disciplines on urban and peri-urban agriculture in order to motivate interdisciplinary discussion and comment. The author(s) alone is (are) responsible for the content.

ISBN 978-92-9060-299-6

Published by the International Potato Center (CIP), convener for Urban Harvest.
CIP contributes to the CGIAR mission through scientific research and related activities on potato, sweetpotato, and other root and tuber crops, and on management of natural resources in the Andes and other mountain areas.
www.cipotato.org

Editors: Freda Wolf, Maarten Warnaars
Cover Design: Communications and Public Awareness Department, CIP

Printed in Peru by Comercial Gráfica Sucre S.R. Ltda.
Copies printed: 100

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INTRODUCTION

Vietnam has two clearly defined core areas: Hanoi-Haiphong in the north and Ho Chi Minh City in the south, which are the two major centers for urban growth. Vietnam as a whole has experienced steady economic growth over the past 20 years after the introduction of the Doi Moi reforms in 1986. The transformation of the economy provided the opportunities for substantial growth, however certain transformations were not planned or well designed. Vietnam's economy continues to grow and transform, impacting the daily lives of millions of people, especially in urban areas. Compared to other South Asian countries Vietnam has relatively low levels of urbanization, nevertheless there has been an increase in the 1990s with a 23.7% of the total population living in urban areas in 1999, compared to 19.4 in 1989. The hinterlands of the Hanoi and Ho Chi Minh urban centers vary significantly in their demography and resource endowments, suggesting the need for developing different approaches.

In recent years, urbanization has been occurring very fast in the peri-urban areas of Vietnamese cities. The urbanization process goes on both with planning and without planning. Urban planning means building infrastructure such as roads, a clean water supply, wastewater drainage, planning and building public works to keep pace with the expanding towns and cities. The unplanned development of former agricultural lands around cities into areas of a dense population living in concrete constructions brings problems of waste disposal. Solutions have been offered by government agencies and foreign organizations to alleviate pollution problems, which include integrated and long-term planning of industrial, agricultural, and infrastructure development with zoning; improving livelihood options for agricultural producers and allocating land for proper waste disposal together with methods to reuse waste.

In recognition of the importance of urban agriculture to solve persistent problems faced by cities and towns, this annotated bibliography has been compiled by the authors to introduce general background information and an overview of the present status of urban agriculture in Vietnam.

Urban agriculture began in Vietnam before the catch-phrase became popular and the practice was recognized by local administrators, academicians and scientists. Information is included on urban and peri-urban agriculture and their contribution to supplying the cities of Hanoi (the capital city) and Ho Chi Minh City. Emphasis is on vegetable production in the peri-urban area of Hanoi and its constraints. Constraints identified are: the quality of the vegetable products and supply seasonality of the Hanoi market. The solutions adopted to overcome these constraints have been farmer strategies based on diversification and institutional activities based on innovative technology transfer. Further developments are proposed for better management of rural-urban production to complement urban market supply and transfer of new technology. Several interesting insights can be provided in the data presented.

The annotated bibliography not only focuses on the literature dealing with crop/livestock production but also tackles several sources of related information that can provide significant impact on the success or failure of the future development of urban agriculture in Vietnam. Of considerable importance are the works dealing with the topics of local environment and human health. Most of the studies provide detailed information on air pollution, water pollution, waste management, the sewage and drainage system capacity and coverage, sanitation facilities and waste generation, aquaculture, pig raising and waste reuse and their capacities in each city. Studies related to the various sources and type of air pollutants as well as heavy metals, which have an important bearing on the quality and safety of vegetables produced in the urban environment, have also been included in the annotated bibliography. Also, lists of available databases and government agencies involved in environmental management are provided.

This annotated bibliography compiles various entries on urban agriculture in Vietnam. The diversity of sources and nature of information found in this document reflects the multi-disciplinary character of urban agriculture. Sources of information were collected from articles in books and journals, program reports, technical reports, proceedings from workshops, unpublished papers, and working papers, etc.

This document aims to contribute to the growing recognition and critical role of agriculture in development in Vietnamese cities. It is hoped that more valuable scientific information will be generated in the near future and eventually added to the compilation that has been initiated.

ASSESSMENT OF URBAN AND PERI-URBAN AGRICULTURE

Anh, M.T.P, M. Ali, H.L. Anh, and T.T.T. Ha. 2004. Urban And Peri-urban Agriculture in Hanoi: Opportunities and Constraints for Safe and Sustainable Food Production. Shanhua, Taiwan: AVRDC – The World Vegetable Center. Technical Bulletin No. 32 (14)

Keywords: urban and peri-urban agriculture, policy, crop production, marketing

It is estimated that 60% of Asia's population will reside in urban areas. In the province of Hanoi alone, the population has increased by a factor of 40. The percentage of Hanoi's population living in urban districts has increased from 31% in 1978 to 54% in 2001. The increase of population in urban areas of Hanoi creates a higher demand for food consumption. The city has extended its city boundaries to meet commercial and residential demands, while agricultural land has also increased from 627 ha in 1995 to 1,748 ha in 2002, making it a total of 17.7% of urban land dedicated to agriculture.
This study evaluates the geopolitical environment, pollution emission, agriculture production, especially vegetables, assesses human, physical and institutional resources and describes marketing systems relating to agricultural systems in Hanoi. Moreover the paper evaluates recourses, constraints and opportunities of the urban and peri-urban agricultural system and how policy makers can be helped to meet the demands of a mega city. The paper draws data mainly from secondary information, especially from the Hanoi Agricultural Rural Development Department and the Hanoi Statistical Office. The report provides statistics on many aspects ranging from solid waste discharge to food supply and demand in agricultural markets and marketing systems in Hanoi, while describing the implications of the Doi Moi in 1986.

Berg, Leo van den. 2001. Farming downstream from Hanoi. Paper for the conference Rural-Urban Encounters: Managing the Environment of the Peri-Urban Interface. London. 9–10 November 2001. (32a)

Keywords: irrigation; urbanization, horticulture

Rapid urban growth is affecting farming communities in the Thanh Tri district in southern Hanoi, losing agricultural lands and experiencing more seasonal flooding with contaminated water. The paper outlines the challenges farmers face in the changing environment by intensifying their horticulture production and fish farming to meet more market demand, while demanding more compensation for lost land. Economic liberalization and city development agencies that seek land for residential, industrial and infrastructural purposes are causing strains on the already complicated livelihood of many farmers. There are recent mechanisms to use the compensation received from the

loss of lands to reinvest in agricultural activities to make farms more sustainable and environmentally healthier.

Pham, Van Khoi. 2004. Removal of urgent issues for rapid development of private economy in Hanoi suburb agriculture. *Science and Technology Journal* of *Agriculture and Rural Development*, (in Vietnamese). Ministry of Agriculture and Rural Development, Vietnam. 2004, no.1: 11−13. (10)

Keywords: peri-urban, private sector, peri-urban agriculture

The private economy in Hanoi's suburban (peri-urban) agriculture is mainly family-based and farm-based. In recent years, agricultural land has narrowed while agricultural production in Hanoi has developed rapidly, with an annual average of 4.5%. Hanoi is focusing a great deal on the development of the private sector, in particular on suburban agriculture. However, there exist some difficulties and urgent issues that considerably slow down the development of the private sector, which include production organization, protection, jobs, capital, science and technology, etc. In subsequent years, different forms of private economy, like farms and private businesses, will be strongly promoted while changing the way trade is conducted. The economy of the private sectors of Hanoi's suburban agriculture will develop in relation to each other and other production systems. In this paper, seven relatively concrete measures to remove particular problems in the promotion of the private economy are presented and scientifically supported.

Phi, Van Ky and Nguyen Dinh Long. 2003. Some basic solutions for market development in Hanoi suburbs and rural areas. *Science and Technology Journal of Agriculture and Rural Development*, (in Vietnamese). No.11: 1355−1356. (10)

Keywords: marketing, commercialization, post harvest

In the past 15 years of Vietnam’s renovation of economic strategies, economically Hanoi’s suburbs have developed significantly. However, suburban markets still face certain difficulties. Every day, markets in rural and suburban areas of Hanoi experience large amounts of commodity exchange, therefore it is important to develop strong local markets in order to open up opportunities to the world market.
The paper explains that suburban markets are insufficient and have limited problems. The first, infrastructure, although it has improved substantially, still does not meet the requirements for commodities exchange. Second, the market systems, such as financial, labor and commodities, are insufficient, and the government is unable to manage them effectively. Third, suburban markets have an inadequate trade network, making business operations are not very effective.
The paper provides some recommendation to develop market potentials in the areas discussed. First, suburban markets have to be better organized in order to create conditions for the circulation of goods from producer to consumer. Second, market systems and trade centers have to be developed and rural commercial models have to be established. Finally, the role of the government has to increase.

CROP PRODUCTION

Berenyi, B. 1991. Developing tomato production in the Hanoi region, Vietnam. *Bulletin of the University of Agricultural Sciences*, Godollo, Hungary. 1991, No. 1991–92: 119–124. (3)

Keywords: vegetables, cash crop, methods

Tomatoes are a major vegetable crop in Vietnam. They are mostly sold fresh for local consumption and only a small quantity is actually processed. Trials of cultivars and sowing dates for crops to be produced for canning were conducted in Hanoi on farmers' holdings and at 2 experimental stations. The data is documented in table form, describing cultivar flowering and fruiting, assessment of disease resistance (to fungi and viruses) and yields. The results showed that the climate was suitable for tomato culture during 8 months of the year, while unsuitable between 1 May and 8 Aug. There were 2 main sowing periods, 30 Jan.-15 Feb. and 15 Aug.-10 Sep. Suitable cultivars for these 2 sowings were (1) Chico III, Mobil, Washington F1 and Gala F1, and (2) K. Bibor, Nivo (K-555), Treff, Mobil, Chico III, Peto-86, Peto-98 and UC 134-1-2.

Bon, H. De, To Thi Thu Ha and Gil B. Toscano. 2002. Vegetable production during the hot season around Hanoi city. *Cahiers Agricultures*. 2002, 11: 5, 323−331. (23a)

Keyword: vegetables, crop production, integrated crop management

Studies have shown that there are high price fluctuations of vegetables, mainly in the hot season, which indicate there is variation in production. Peri-urban vegetable production around Hanoi contributes greatly to urban markets. Two surveys have been carried out to understand the constraints of production during the hot season. Three farmer groups were identified; vegetable farmers, diversified plant-based farmers, and rice farmers. The study found that 25 different plant species were present, with Choysum and mustard being the crops commonly grown during the hot season. It was found that no homogeneous crop management strategies exist during the hot wet season and the choice of species, fertilization and crop protection management varies substantially from farmer to farmer.

Bui, Huy Thuy, Tran Duy Quy and Nguyen Minh Cong. 2002. The results of research on creation and selection of rice variety DT12 in the North Vietnam. *Science and Technology Journal of Agriculture and Rural Development*, (in Vietnamese). No.3: 199–200. (10).

Keywords: technology, plant breeding, innovation

This paper discusses how many scientists find it important to conduct research on the creation and selection of new rice varieties with high yield, good quality and resistance to pest and insects.
DT12 was created from sexual hybridization of DT10 (mutant variety) and OM80 (quality variety) by pedigree method. It was tested and experimentally produced in different localities of North Vietnam from 1998–2001.
DT12's growth duration is 180 to 185 days in early spring and has plant height of 90-100 cm, nice form, erect dark green leafage; strong tilling; large panicle, grains/panicle 145-189, weight of 1000 seeds 23-24 gram; high yields potentiality 60-8.5 tons/ha. DT12 and DT10 are tolerant to the cold with the ability to resist insects and diseases better than OM80.
In addition, DT12 is a promising restorer line in hybrid rice research.

Bui Thi Gia, W. Bokelmann, and J. P. Ogier. 2000. Key study on vegetable production in the district of Gia Lam, Hanoi, Vietnam. Proceedings of the XIVth International Symposium on Horticultural Economics, St Peter Port, Guernsey, UK, 12–15 September 2000. *Acta-Horticulturae* 536: 355–362. (15)

Keywords: vegetables, fertilizers, pesticides, knowledge systems

This paper analyzes the impact of main conventional inputs (fertilizer, labor, seed and pesticides) as well as other inputs, such as farmer's cultivation experiences and seasonality on cabbage and kohlrabi yield. A farm household survey was conducted in five villages (Van Duc, Thach Ban, Phu Dong, Dang Xa and Le chi) in Gia Lam District, Hanoi City, Vietnam (n=160, 1997/98). Mean test method has been used to compare the input used by farmer groups with knowledge on vegetable cultivation and to compare the input used for "ecological or clean vegetable production technology"'. Furthermore explorative statistical methods have been used to identify the main factors determining the success of production.

Nguyen Thi Kim Ly, Nguyen Xuan Linh. 2003. Primary evaluation of spray chrysanthemum varieties grown on autumn-winter cropping season in Hanoi. *Science and Technology Journal of Agriculture and Rural Development*, Ministry of Agriculture and Rural Development, Vietnam, (in Vietnamese). No.10: 1279–1281. (10)

Keywords: cash crop, technology, crop production, plant breeding

Chrysanthemum flowers have the potential to grow all year round and bring high economic profit. To increase yield and flower quality, research and evaluation of spray chrysanthemum varieties are needed. Selecting suitable varieties for each growing season along with appropriate technical support are key to improving flower production. Results from 20 chrysanthemum experiments collected from the Netherlands were evaluated, based on: rooted cutting ratio, duration of growth and development, flower quality and vaselife, and some other variety characteristics.

Most of the varieties had good growth and development during the autumn and winter seasons, especially numbers 4, 5, 9, 13, 19 and 20, which have been considered to be the most promising. These varieties have short growth duration, high plant growth, strong and big sterns, nice color, and long vaselives. The rest of the experimental varieties have produced many excellent characteristics, although flower color has not been satisfactory, which implies further experiments will have to be carried out next season. Furthermore, many flower growers and consumers are very interested in these developments.

Nguyen Truong Thanh, Nguyen Huu Vinh, Nguyen Thi Thanh, Tran Quoc Viet, Nguyen Hanh Nguyen, Cu Thanh Phuc. 2002. Measures to minimize the impact of plant protection of chemical residues in agro-products in vegetable production in suburban and adjacents of Hanoi. *Science and Technology Journal* of *Agriculture and Rural Development,* (in Vietnamese). Ministry of Agriculture and Rural Development, Vietnam. No.3: 205–207. (10)

Keywords: fertilizers, pesticides, integrated crop management, crop production

Chemical fertilizers and pesticides are necessary in agricultural production; however, many producers often exceed the standard level of application. This is one of the main causes of environmental pollution and food poisoning.
The research results show that in vegetable production areas, in a suburb and adjacent district of Hanoi, proportions of samples having plant protection, chemical residues exceed the acceptable limit, which is relatively high (35%). To minimize the impact of residues, it is necessary to determine isolated duration of chemicals on agro-products. Timmes and Freshe exponential regression can be used to estimate the duration. Under humid tropical conditions in Vietnam, isolated duration of chemicals tends to be shorter than that recommended by manufacturers and in other temperate countries.

Tran, Khac Thi Dr. 2000. Safe Vegetable Production Development to Supply Hanoi (Vietnam). (5, 17)

Keywords: vegetable, peri-urban, crop production.

The administrative districts of Hanoi include: the citadel (7 districts) and the suburbs, which are also called the rural districts (5 districts). The total population is 2,711,600 million inhabitants. The annual natural population increase rate is: 9.9‰ in the urban areas and 11.9‰ in the peri-urban areas. Agriculture around Hanoi is still very important where more than 70% of the vegetables in Hanoi markets are supplied by peri-urban production. The majority of Hanoi's vegetable production comes from the rural district, mainly two districts representing half of total production. This production faces some problems of quality due to pesticide residues, heavy metal and nitrate contents, and microorganisms that pollute vegetables products. Results of farm surveys and market surveys indicate the risks farmers and consumers face. The results of a project conducted

by Hanoi People's Committee are discussed at the production land marketing levels and other proposals are mentioned.

Quang Le, Vinh. 2004. Scientifically based possibilities for the spread of the water supply method to support the production of safe vegetables in Linhnam commune, Hoangmai district, Hanoi city. *Science and Technology Journal* of *Agriculture and Rural Development*, (in Vietnamese). No.7: 912−918. (10)

Keywords: vegetable, water supply, crop production

At the end of 2002, a pressurized piped water supply system, which was designed by the Center for Water Research and Engineering Application, was completed for 10 ha of vegetable production land in Linhnam Commune. The system included a ground water pumping station, a water treatment system and a pipe system with valves and outlets, which evenly distribute water to the field. This water supply method has changed vegetable production systems, making them safer and cleaner, and has formed the new model for agricultural production in the Red River Delta. This solution has brought social and economic benefit and changed the way of thinking among many farmers. This paper introduces scientific possibilities to support widespread use of this water supply method for the production of safe vegetables in other areas for industrialization and modernization of Agricultural and Rural Area.

Van Diem, Doan. 2003. Assessment of the water requirements and the irrigation requirements of the DT84 soybean variety at Gialam district in the spring crop season of 2003. *Science and Technology Journal* of *Agriculture and Rural Development*, (in Vietnamese). No.12: 1543–1545. (10).

Keywords: legumes, irrigation, water, technology

Soybean (Glycine Max (L) Merrill) is a crop that does not have high water requirements. However, during spring season in Hanoi, soybean production faces climate difficulties such as drought. The paper describes the assessment of water and irrigation requirements on DT84 soybean variety in the Gialam district. An experiment was carried out in Gialam district in the spring of 2003 where the DT84 variety was cultivated at 4 different periods. Each experimental area was 10m2 and replicated 3 times. The results of the study showed that climate conditions in the spring affected DT84 in its evaporation potential and the retention of rainwater in the growing and developing stages. The production stages of DT83 are as followed: in early sowing seasonal DT84 variety should be irrigated from 3 leaf stage up to the harvest and in the late sowing seasonal DT84 variety should be irrigated in the beginning stage and in the final stage water should be drained. These results allow the development of irrigation schedules for different management conditions on varying seasonal cropping patterns.

ENVIRONMENTAL AND HUMAN HEALTH

Bui, Tam Tung and Dang, Duong Binh. 1990. Solving Environmental Problems Along with Development of Hanoi City up to the Year 2000. *In International Conference on Environment and Sustainable Development December 3–6, 1990*. Ed. by UNDP and State Committee for Sciences, 267–276. Hanoi, Vietnam: UNDP.

Key words: environmental health, pollutants, urban environment

This paper reviews Hanoi's environmental situation and development trends up to 2000 in order to identify major environmental problems and build strategies to solve them.
The paper provides general information on air, water, soil and noise pollution in Hanoi resulting from industrial activities, traffic and human waste disposal. These factors threaten the health of Hanoi's inhabitants and its environment. Future urbanization growth will exacerbate current problems and create new ones that will need to be mitigated, such as developing conservation strategies, environmental management system, and action programs. Many projects are proposed that include the building of the Hanoi Center for Environmental Control in order to research the development of an environmental protection law and to promote environmental protection and health for Hanoi's citizens.

Bui Van Chinh, Le Viet Ly, Nguyen Huu Tao and Nguyen Giang Phuc. 2002. Biogas technology transfer in small scale farms in Northern provinces of Vietnam. Proceedings Biodigester Workshop March 2002. (25)

Key words: animal production, technology, waste, recycle

During the last twelve years animal production has developed rapidly in Vietnam. The annual growth rate of animal production in North Vietnam is estimated to be from 4.5% to 5%. Untreated waste from animal production is a main source of environmental pollution, although the demand for fuel wood and energy for households is steadily increasing due to the rise in population. The introduction of biogas technology into North Vietnam in the 1970s and the introduction of low-cost tubular plastic biodigesters in the 1990s, has created a demand for animal waste. In the 1990s many technical assistance programs have emerged to help small-scale farmers handle their animal waste and convert it into cheap fuel.

Crippen Consultants Vancouver, B.C. 1993. Urban Waste Management Study Hanoi, Haiphong and Ho Chi Minh City. *Final Report*. CIDA Project E4936K043860.

Key words: waste management, urban environment, recycling

This study provides and analyzes information relating to waste management in three Vietnamese cities: Hanoi, Haiphong and Ho Chi Minh City. The study also provides information on waste management institutions and regulations in the three cities. The paper explains how these three cities share similar waste problems and only 50-90% of refuse is collected in them and that only HCMC was composting waste at the time of the study. Moreover, none of the cities had government-organized recycling programs or satisfactory methods of disposing of hospital and toxic waste. Most of the data provides detailed information on air and waster pollution, and waste management in each city. A list of government agencies and databases is also provided.

Cuong P.V. 1994. Hanoi Environment, Sewerage and Drainage Management and Wastewater Treatment. Unpublished report written for the Training Program on Waste Management sponsored by MOSTE, Hanoi, February 21–March 5, 1994. (32a)

Keywords: wastewater, environmental health, water quality, technology

This paper provides a general view of Hanoi's sewage and drainage system and the relationship between wastewater management and treatment with the environment. The paper explains that the system is outdated, overloaded and does not encompass the entire city. The sewage system consists of a network of connecting manholes, sewers, tunnels, channels, rivers, and regulating lakes. The lakes are polluted with domestic and industrial wastewater, chemical fertilizers, nightsoil, garbage, mud and sludge; toxic gases are suspended in the air. Several projects were proposed to ameliorate Hanoi's sewage and drainage inadequacies, such as: develop a sewer and drainage master plan, flow clearing and local flood control, develop laws and regulations for environmental protection, create protection mechanisms, training schemes, investment and public awareness of environmental protection.

Dalsgaard, Anders. 2001. Health Aspects of the Reuse of Wastewater in Agriculture and Aquaculture in Vietnam**.** In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords**:** wastewater, aquaculture, human health

It is very common in Vietnam to use untreated wastewater for agriculture and aquaculture. This poses a serious risk to public health, both among farmers and the public at large. This paper aims to explain epidemiological aspects and provide guidelines for the safe use of wastewater and excreta as recommended by the World Health Organization. Hygiene standards in the use of wastewater have been lax in recent years, adopting a more realistic approach to the use of wastewater based on epidemiological evidence on health risks. There are a few well-designed epidemiological studies on reuse of wastewater; however there are more studies on the health risks of using wastewater in

agriculture and aquaculture. World Bank studies show that using untreated wastewater for crop irrigation may cause intestinal nematode infections, cholera and typhoid in crop consumers and field workers. On the other hand, wastewater irrigated agriculture provides cheap fertilizer with high nutrient content for crop production, which can be very acceptable for a number of crops. Furthermore, epidemiological studies associated with the risks of untreated wastewater in aquaculture present fecal pathogens that can transmit trematodes.

Ellegård, A. 1995. Urban Household Air Pollution Monitoring in Hanoi, Vietnam. *Renewable Energy for Development*, February 1995, Vol. 8, No. 1: 19–21. (30)

Keywords: air pollutants, human health, human settlements

The paper discusses a project carried out by the Hanoi Architectural Institute (HAI), Lund Center for Habitat Studies and Stockholm Environment Institute to assess the indoor air pollution of Hanoi dwellings and the effect of architectural solutions on indoor air pollution. Urban households in Vietnam rely heavily on coal for cooking and heating. Although almost all households are connected to the electricity grid, people prefer to use coal because it is much cheaper.
Experimental apartments and actual apartments were used to determine if air pollution exists in indoor dwellings resulting from cooking with coal. The experimental apartments showed apartments with improved chimneys contained 14 ppm CO concentration compared to 33 ppm CO from traditional ones. However, the cook's exposure is higher with the improved chimney (48ppm) than with traditional ones (40ppm). Monitoring was also carried out in six homes, however, with opposite findings, with lower concentrations for the cook in the kitchen (8ppm compared to 43-58ppm). High peaks occurred during the ignition of the coal stove and when the stove is used for heating.
The project will continue with the assessment of three categories of households: modern, planned Soviet-design, multistory apartments; traditional, unplanned urban apartments; and traditional, one-story houses.
The monitoring shows that air pollution could affect the well-being of residents, however more work is needed before recommendations can be made.

Ho Thi Lam Tra. 2001. Status of Heavy Metal Pollution of Agricultural Soils and River-Sediments in Central Hanoi. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: environmental health, heavy metals, wastewater

This paper presents the findings of a study on the evaluation of heavy metal pollution on agricultural soils and river sediments in Hanoi. The study took soil samples from the Tuliem and Thanh Tri districts and from the Kimnguu River in July 1997. Sediment

samples were taken from three rivers flowing through the center of Hanoi and the districts of Tuliem and Than Tri in July 1998.

The soil samples did not show significant levels of contamination, thus were below the range according to Vietnam standards for heavy metal concentrations. River sediment samples did show that heavy metals contamination exists, with zinc having the highest concentration for the six heavy metals examined.

Hoang Thi Nghia, Nguyen Thai Hiep Nhi, Nguyen Thi Xuan Anh, and Nguyen Bao A. 2001. The Microbial Water Quality of the West Lake, Hanoi Bacterial Indicators. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: wastewater, water quality, environmental health

West Lake is the largest lake in Hanoi and is a main source of untreated discharged wastewater. A study was conducted to monitor microbial water quality of the lake between 1997 and 1999. The lake was divided into three sub areas for sample collection and analysis. Sub area I lies in the southern part of the lake and contains two large sewage inlets from the city and is very densely populated. It was found that Subarea I met with 12% of guideline standards of coliforms and 20% of samples contained less than 10,000 fecal coliforms per 100 ml. Sub area II, also in the southern part of the lake, has several hotels and is a popular tourist area. Sub area II contained 28% of standard guideline values of coliforms and 56% of samples contained less than 10,000 fecal coliforms per 100 ml. Sub area III is located in the northern section of the lake which is less populated than the other two areas and dedicated to vegetables production. Eighty-five percent of the samples from sub area III met guideline standards for total coliforms, while 92% of samples contained less than 10,000 fecal coliforms per 100 ml. There was little difference between dry and rainy season results, however the number of total coliforms was lower during the rainy season due to a dilution effect.

Ho Thi Lam Tra, Nguyen Dinh Manh, Do Nguyen Hai, K. Egashira. 1998. Pollution of water and agricultural soils in Tuliem and Thanhtri districts of Hanoi city—a Report. *Journal of the Faculty of Agriculture*, Kyushu University, Japan. 1998, 42 (3-4): 509–521.

Keywords: soils, polutants, water quality, agriculture

Limited information is available on the quality of water and agricultural soils in Tuliem and Thanhtri districts of Hanoi city, Vietnam. Based on the Vietnam standard for the quality of water and soils, 14 water and 22 soil samples in Thanhtri district, and 7 water and 14 soil samples in Tuliem district were collected and analyzed for the prescribed parameters. In comparison with the Vietnam standards for the quality of water and soils,

water and soil quality in Tuliem and Thanhtri districts was evaluated. Quality of water for agricultural use was as follows: pH was neutral; EC was between 0.18 and 0.59 dS/m; C.O.D. was below the limit; no sample was over the limit value for Zn, but one, three and two samples exceeded the limit values for Cu, Pb and Cd, respectively. Quality of agricultural soils was as follows: pH ranged from 5.40 to 7.00; all soil samples showed total N content below 0.25% and available P2O5 more than 20 mg/kg; contamination of several heavy metals was indicated in soils around the manufacturing factory and in mud of the river bed, while contamination by Cu was in soil affected by agricultural chemicals.

Le Van Chau. 2001. Epidemiology of Clonorchiasis in Northern Vietnam. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30**.** (22)

Keywords: human health, environmental health, food safety.

It is estimated that 50 million people worldwide are infected with Clonorchiasis, which is prevalent in the Red River Delta of Vietnam. A survey in 1998, in the Nghia Phu commune concluded that the main cause of the disease was the customary eating of raw fish. The study found the infection rate to be higher among males (267/579) than in females (45/413). Moreover, the study found that snails are the primary intermediate host and fish are the secondary intermediate host of Clonorchis. Clonorchiasis can be treated by a 3-day treatment.

Nghiem, X.D. 1993. Terminal Report on Solid Waste Treatment in Hanoi—Draft. Hanoi: URENCO. (32a)

Key words: solid waste treatment, composting, environment

This report discusses a study conducted by the UNDP on the Cau Dien Composting Plant Pilot Project. The report summarizes the pilot project activities and findings from April 1990 to June 1993. A general description of the plant is given and further explanations are provided on how the objectives of the study were fulfilled. The main findings include: the plant environment changed as waste generation increased, more plastic bags were observed in the waste, forced air composting was the most appropriate and effective option, health concerns of the workers, and close relationships are needed between CTA, SC, NPD and UNDP. Finally certain recommendations are provided, such as continuation of UNDP in the project, the development of a waste management plan, and additional equipment is needed.

Nghiem Xuan Dat. 1994. Solid waste management in Hanoi. *Publication Series Report No. 3 The Urban Waste Economy in Vietnam*. Proceedings of a Workshop Funded by the International Development Research Centre, Ottawa, in Hanoi, August 22–25, 1994. (320b)

Keywords: environmental health, solid waste, waste, urban environment

Around 14 million people live in about 500 urban centers in Vietnam. The rise in population has caused the government to devote more energy to public health and urban environmental problems. The most critical of these problems is urban solid waste for which management solutions need to be identified.
In Hanoi only 70 percent of it 1.1 million inhabitants benefit from the city's water supply, and the drainage and sewage system is now in poor condition. Every day about 250,000 cubic meters of wastewater are discharged into rivers, streams and lakes. Moreover a recent survey found that Hanoi produces 2,290 cubic meters of waste a day, comprised of domestic waste (1,640 cu m), public waste (520), and hospital and industrial wastes (130). It is estimated this figure will grow to 3,000 cubic meters a day by the year 2000. URENCO, the state run water supply, drainage and sewage enterprise, only collects about 56% of waste generated in the city. There is great concern for the untreated waste discharged from hospitals. The government is aware it needs to invest more local and foreign capital to improve the waste management system in cities. One solution that is being worked on is reusing waste as energy or biogas. In 1990 the Government of Vietnam and UNDP began a composting project, turning waste into valuable organic fertilizer.

Nguyen Ngoc Nga, Hoang Thi Nghia, Nguyen Quang Quynh, and Tran Quang Toan. 2001. Water Quality in Drilled Wells in Hanoi. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: wastewater, pollutants, urban environment

The object of the study was to analyze the water quality of drilled wells in Hanoi by focusing on bacterial indicators and chemical parameters between 1989 and 2000. The method Most Probable Number (MPN) recommended by WHO was used. Chemical analysis was carried out according to WHO standards. The study found that 342/462 (74%) samples did not contain fecal coliforms. Between 1989 and 2000, 222/234 (69%) samples contained <10 total coliforms per 100 ml. Further analysis of 729 drilled water samples showed that only 112 (15%) met standards for all the parameters studied. There were some indications of high concentrations of iron, nitrate and other parameters indicating organic pollution. Further research is suggested.

Nguyen Ngoc Thu. 2001. Urbanization and Wastewater Reuse in Peri-Urban Areas: A Case Study in Thanh Tri District, Hanoi City. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: urbanization, wastewater, peri-urban agriculture, recycling

The paper discusses the results of a study on the impact of urbanization on agriculture in peri-urban areas in Hanoi. The study focused on the loss of cultivated lands, the transformation of the agricultural system, and the role played by the reuse of wastewater on these developments.
It was found that over the 1960-1993 period the area of cultivated land decreased by 2.8% per inhabitant per year, however flooding events and duration increased between 1984 and 1994.
It was found that wastewater is reused to feed ponds for aquaculture, which is beneficial compared to non-wastewater-fed fishponds. Fishponds fed with wastewater give 2-2.5 times higher yields and 2-3 times higher financial benefits than non-wastewater fed fishponds. Wastewater is also used for rice and vegetable cultivation. Rice yields under wastewater give 10-15% higher yields and 10-20% higher financial benefits than non-wastewater fields. The author mentions that urbanization has caused the loss of agricultural lands and increased flooding, however urbanization has created a larger consumer market.

Nguyen Quang Trung. 2001. Impact of Wastewater on Water Quality in Irrigation System and Treatment Measures to Reduce Pollution: A Case Study in Nhue Irrigation System. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: wastewater, water quality, pollutants, irrigation

This case study evaluates impacts of wastewater on water quality in Hanoi and identifies treatment methods to reduce water pollution, preserve the environment, protect crops and improve human health. Experiments to test different dilution ratios were conducted on the Hong River and the Nhue River. It was found that the city discharges 335,000 m3 of wastewater a day. Industries account for 27 to 30% of total wastewater, while domestic wastewater released into the rivers account for 70-73%. Furthermore, it was found that, although hospital waste is small in quantity, 1.4%, it is a serious threat to the environment.

Nhu, P.Q. 1994. Project Proposal for: The Construction of Bio-Fertilizer Plant and Setting up a Clean-Vegetable Belt Surrounding Hanoi Municipality. Unpublished report prepared by P.Q. Nhu of the Hanoi Environment Committee. Vietnam.

Key words: solid waste, fertilizer, bio-safety, organic agriculture

The report describes a project proposal for the construction of a bio-fertilizer plant and the creation of a clean vegetable belt encircling Hanoi. Moreover, the report discusses the current solid waste situation and explains the need for the project, outlining its objectives, implementation strategies, duration and budget.
Inappropriate sanitation practices along with the collection, processing and disposal of solid waste in Hanoi threaten the health of many residents. The responsibility of solid waste collection and disposal falls to URENCO whose principle objective is to provide an adequate service to meet public health and living conditions. Furthermore, the report states that the use of uncomposted nightsoil for vegetable production spreads intestinal diseases and further contaminants. Thus, the Hanoi Environment Committee plans to construct a "Bio-Fertilizer Plant" and establish a "Clean Vegetable Belt" around Hanoi. Within the project proposal, education and training will be provided to farmers about the hazards of uncomposted night soil, a restriction on the use of human waste as fertilizer and the development of pilot gardens using only bio-fertilizers and safe water.

Quy, L. 1994. Summary—The Issue of Waste Management. Unpublished report written for the Training Program on Waste Management sponsored by MOSTE, Hanoi, February 21–March 5, 1994.

Key words: waste, wastewater, environmental health, policy

The purpose of this paper is to provide a summary of waste management issues in Hanoi, thereby identifying the main problems and making recommendations to solve them.
Wastewater may be a good fertilizer for fish production, although it can cause many problems. The residues of bio-products and groundwater pollution negatively impact human health.
The new Environmental Protection Law requires that new waste operational systems must pre-treat waste before it is discharged and these operations developed prior to the law must assess and treat wastewater. Two problems were identified: recycling is inefficient because of high solid waste content and the presence of construction materials, and no waste management policy exists. The report provides recommendations, including the adoption of an environmental mandate, aiming to guide waste management policies and develop a trickle-down effect from top government levels to local levels.

Peters, D., Do Duc Ngai and Dang Thi An. 2000. Agro-processing Waste Assessment in Peri-urban Hanoi. (21)

Keywords: wastewater, environmental health, agro-processing, recycle

Agro-processing and livestock raising, especially of pigs, are main sources of income for many households in peri-urban areas of Hanoi, although these enterprises may cause environmental and social consequences, generating large amounts of wastewater in local and neighboring communities. The benefits of agro-processing, mainly cassava, are very profitable compared to non-processing farmers; however, the solid waste and wastewater resulting from such activities exceed critical values set by the government. On average, processing 1 t of cassava roots produces 10.7m3 of wastewater. Laboratory analysis showed that cassava solid waste contains 87.5% moisture and 12.5% dry matter, which can be used as pig and fish feed. It is estimated that 80% of cassava solid waste is being used productively, mainly as feed, but also as a medium for mushroom growing. Local residents perceive the waste to be an environmental health hazard, however there are local recycling strategies to help minimize those affects.

Satoshi Takizawa. 2002. Wastewater Reuse for Agriculture and Aquaculture in Hanoi, Vietnam. From E-conference: Agricultural use of untreated wastewater in low income countries, 24 June–5 July 2002. (29b)

Keywords: urban environment, wastewater, agriculture, aquaculture

The author describes the reuse of wastewater for agriculture and aquaculture in Hanoi, its risks, its potentials and the different types of wastewater. Wastewater provides agriculture and aquaculture an attractive source of nutrients, however with health risks. The author argues that it is important to classify types of wastewater, especially for people who collect and reuse wastewater using traditional methods, which increase the health risks of local people.
The demand for nutrients, like nitrogen and phosphorous, make wastewater attractive, however, as household incomes increase so does the use of commercial chemical fertilizers. With increased use of chemical fertilizers, organic waste matter, like urine and human feces, high in nitrogen content, is not reused and hence, not properly disposed of or treated.
The main problems for human health from untreated or partially treated wastewater are gastrointestinal diseases and eye and skin diseases. Another problem of urban wastewater reuse is the presence of heavy metal and toxic constituents.
Farmer education is important and the involvement of local institutions is essential to decrease the risks of wastewater reuse and possible side effects. Other recommendations are given which are based on water and wastewater quality monitoring and waterborne disease data obtained since 1998.

Soil and Water Ltd. 1990. Hanoi—Wastewater Treatment Needs and Recommendations and Development Strategies. *Finland: Soil and Water Ltd*. (32a)

Key words: wastewater, pollutants, water quality.

This study is part of a larger study that aims to reduce the pollution of rivers in and around Hanoi by applying appropriate wastewater treatment and wastewater management techniques. This paper provides an overview of Hanoi's wastewater reticulation and treatment requirements. Project results from the suburb of Kim Lien may provide solutions that are compatible with wastewater treatment goals for the entire city. The study describes the topographical and hydrological conditions, land use, population and industry, current wastewater facilities and sanitation and the lake and pond ecosystem while also discussing the legislative and regulatory framework. Furthermore, the study assesses developmental needs, proposes some development strategies and provides future forecasts.

SWECO. 1993. Assessment of Environmental Problems in Hanoi. Draft of Final Report. Hanoi. (32a)

Keywords: environmental health, pollutants, wastewater, solid waste, air pollutants

The paper describes the objectives and findings conducted on the various factors affecting the urban environment of Hanoi. The study aims to provide sufficient information upon which to base future projects to improve environmental conditions in Hanoi. The study focused on general environmental issues, policy and legal aspects at various government levels, nature conservation and assessing the city’s planning process. It concluded that Hanoi suffers from many environmental problems, such as: water pollution due to the lack of sewage treatment; soil and ground contamination, which is due to illegal dumping of solid wastes, open dumpsites, etc., and air pollution caused by traffic, cooking methods and industrial activities. The paper also provides a list of institutions and departments of interest for environmental and greening structures.

Tran Duc Vien and Dang This Say. .2001. The role of aquaculture in pollution remediation in Tay Lake and Ruc bach Lake of Hanoi. *Paper for topic 1 of the workshop* "Appropriate Methodologies for Urban Agriculture", October 2001, Nairobi, Kenya. Proceedings. (29)

Keywords: wastewater, water quality, environmental health, pollutants

This paper discusses the findings from a study carried out on two lakes in Hanoi on pollution levels and content and providing recommendations to solve some of the pollution problems. The source of pollution results from domestic waste coming from the increase in residential homes, waste from the recent development of restaurants and hotels, industrial waste from the factories surrounding the lakes, construction sites, and agricultural residues, such as from chemical fertilizers. It is estimated that 30,000 m3/day are discharged from 10 main drains from lakes Tay and Truc Bach. The total volume of phosphorous ranging from 10,000 to 14,000 tons/year discharges into Truc Bach Lake. Biological compositions of the lakes were analyzed to determine the health of the aqua environment to help determine how to improve the state of the lakes. Certain

recommendations include the introduction of particular fish to control phytoplankton and zoobenthos, construct shore barriers and to close some city drainages.

Tran Hieu Nhue and Duong, Tien Duc. 1990. Some Results of Studies on the Pollution by Sewage in Hanoi and Proposal Measures to Solve the Problem. In *International Conference on Environment and Sustainable Development December 3–6, 1990*. Ed. by UNDP and State Committee for Sciences, 108–112. Hanoi, Vietnam: UNDP. (32a)

Keywords: wastewater, management, urban environment

This paper discusses the sewage system in Hanoi, its characteristics, the amount of pollutants and provides some recommendations for projects to solve the existing problems.
Hanoi consists of a combined sewage system of underground drains in the old quarter, and a separate system of underground drains and open channels in the new quarter. There are two main problems that need attention: the selection of a sewage system and wastewater treatment. There are four projects proposed to study wastewater treatment in combination with regulation of storm water, fishing lakes as aeration methods, treatment on biodisk for industry and a plan to protect water resources.
Moreover, the paper provides information on the size of the sewage system and drainage system and its flow rate. Data is also presented on the amount and characteristics of industrial wastewater discharged into rivers.

United Nations Development Program (UNDP). 1993. International Seminar Solid Waste Treatment in Hanoi. VIE/86/023. Hanoi: UNDP. (32a)

Keywords: solid waste, wastewater, water quality, fertilizer

This paper documents the proceedings of a seminar held March 25, 1993, on solid waste treatment in Hanoi. The main focus of the seminar was the solid waste system in Hanoi and the outcomes of the UNPD pilot project. Other topics discussed in the seminar included: using thermophilic streptomyces to convert waste into organic fertilizer, solutions to urban solid waste problems in Vietnam, using fertilizer for tea plants and possible solutions to improve waste processing in Hanoi City.
The paper includes figures on the density and composition of Hanoi's waste, the amount of waste generated by the major cities in Vietnam in 1991 and the amount of total and domestic waste in Hanoi from 1981–1991.

United Nations Development Program (UNDP). 1999. Reduction of Industrial Pollution in Ho Chi Minh City. UNIDO. (31)

Keywords: wastewater, environmental health, private sector

This report describes the Cleaner Production (CP) program proposed by the Environmental Management section of Ho Chi Minh City (HCMC)-Department of Science Technology and Environment (DOSTE) with assistance and advice from the United Nations Industrial Development Organization (UNIDO) and the Swedish International Development Cooperation Agency (SIDA). The program is a result of the increase of environmental impacts due to industrial and urban wastes in HCMC. The city has grown substantially over the last 10 years, with the industrial sector growing the fastest, generating 31.2% of Vietnam's GDP in 1997. Moreover, the industrial sector in HCMC represents 25% of Vietnam's total economic growth and accounts for 35% of total industrial production output in the country. The increase in industrial growth has had serious effects on the environment. The program is focused on dealing with environmental protection and continued competitive production. The program's aim is to demonstrate that a preventive approach to industrial pollution is capable of reducing consumption of resources, minimizing waste at the source through better practices and incorporating cleaner technologies. In order to achieve this, the program included six case studies of companies involved in food processing, pulp and paper production, and textile dyeing in HCMC.
The process to produce successful results included: practical demonstrations of financial and economic benefits; development of a cadre of trained CP professionals within the country; the appropriateness and usefulness of systematic CP methodology; identification of barriers and enabling measures for cleaner production; dissemination of the results of CP demonstrations; and strategies for promotion and development of CP in the country. The studies found 66% reduction in wastewater discharge, up to 70% reduction in air emissions and up to 17% reduction in solid waste generation. In total 45% of measures across the six case studies showed medium to high improvements on environmental performance, while 33% had significant environment improvements. The paper presents the material by case study.

Urban Environment Sanitation Company (URENCO). 1994. Hospital Waste Management in Hanoi. (Case Study). Prepared by the Hanoi People's Committee. Hanoi Office for Urban Transportation and Urban Public Works and Hanoi Urban Environmental Company. (URENCO). Hanoi: URENCO. (32a)

Keywords: waste, management, collection

This case study provides information on the entire hospital waste system among 36 hospitals in Hanoi. Twenty-two hospitals, which have waste collection service from URENCO, the Urban Environment Company, generate a total of 459.8 cubic meters of waste per month. Two types of solid waste are produced: body parts and materials, such as gauze, paper and bandages. It was found that liquid waste is not treated before it is discharged into the city drainage system and solid waste treatment is still at preliminary stages, with no immediate treatment. Moreover, the study shows that the improper collection and disposal of waste is a public health issue. Recommendations explain that more detailed studies be carried out and regulations and enforcement measures to protect public health are implemented.

Urban Environment Sanitation Company (URENCO). 1994. Solid Waste Management in Hanoi'. Sw-Man2. Doc 28. Feb 1994. (32a)

Keywords: solid waste, management, urban environment

This paper provides a general view of Vietnam's economic development, public health problems, legal and institutional framework and presents an overview of the solid waste management system in Hanoi. The data provides information on the amount of solid waste generated in sectors of Hanoi in 1994. The paper identifies problems that affect the waste management system, including the relation of traffic density with collection services, lack of complete sewage coverage, poor sewage systems and high air pollution. Waste collection services only covers 8 percent of the urban area, which comprises 50 percent of total waste generated in 1996.
The paper also describes the number of employees and collection vehicles URENCO has.

Vu Kim Tuyen and Nguyen Xuan Tang. 2001. Wastewater Problems and its Potential to Contaminate Clean Water Sources in Hanoi. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. . (22)

Keywords: wastewater, pollutants, urban environment, management.

This study assesses the status of water pollution caused wastewater in Hanoi. Approximately 500,000m3 of wastewater is produced a day in Hanoi. This pollutes the surface water system causing bad odor. The contaminants filter into the soil and pollute the groundwater sources of the city. Some recommendations are suggested: better management of clean water sources; enhance wastewater treatment systems, and community education about environmental and water sources protection.

Vu Thi Thanh Huong. 2001. Treatment of Domestic Wastewater and its Reuse in Farm Irrigation in the Red River Delta. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: wastewater, environmental health, pollutants, fertilizer

The study assesses a model for wastewater treatment and reuse in the Red River Delta. The study provides data on the composition of the river before biological treatment and after the treatment. Findings included high levels of pollution exceeding the acceptable labels for agricultural use and that biological treatment would be an effective method to decrease pollutants. After 20 days of treatment, BOD was reduced from 76.4% to 93.8 %, COD decreased from 61.1% to 85.4 %, NH4+ reduced by 36.6% to 45.6% and suspended

matter reduced by 58% to 75.6%. The level of nitrogen provides a good source of fertilizer for plants. Thus, the optimum use of wastewater can be determined for each crop, enabling the reuse of wastewater for agriculture without hazards. These results show that using biological reservoirs is a simple and effective method to reduce pollutants and a source of fertilizer for crop production.

Whitney, J. (1994). The waste economy of Hanoi: a preliminary conceptual model. Publication Series Report No. 3 The Urban Waste Economy in Vietnam. Proceedings of a Workshop Funded by: International Development Research Centre, Ottawa, in Hanoi, August 22–25, 1994. (32c)

Keywords: waste, recycling, management,

Dr. Joseph Whitney analyzes the generation, management and disposal of wastes in Vietnam. The author recognizes that the old recycling system is disappearing. Problems arising from wastes are related to per capita incomes in urban areas and associated increases in per capita waste generation, a rapidly growing industrial sector, and the substitution of chemical fertilizers for organic wastes.
Whitney uses the term "waste economy" to describe the relationship between economics and waste, in which formal or informal economies whether industrial, agricultural, retail and wholesale or household embrace all aspects of the generation, transportation and disposal of wastes. The paper further describes two economic outputs: a product output and a non-product output or waste material. These waste materials are used either as waste-derived resources or waste deprived products in four ways: material/energy recovery, production of products, processing to obtain materials for use as subsequent inputs to production or energy conversion, and reuse in the same way. Moreover, the paper places Vietnam between an internalized waste economy and an external waste economy.
The author concludes that there is a greater need to concentrate on the organic waste situation than the inorganic, since the traditional market system has been able to handle the latter, thus a market must be developed to deal with the former.

Yam, T. 1990. Problems of Solid Wastes on Hanoi City. In *International Conference on Environment and Sustainable Development December 3–6, 1990*. Ed. by UNDP and State Committee for Sciences, 167–173. Hanoi, Vietnam: UNDP.

Keywords: solid waste, urban environment, management

This paper identifies the problems of solid waste in Hanoi. It discusses the actual generation and future predictions of solid waste, the relation to the human population, and factors involved with the collection and disposal of solid waste. The paper states that 625 cubic meters of waste are generated daily, of which 82% is domestic and 10% is industrial. Major components of this waste are fermentable organic matter, comprising 50% of total solid waste. Some factors affecting solid waste generation are topography,

hydrology, climate, economic, social customs and habits and the regulation of public sanitation.

Further data is provided on waste generation between 1981 and 1987 and predictions for 1990, 1995, and 2000. Waste composition by type and by chemical content is also provided.

GENDER ISSUES

Lauridsen, Mette Ide. 1998. Evaluation of the impact on women's lives of the introduction of low cost polyethylene biodigesters on farms in villages around Ho Chi Minh City, Vietnam. *Livestock research for rural development*, Volume 10, number 3. (12)

Key words: women, bio-safety/technology, urban environment, human environment,

Despite changes and progress the developing world faces serious environmental problems. With increasing population and development activities there is an increase in the demand for fuel and hence more pollution. Biodigesters have been introduced in many countries as an alternative to traditional energy. There are many economical, environmental and social benefits from the introduction of biodigesters, which replace the use of firewood, reducing pollution. Biodigesters are beneficial for integrated farming systems because they convert manure into energy. Studies show that women benefit substantially from biodigesters because they save time and money. Moreover, polyethylene biodigesters improve women’s practical and social lives. It is recommended that this technology would be beneficial to many people around the world, especially women.

FOOD SECURITY AND NUTRITION

Figuié, M. 2003. Vegetable Consumption Behaviour in Vietnam. Sustainable Development of Peri-urban Agriculture in Southeast Asia (SUSPER). Hanoi, Vietnam (27a)

Keywords: food consumption, human health, crop production, leafy vegetables, supermarkets

In the last fifteen years vegetable consumption has increased in Vietnam as a result of an increase in population and in individual consumption (from 45.5 kg/capita/year in 1987 to 54 kg/capita/year in 2000). The study shows that urban vegetable consumption is higher than in rural households in 1998: 43kg and 37 kg/capita/year. Hanoi surpasses the urban average at 73 kg/capita/year in 1984, however it decreases to 66.5 kg/capita/year in 1995. This is the result of wealthier households buying expensive products that substitute a larger volume of inexpensive foods for less volume of expensive alternatives. Furthermore, the paper describes how consumers perceive vegetables and food health risks. Vegetables are perceived as foods with high risk for consumer health, which is mainly perceived to be a cause of chemical residues from agricultural practices. However, according to consumers these risks are mitigated by their own household practices and cooking techniques to protect themselves. Chemical contamination of vegetables does not harm the image of the products because of the importance of ”freshness” of foods in Vietnam and the belief that preparation practices are effective in avoiding illnesses. On the contrary, according to WHO, 60% of food borne illnesses in Vietnam occur from family meals. The author concludes that a social contract be established to coordinate between consumers and producers, urban and peri-urban dwellers.

Hoang Bang An, Le Nhu Thinh, Dang Dinh Dam, Ngo Van Nam, Le Thuy Hang, Trinh Quang Thoai, Isabelle Vagneron, Paul Moustier. 2003. Spatial and Institutional Organization of Vegetable Market in Hanoi. Sustainable Development of Peri-urban Agriculture in Southeast Asia (SUSPER). Hanoi, Vietnam. (27b)

Keywords: food consumption, crop production, commercialization, leafy vegetables

This paper is the second module from the SUSPER project—Market development of peri-urban food commodities—aims to provide a more accurate picture of the spatial and institutional organization of vegetable markets in Hanoi. The survey was carried out in 2002 in different times of the year to focus on seasonal variations, vegetable pricing and purchase, identity and distribution of different actors involved in fresh vegetable markets, and mapping vegetable flows between Hanoi and surrounding areas. The survey indicates that most of leafy vegetables are grown near Hanoi, for example 95-100% of lettuce in Hanoi is grown 20km from the city and kangkong is grown 10 km from the city. Furthermore, the survey describes how certain Hanoi-bound vegetable production

supplies depend on the season. For example, during the hot and wet season (July–September) tomatoes come as far as Son La and Lam Dong provinces or China. In addition, mainly the producers sell choysum in March (81%) and June (67%), while 85% of the lettuce sold in March and November is sold directly by the producers. Markets are mainly characterized by a large number of small traders with a high level of competition between them. Further studies found that vegetable prices have been growing faster than the overall price index and vegetable prices experience very strong seasonal variations, creating an increase in demand for vegetables. The study links seasonality with the organization of supplies and the origin of vegetables, the identity of the sellers and the overall market activity and market chain. In conclusion the study shows the importance peri-urban farmers have in the supply of food to the city.

Le Danh Tuyen, Le Bach Mai, Muriel Figuié, Nicolas Bricas, Bernard Maire, Marie-Claude Dop, Nguyen Dinh Chung, Nguyen Cong Khan. 2004. Trends in food consumption and in the nutritional status of urban dwellers in Vietnam, over the last twenty years (2). *Cahiers d'études et de recherches francophones / Agricultures.* Number 13, volume 1, 31–8, Janvier-Février 2004 - L'alimentation des villes, Étude originale. (23b)

Keywords: human health, food consumption, human nutrition

This paper analyses the changes of food consumption and nutritional status of the urban population in Vietnam before and after the change to a market-economy (Doi moi). Before Doi moi, nutritional status of urban populations showed energy-deficiency and dietary energy intake was 17% below recommended energy requirements. The transition to a market economy changed the living conditions and food supply of urban populations. For example, the consumption of fruit increased. The number of underweight women has decreased and the percentage of underweight women in urban areas is now lower than in rural areas (20% vs. 28%). The study shows that there is a strong correlation between nutritional status and income level. Overweight and obesity do not seem to be a serious problem in urban Vietnam. The results show a need to improve survey methodologies in order to include outside home consumption.

Tran Thi Minh Hanh, Tatsushi Komatsu, Nguyen Thi Kim Hung, Nguyen Van Chuyen, Yukio Yoshimura, Pham Gia Tien and Shigeru Yamamoto. 2001 Nutritional Status of Middle-Aged Vietnamese in Ho Chi Minh City. *Journal of the American College of Nutrition*, Vol. 20, No. 6: 616–622. (24)

Key words: human health, human nutrition, food consumption

This paper discusses the importance of nutritional status of populations as a means to control and prevent nutrition-related chronic diseases. A study was conducted to investigate the nutritional status of middle-aged Vietnamese in urban, suburban and rural regions of HO Chi Minh City. The change of the economic system in Vietnam to a

market economy and has lead to a more western style lifestyle. The study shows that there are differences in the intake and the nutritional status of urban and rural Vietnamese. There are many dietary factors and physical activities that are different between urban and rural regions. Middle-aged people in Ho Chi Minh City are characterized by undernutrition (35%) in the low-income, rural region and overnutrition (18%) in the high-income, urban region. The suburban region faced both under- and over nutrition problems.

LIVESTOCK- AND PIG-RAISING

Le Thanh Hoa. 2003. Molecular biology of Gumboro virus and application in Vietnam 'Comparative of VP2 sequences of 9 Vietnamese Gumboro strains isolated in Hanoi and surrounding provinces'. *Science and Technology Journal* of *Agriculture and Rural Development*, (in Vietnamese).ISSN 0866-7020. Ministry of agriculture and rural development, Hanoi, Vietnam. 2003, no.10: 1255–1257. (10)

Keywords: gene, vaccines, animal production

This paper describes the antigenic properties of “hypervariable” region of the VP2 gene of nine Vietnamese Gumboro strains; 475 bp of “hypervariable” region of the antigenic VP2 are comparatively aligned with the corresponding sequence of the selected Asian (HK46, Hong Kong), European (CU-1) and America (52-70) strains. Compared with G202 (classical strain of Vietnam), 95-100% homology was observed between Vietnamese Asian and 52-70 and CU-1. All strains have substitutions in nucleotide composition of which there are significant substitutions at least 5 loci at nucleotide levels that altered the amino acid composition between GGL3; GGl4; CU-1 and 52-70 compared with G202. Variation observed among the Vietnamese and global strains indicated that the amino acid composition and antigenic property of "hypervariable" region of the VP2 gene is extremely complicated cautioning the appropriate use of vaccines.

Le Thanh Hung . 2005. Production and Marketing Systems of Aquatic products in Ho Chi Minh City. Urban Agricultural Magazine 14. Leusden, The Netherlands. (28)

Keywords: aquaculture, wastewater, peri-urban

Peri-urban aquaculture is widely practiced in many communities in Ho Chi Minh City. However, the increase of urbanization and industrialization has caused constraints. The agriculture-aquaculture sector in the city’s economy in regards to GDP has decreased from 2.2% in 2002 to 1.4% in 2005. Moreover, the area available for the agricultural sector has also decreased from 128,760ha n 2000 to 121,235 ha in 2005.
Peri-urban aquaculture can be classified into two types: wastewater-fed and non-wastewater-fed systems, where the latter is found on higher lands and the former in lowland areas. In these systems fish raising and plant production exist. The preferred fish is tilapia, for seed and table fish production, while other fish, like gourami and kissing gourami are also grown. Some farmers cultivate water mimosa and water spinach, and sometimes combine fish culture with plant production, but in different ponds and/or locations.
There are certain constraints to the aquaculture systems in HCMC mainly caused by the development of residential areas and public construction zones and hired labor, caused by the lack of interest by youth to participate in fish culture.

Little, D., Pham Anh Tuan and Nguyen Van Tu. 1994. Catfish Microhatcheries in Ho Chi Minh City. In: *Leisa Magazine*, Vol. 10, No. 4. (26)

Keywords: aquaculture, space contained agriculture, livelihoods

Hybrid catfish production in Ho Chi Minh City can be carried out as a small-scale business. This paper describes how one catfish producer has developed a microhatchery, of 18 m2, in their home. A hybrid between Asian catfish (Clarius macrocephalus) and African Sharptooth catfish (Clarius graiepinus) is the preferred species in backyard seed production in Vietnam because it is efficient in using static water, has high density capacity, and is easy transport without sophisticated facilities. In an area of 18m2 around 1,500 kg of female catfish and 200 kg of African catfish are raised on trash fish and chicken intestines. Hormones, a combination of Human Chorionic Gonadotropin (HCG) and dried pituitary glands, are used for the final stages of maturation. These are purchased from either within Vietnam, Eastern Europe, and the Peoples Republic of China. Between February and April, 1 kg of females can produce 5,000-7,000 hatchlings, with the potential to increase to 20,000 later in the season. In a shallow tank, 2x1 m or 200 liters, 400,000 hatchings are produced in which every two to four days around 1.5 million hatchlings are sold.
This report outlines a small success story of micro-hatcheries producing hybrid catfish, in Ho Chi Minh City. Good water sources and high standards of hygiene are key for a successful micro-hatchery. Success stories like this and even government policies can help in the dissemination of information to attract other entrepreneurs and expand new markets.

Nordesjo, B. 1999. A survey of the brucellosis status of dairy cows in the Hanoi peri-urban area. *Minor Field Studies*, International Office, Swedish University of Agricultural Sciences, Uppsala, Sweden. No. 84: 18.

Keywords: animal production, dairy, animal health

This survey describes the status of brucellosis among dairy cow populations in peri-urban areas of Hanoi from February and April 1999. The survey was conducted by analyzing milk samples, conducting milk ring tests, and obtaining background information on herd structure and possible disease transmission. Samples were taken from 351 cows from 178 smallholders in peri-urban areas and 52 cows from a large-scale farm in the Hanoi area. Positive samples of Brucella abortus were transported to Sweden for confirmatory analysis with an indirect ELISA. Nineteen cows (5.4%) from small holder farms and a cow (1.9%) from the large-scale farm reacted positively to the milk ring test. About 79% of cows were vaccinated against at least one disease. The most common vaccination was Pateurella spp. and anthrax. The survey also concentrated on the fertility of the cows and the destination of the milk.

Paul Pozy, Le Van Ban, Doan Thi Khang, Arman Deswysen, Daniel Deharen. 2001. Nutritive value of several forages commonly used for dairy cattle in the suburb of Hanoi. *ScienceReport of National Institute of Animal Husbandry,* 2001: 167–171. (8)

Keywords: animal production, dairy, animal health

A well-balanced diet for dairy cattle is important to meet requirements for meat and milk production and fetus development. It is important to include crude protein, minerals and vitamins in dairy cattle diets that are available in local areas. To calculate the quality of nutrients it is essential to know nutritive values of available feedstuffs. Experiments were carried out on different kinds of grasses, such as natural grass, cultivated grass and other feedstuffs used for dairy cattle in Hanoi. The results showed that all grasses contained low levels of energy value, particularly natural grass, hence adding molasses to supplement for energy inefficiency. Agriculture by-products such as ensiled corn stover may be included in dairy cattle's diets. The use of rice straw, when grass is not available, still requires adding feed rich in nutrient and crude protein.

Peters, D., Nguyen Thi Tinh, and Tran Thanh Thuy. 2000. Improved pig feed in Vietnam. (27c)

Keywords: animal production, rootcrops, women

Meat production in Hanoi has increased from 31,000 t in 1997 to 33,000 t in 1999. The demand for meat is increasing and will continue to grow, estimates calculate that by 2010 the demand will research 119,600 t. Around 80% of the production of meat will come from peri-urban farmers. Pig raising in urban areas provides part of the demand for meat in Hanoi, however feed availability constrains production. Sweetpotato is a valuable feed for pigs: both roots and leaves are used fresh, dried or as fermented silage. It was found that sweetpotato vines fermented with chicken manure provide the highest feed and dry matter conversion rate and the lowest cost of feed per unit of grain in weight. Moreover this combination is labor-saving and its storage potentials are very beneficial, especially for women, who usually feed pigs.

Phung Thi Van, Pham Sy Tiep et al. 2003. Building Model of Pig Production at Farmer Household to Reduce Environmental Pollution. *Science Report of National Institute of Animal Husbandry,* 2003: 145–157. (8)

Keywords: environmental pollution, technology, households, animal production

The report describes the techniques to reduce environmental pollution in pig production at farmer households. The applied techniques include wastewater treatment, improving breeding facilities, and pig raising in cages. A biogas system contributed to treating waste while raising a foundation and roof and installing a water shower improved the breeding facilities. After the techniques were applied, environmental pollution decreased.

Pneumonia and diarrhea ratios in piglets and metritis ratios in sows reduced 4.23%, 8.53% and 4.84%. Performance production increased and feed costs per one kg weight-gain decreased from 5.83% to 6.34%. The biogas system contributed to household needs, like cooking and lighting.

Thang Vu Quyet 1996. Effect of Sewage Utilization on Fish Farming and Irrigation (Vietnam). Vietnam National University, Hanoi. (19)

Keywords: wastewater, livelihoods, aquaculture

This report describes the outcomes of a project aimed at studying the environmental and health effects of using untreated wastewater for crop irrigation and aquaculture. There are many indirect and direct risks to human health originating from wastewater, exposing humans to pathogens and toxins. The project was carried out by the Center for Natural Resources and Environmental Studies in Hanoi. The project aimed to evaluate various sources of wastewater used for agriculture, assess the impact of raw sewage for fish farming, public health and socio-economic wellbeing as well as to provide measures to improve food production systems while reducing hazardous substances and train local scientists in the analysis and management of water pollution problems. Water and sludge samples were collected, a health survey was conducted on five communes, and an examination of sewage-fed fishponds was carried out. Socio-economic assessment was conducted, although more work is needed on land tenure and on the contractual relationships governing sewages use.

Tuan, P.A. and Vo Van Trac. 1990. Reuse of Wastewater for Fish Culture in Hanoi, Vietnam. In *Wastewater-fed Aquaculture*, ed. P. Edwards and R.S.V. Pullin, 69–72. Bangkok: Environmental Sanitation Information Centre, Asian Institute of Technology.

Keywords: wastewater, aquaculture, recycling

The paper describes the wastewater reuse system for fish culture. Data is provided on the characteristics of wastewater in Hanoi and the amount of fish being produced. Sewage is also used for the rotation of rice and vegetables with fish culture. Approximately 4,000 tonnes of fish, mainly tilapia and silver carp, are harvested annually on a surface of 1400 hectares. Three production systems reuse wastewater: fish culture, fish-rice and fish-rice-vegetable rotations. The latter system appears to be disappearing due to the lack of sufficient income, therefore the first two systems are preferred.

POLICY AND PLANNING

Le Quoc Doanh, 1998. Farmer Organization in the Red River Delta. *Science and Technology Report, VASI*, 1998, (in Vietnamese), Agriculture publishing house, 38–43. (1, 11)

Keywords: crop production, collective action, households

The paper describes the recent trend in the Red River Delta of Vietnam to organize farmers into cooperatives. About 10% of the delta's agricultural cooperatives have managed to change structure according to new policies. The cooperatives have provided farmers with a variety of benefits for household agricultural production. About 60% of cooperatives exist in name only and have no role in local agricultural production.
The changes that occurred among agricultural cooperatives are varied, in some locations farmers have been able to establish themselves into collective groups. There are similar aspects between cooperatives and collective groups, however the former tends to meet needs to strengthen household incomes and bring positive effects to local agricultural development.

Tran Van Vy. 2001. Sewage Water Aquaculture in Hanoi: Current Status and Further Development. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30**.** (9) (22)

Keywords: aquaculture, wastewater, policy,

The paper describes the current status of sewage water aquaculture development in Hanoi and presents the master plan for future developments of fish culture. The information was based on written sources: published and unpublished reports on surveys conducted by the Research Institute for Aquaculture No.1, journals and the author's personal knowledge and input.

It is estimated that Hanoi has over a 5,000 ha potential surface area for aquaculture development and tourism services. The aquaculture authorities are interested in integrated and sustainable fish production and exploiting maximum potentials, thus involving modern technology, intensive systems, stocking valuable fish species and introducing better marketing strategies. Certain aspects have to be resolved that relate to the type of species used, the impact of wastewater on fish quality, degraded conditions of hatcheries and breeding stocks, and the lack of prevention and treatment of fish diseases. Moreover the aquaculture industry lacks policy measures to deal with production, financing, extension services and technical staff, fish diseases, etc.

Vo Quy Hoan, 2001. Wastewater Reuse through Aquaculture in Hanoi: Status and Prospects. In *Waste Reuse in Agriculture in Vietnam: Water Management and Human Health Aspects*. Proceedings from a Workshop in Hanoi, Vietnam, March 14, 2001. Edited by Liqa Raschid-Sally, Wim van der Hoek, Mala Ranawaka. IWMI Working Paper 30. (22)

Keywords: wastewater, aquaculture, urbanization, recycling.

The object of the study is to describe the historical development of wastewater reuse through aquaculture, wastewater-fed aquaculture, main constraints and potentials and to make recommendations for future studies and development programs. The study was carried out in the Thanh Tri District in Hanoi, the total aquaculture area 1121 ha or 19% of total farmed area, as of 1995. Figures show that 3,000 ton/years of fish, a total of 10% of the total fish supply in Hanoi, were produced. Four farming systems exist: fishing, rice-fish culture, fish seed and vegetable production include wastewater-fed production.

The fish that are grown include: Mozambique tilapia (Oreochromis mossambicus), Nile tilapia (O. niloticus), two Indian carp (Rohu, Labio rohita and mrigal, Cirrhinus mrigala), and Chinese silver carp (Hypophthalmichthys molitrix). The favorable fish species include rohu and mrigal farmed in areas with and without wastewater supply. In wastewater fishponds, fish yields ranged from 4.7 ton/ha in rice-fish culture to 5.6 ton/ha in fish-only culture. Production systems have gained momentum and importance among local people and Hanoi authorities in terms of socioeconomic, environmental and recourse recovery terms.

Vu Nang Dung. 2004. Urbanisation in Red River Delta and Projection for Sustainable Development. *Science and Technology Journal* of *Agriculture and Rural Development*, (in Vietnamese). Ministry of agriculture and rural development, Hanoi, Vietnam, no.1: 4–6. (10)

Keywords: urbanization, agriculture, waste-management

This paper discusses the reasons for the rapid urbanization in the Red River Delta (RRD) region of Vietnam, outlining some of the major consequences this has for sustainable development and infrastructure in the region. The RRD region is home to 3 of the largest cities in Vietnam, including Ha Noi, with a high degree of industrialization and surrounding peri-urban and rural areas where mainly agriculture is practiced. While this region is the second largest rice producing plain in Vietnam, increasing pressure from industry, trade, and urbanization over the last decade is seriously reducing the land available for cropping. This in turn has consequences for the economy in this region—which more and more is going from an agricultural base to industry and trade. This is accompanied by reduction in the livelihood options of agricultural producers in the peri-urban areas, and serious problems of solid and liquid waste disposal. Using the case of Hanoi city, the author describes how planned and unplanned urbanization processes go hand in hand and put increasing pressure on land in the peri-urban areas. Farmers in these

latter areas sell their agricultural land to city dwellers who are in dire need of living space. Thus earlier natural spaces are replaced by concrete constructions and the unplanned nature of this development worsens the problem of waste disposal. Finally some solutions are offered to alleviate the above problems, which include integrated and long-term planning of industrial, agricultural, and infrastructure development with zoning; improving livelihood options for agricultural producers and; allocating land for proper waste disposal together with methods for waste reuse. Urbanization in Red river Delta and projection for sustainable development

RURAL-URBAN LINKAGES

DiGregorio, M. 1995. Recycling in Hanoi. Hartford Web Publishing. (18)

Keywords: waste, recycling, urban environment

The collection and buying of waste provides occupation opportunities and a secure economic niche for a variety of actors—local industries, communities, etc. Scavenging and buying waste incorporates a rural workforce, small-scale enterprises, and usually hierarchical and dependent economic relationships. It is usually characterized as informal, innovative, adaptive and an efficient economic sector and a refuge for the poor. This recycling business includes household labor, integration into the agricultural cycle, high degree of solidarity and exclusion, and off-season cash incomes. There is evidence that there are divisions by gender and for children in the recycling and scavenging activities.

It is suggested that URENCO, the Hanoi Urban Environment Company, forge agreements with local recycling communities and develop delivery services for areas outside URENCO's reach. Collaboration is needed to integrate recycling and refuse disposal to the needs of recyclers, refuse managers, and the public.

Hoang Xuan Thanh, Dang Nguyen Anh, Cecilia Tacloi. 2005. Livelihood Diversification and Rural-Urban Linkages in Vietnam's Red River Delta. *Food Consumption and Nutrition Division Discussion paper 193*. International Food and Policy Research Institute: Washington D.C. (20)

Keywords: rural-urban, private sector, households, migration

Twenty years after the introduction of Doi Moi reforms in 1986, the Vietnamese economy has not only grown substantially but has seen many fundamental changes socially and economically that has helped reduce poverty. Vietnam's economy has shifted away from subsistence farming towards high-value food production for export and local urban markets and nonfarm employment. This paper presents findings from case studies on two villages in the Ha Nam province. The first village, Nhat, relies primarily on agricultural activities, although nonfarm activities are supplementary or relate in some way to agricultural production and commercialization. The second village, Ngoc Dong, originally rice farmers, while still owning rice farms, has shifted to handicraft production as their main source of employment. Despite the differences, there are many similarities between the two villages. Both have links to markets, especially urban centers and Hanoi, excellent communications infrastructure, improved transport systems, the development of forward and backward linkages in their production activities, and the importance of local authorities in supporting economic development. The paper mentions the importance of rural-urban linkages in improving economic

growth and in reducing poverty. The paper also describes the contribution migration has had on the two villages economically and socially.

De Bon, H. and T. K. Thi. 2000. The response of peri-urban agriculture to urbanization in Vietnam Feeding Asian Cities Regional Seminar, Bangkok, Thailand, 27-30 November 2000. FAO, AFMA, CITYNET. Rome: FAO. (15)

Keywords: peri-urban agriculture, crop production, technology

Information on agriculture in Hanoi (capital city) and Ho Chi Minh City is given along with the contribution of peri-urban agriculture to supplying these cities. Emphasis has been on vegetable production in the peri-urban area of Hanoi and its constraints. Constraints identified are: quality of the vegetable products and supply seasonality of the Hanoi market. Seasonality is the constraint discussed in this paper. Farmers' strategies based on diversification, and institutional activities based on innovative technology transfers are the solutions adopted to overcome this constraint. Further developments are proposed for better complementary management of rural-urban products in supplying urban markets and new technology transfers.

Mundle S., and B. Van Arkadie. 1997. The rural-urban transition in Viet Nam: some selected issues. *Economics and Development Resource Center Occasional Paper No 15.*. Manila: Asian Development Bank. Philippines. (16)

Keywords: rural-urban, management, policy

The paper analyzes the urban-rural process in Vietnam in its transition to a market economy. The paper states that the government will face decisions that will affect the development patterns of the urban and rural linkages and their own development. Certain positive benefits could arise, however some negative scenarios may result in the over-concentration of resources in one or two metropolitan centers, with poor links to rural development, thus an increasing gap between rural and urban areas. The negative impacts can be minimized with policy and investment options explored in the development of regional areas. Vietnam has two core centers: Hanoi-Haiphong in the north and HoChi Minh City in the south. The two centers, which will be the centers of future growth, vary in their demographic and resource endowments, which imply the need for developing different approaches. The government is projecting the creation of a third center, in the central part of the country, although major developments will need to be undertaken, for example, transborder arterial roads, a deep water port, and an effort to link the coastal area to the hinterland.

Paule Moustier, Isabelle Vagneron, Bui Thi Thai. 2004. Some insights on the organization and efficiency of domestic vegetable markets in Hanoi (Vietnam). (3) *Cahiers d'études et de recherches francophones / Agricultures.* Number 13, volume 1, 142–7, Janvier-Février 2004 - L'alimentation des villes, Étude originale. (23c)

Keywords**:** private sector, vegetables, marketing.

The change to a market based economy in Vietnam, especially in the food market, has made decision makers and social scientists question the performance of private markets and the role of public authorities in market regulation. Results from quantitative and qualitative studies on vegetable markets in Hanoi challenge the common perception that private markets are disorganized. Commodity chains are organized in such a way they relate to transaction cost economics, where contractual arrangements exist depending on the demand for information on quality and punctuality of supply. Organizational patterns that include peri-urban production and assembling stages are a consequence of small-scale production and transport. This paper provides recommendations where the public sector needs to be more involved in credit production, improving transport, technical and market information for the development of off-season supplies and the promotion of producers' assembling associations.

Key for Location of Entries

1. **Agriculture publishing house:**
   6/167 Phuongmai, Dongda, Hanoi, Vietnam
2. **Center for Irrigation and Water Supply Research, VIWRR**
   No. 4, 165 by-street, Chua Boc, HaNoi, VietNam.
3. **Hanoi Agricultural University (HAU)**
   TrauQuy, GiaLam, HaNoi, Vietnam.
4. **Hanoi Architectural Institute (HAI)**
   389 DoiCan, BaDinh, HaNoi, Vietnam
5. **National Centre of Natural Science and Technology**
   Institute of Materials Science
   No. 18, **Hoang** Quoc Viet Street, Cau Giay, HaNoi, Vietnam
6. **National Institute of Malariology, Parasitology and Entomology (NIMPE)**
   BC10200, Luong The Vinh street, Tuliem, Hanoi, Vietnam
7. **National Institute of Occupational and Environmental Health, Hanoi**
   1B Yecsanh, HaNoi, Vietnam
8. **National Institute of Animal Husbandry**
   ThuyPhuong, Chem, TuLiem, HaNoi, Vietnam
9. **Research Institute for Aquaculture No.1**
   Dinh Bang, Tu Son, Bac Ninh Vietnam
10. **Science and technology journal of agriculture and rural development**.
    Ministry of agriculture and rural development, Hanoi, Vietnam
    No. 2, Ngocha street, Hanoi, Vietnam
11. **Vietnam Agricultural Scientific Institute (VASI)**
    Van Dien, ThanhTri, HaNoi, Vietnam

Articles available on the Internet

12. **Apropriate Infrastucture Development Group (AIDG)**

    http://www.aidg.net/index.php?option=com_remository&Itemid=34&func=download&filecatid=48

13. **AVRDC The World Vegetable Center**

    http://www.avrdc.org/pdf/TB32.pdf

14. **Acta Horticulturae**

    http://www.actahort.org/books/536/536_41.htm

15. **International Cooperation for Agricultural Research and Development (CIRAD)**

    http://publications.cirad.fr/une_notice.php?dk=477494

16. **Econopapers**

http://econpapers.repec.org/paper/fthasdbed/15.htm

17a. **Food and Agriculture Organization (FAO)**
http://www.fao.org/ag/ags/agsm/sada/asia/DOCS/DOC/Tran1.doc

17b. **Food and Agriculture Organization (FAO)**
http://www.fao.org/AG/aGa/agap/FRG/FEEDback/lrrd/lrrd10/3/met1031.htm

17c. **Food and Agriculture Organization (FAO)**
http://www.fao.org/ag/ags/agsm/sada/asia/DOCS/DOC/Debon1.doc

18. **Hartford Web Publishing**
http://www.hartford-hwp.com/archives/25b/003.html

19. **International Development and Research Center (IDRC)**
http://www.idrc.ca/es/ev-4277-201-1-DO_TOPIC.html or
http://network.idrc.ca/ev.php?ID=4277_201&ID2=DO_TOPIC

20. **International Food Policy Research Institute (IFPR)**
http://www.ifpri.org/divs/fcnd/dp/fcndp193.htm

21. **International Potato Center (CIP)**
http://www.cipotato.org/market/PgmRprts/pr99-00/58hanoi.pdf

22. **International Water Management Institute (IWMI)**

www.iwmi.org/pubs/working/WOR30.pdf

23a. **John Libbey Eurotext**
http://www.john-libbey-eurotext.fr/en/revues/agro_biotech/agr/e-docs/00/00/EA/63/resume.md?type=text.html

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http://www.john-libbey-eurotext.fr/en/revues/agro_biotech/agr/e-docs/00/03/FE/E0/resume.md?type=text.html

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http://www.john-libbey-eurotext.fr/en/revues/agro_biotech/agr/e-docs/00/03/FE/EF/resume.md?type=text.html

24. **Journal of the American College of Nutrition**
www.jacn.org/cgi/content/full/20/6/616

25. **Mekarn**

http://www.mekarn.org/procbiod/chinh.htm

26. **Metafro Infosys**

www.metafro.be/leisa/1994/10-4-26.pdf

27a. **Nông nghiệp Vietnam**
http://www.avrdc.org/susper/publications/m.figuie-vege%20consumption%20behavior-vn.pdf

27b. **Nông nghiệp Vietnam**
http://www.avrdc.org/susper/publications/spatial%20n%20institutional%20org-hanoi.pdf

28. **Papussa**

http://www.papussa.org/publications/ua_magazine_14/uam14_article5.pdf

29a. **Research Center for Urban Agriculture and Food Security (RUAF)**
www.ruaf.org

29b.**Research Center for Urban Agriculture and Food Security (RUAF)**
http://www.ruaf.org/book/print/801 or http://www.ruaf.org/node/867

29c.**Research Center for Urban Agriculture and Food Security (RUAF)**
http://www.ruaf.org/node/133

30. **Stockholm Environment Institute (SEI)**
http://www.sei.se/red/red9503g.html

31. **United Nations Industrial Development Organization (UNIDO)**

http://www.unido.org/file-storage/download/?file_id=40544

32a. **University of Toronto**

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32b.**University of Toronto**
http://www.utoronto.ca/env/vietpro/waste/Chapt2.htm .

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10. **Science and technology journal of agriculture and rural development**. ISSN 0866-7020. Ministry of agriculture and rural development, Hanoi, Vietnam.
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