

# **Urban Horticulture in Africa and Asia, An Efficient Corner Food Supplier**

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## **Abstract**

**Peri-urban agriculture is still the subject of intense debate as regards its viability, its efficiency in urban food supply relative to rural production, and the rationale for the state to protect it from urban development. The paper investigates the role of urban horticulture in the supply of African and Asian cities and the importance of maintaining proximity between farmers and consumers of vegetables. It draws on insights of spatial economics as regards physical proximity and institutional economics as regards relational proximity. It is based on market surveys in various cities of Africa and South-East Asia, especially on the origin of food products, and the relationships between buyers and purchasers. The results show the importance of urban agriculture in the overall supply of the most perishable vegetables, i.e., leafy vegetables, and its complementarity with rural areas for other vegetables in seasonal supply. In addition to the advantage of quickly bringing fresh perishable products, proximity has advantages in terms of short marketing chains with low marketing costs. In some situations, it also helps in building confidence between farmers and consumers, in particular as regards vegetable safety. Finally it contributes to food sovereignty. The paper concludes by arguing why it is legitimate for the public sector to support a non-polluting multi-functional urban agriculture.**

## **INTRODUCTION**

Since the 1990's, the subject of peri-urban agriculture has drawn the attention of a growing number of scholars around the world. This is mostly due to the present context of fast urban growth, together with rising urban poverty. While urban population accounted for less than 25% of the total population in 1950, it will bypass the rural population by 2007, and account for 60% of the total population in 2030 (United Nations, 2003). Growth is especially fast in the cities of developing countries, which will absorb most of the population growth in the period 2000-2030, with an increase in population from 2 to 4 billion. While at the end of the 1970s, the urban bias of the public policies was denounced by Michael Lipton as a bias in favour of the wealthiest population, we are now witnessing the urbanisation of poverty which will rise from 30% in 2001 to 40% in 2002 and 50% in 2030 (Ravaillon, 2001). The dramatic urban growth has not paralleled with the development of enterprises and infrastructures necessary to absorb the new employment needs (Henderson, 2002). Hence the income gap is widening between a class of wealthy civil servants and traders versus the poor working in the informal sector.

In addition to employment needs, urbanisation creates food requirements, both in quantity and diversity, particularly in favour of vegetables, fruits, fish, and meat. Finally, urban development poses huge environmental challenges. It is estimated that production of wastes will be multiplied by four in cities in the next thirty years (Mougeot and Moustier, 2003). If urban agriculture attracts a growing attention of researchers and development stakeholders, it is mostly because it brings some answers to these social, economic, and environmental challenges (see Figure 1).

In relation with these three types of impacts, a growing body of the literature presents the virtues of urban agriculture. Yet peri-urban agriculture is the subject of intense debate as regards its viability and the necessity for political support. In a challenging paper, Ellis and Sumberg (1998) provided a number of reasons why scarce public resources should not target urban agriculture. The paper stressed that in light of the high land costs in the urban areas and the fact that the land is still not enough to cater to housing and infrastructure needs, it would seem legitimate to let agriculture move towards rural areas whilst at the same time improving the transport infrastructures, as what occurred in Europe. Moreover, urban agriculture is subjected to many types of pollution and is itself a pollutant. In fact, urban agriculture takes advantage of market distortions and can be only transient. The advantages in terms of quality brought by proximity between suppliers and customers, in particular trust, may also be a transient consequence of quality regulations not being adequately enforced. But most of all, the authors looked at the lack of rigorous quantitative data to assess the social, economic, and environmental impact of urban agriculture.

It is the purpose of this paper to contribute in answering this research deficiency and to bring original data which measures the contribution of urban agriculture to urban vegetable supply. The paper uses the insights of spatial economics, grounded by Von Thünen (1851-translated by Huriot, 1994), which enable the researcher to better understand the economic reasons behind the location of supplying sources, in particular the relationship between the proximity between production and consumption areas and the perishable nature of the products. Institutional economics and sociology go further in the analysis of the influence of market proximity on production characteristics. Beyond sole physical attributes of transport, storage or land costs, which can be termed as physical proximity, relational proximity is brought to the fore, in the sense of regular interactions between farmers and market agents, farmers and consumers, and also within the farming community itself (Torre, 2000).

## **MATERIAL AND METHOD**

The recognition of the specific role of UA in urban food supply implies original sources of data. Putting in parallel what is produced in a year in the city with what is consumed in the city with available statistics gives a useful indication of the potential contribution of UA in urban food supply (see Mai thi Phuong Anh and al, 2004; Ali, de Bon and Moustier, 2005) Yet it has some limitations, including the difficulties in grasping the perishable, seasonal products; and the fact that it does not consider the destination of products. Appraising precisely the role of UA in urban food supply implies surveys in wholesale and retail markets, and questions on origin and quantities of products traded. This should be conducted at different times of the year to take account of seasonal variations (between twice and four times a year according to regions). This data collection implies many difficulties, as most fresh products are sold either early in the morning, late in the evening, or at night. In instances when time is limited, the studies had to focus on some products, at least the fresh vegetables, as they provide the bulk of what is supplied

by urban areas. Hence these surveys have also their limitations as they do not cover all days of the year and all markets. But they often provide unique material on the contribution of urban agriculture to food marketed in the major urban wholesale and retail markets.

Figures on the importance of UA in urban food markets using such surveys have been gathered in Cirad case studies conducted between 1990 and 1995 in Central Africa. Details on surveys and results are given in David (1992) for Bangui, David and Moustier (1993) for Bissau, Moustier (1996) for Brazzaville, and Laurent (1999) for Nouakchott. More recently, between 2002 and 2005, similar surveys were conducted in Vietnam (Hoang Bang An et al, 2003), Laos (Kethongsa and al, 2004) and Cambodia (Sokhen and al, 2004; Moustier et al, 2004). The IDRC supported similar studies in Ghana via IWMI (Drechsel et al., 2004). Secondary data on contribution of urban agriculture to food supply was also used in the paper for other cities and for staple food crops (see references in Table 1). Besides, Cirad studies involved in-depth interviews on a sample of farmers and traders on the relationships between buyers and sellers, particularly the regular nature of the relationship and the possible commitments in terms of quality.

In this paper, UA is defined as agriculture located inside the city (intra-urban agriculture) and at its close periphery (peri-urban agriculture) for which there is an alternative between agricultural and non agricultural urban use of resources. This alternative generates possible competition and complementarity between resource uses: land for housing versus agricultural purposes; water for drinking versus irrigation; urban wastes possibly recycled for agriculture (Moustier and Mbaye, 1999; Mougeot, 1999). While the location of intra-urban agriculture may be defined by the administrative boundaries of the city, the delineation of peri-urban agriculture is more difficult, even with the above specifications, and encompasses some level of arbitrary choice. In the cities we investigate (see references above for Africa and Asia), the boundaries of UA as previously defined extend until around thirty to fifty kilometres from the city centre.

## **MAIN RESULTS**

### **The specific role of UA in the supply of perishable food commodities**

The available data confirm the importance of UA in the provision of perishable food commodities, including fresh perishable vegetables, dairy products, and plantain banana (see Tables 1-3). Fresh vegetables supplied by UA are leafy vegetables like amaranth, sorrel, morel, cabbage, lettuce, and chives. These vegetables top the list of vegetables consumed in Africa and in Asia, along with onion and tomatoes (Moustier and David, 1997; Ali, 2000). They are well known for their fragility (after one day they are no longer fresh) in countries where freshness is an important criterion for consumers who often do not have refrigerators. These leafy vegetables are mostly brought into town from distances of less than 30 kilometres from the city centres, be it in Africa or in Asia. The UA origin represents more than 70% of the quotations in all the cities investigated. In Hanoi in 2002, more than 70% of all leafy vegetables came from a production radius of 30 kilometres around the city. Ninety-five to 100% of all lettuce comes from less than 20 kilometres away, while 73-100% of water convolvulus is harvested less than 10 kilometres from the city (Hoan Bang An et al, 2003). In Phnom Penh, urban areas, i.e., those located inside the municipality, are supplying all the kangkong marketed in Phnom Penh (estimated from our market surveys at 2,000 tons per year). This is a vegetable

particularly important for the consumption of the poor (Agrisud, 2000). Kangkong is especially produced in Dangkor and Mean Chey districts.

In the case of less perishable vegetables, such as tomato and cabbage, which can stay fresh for a few days, supply varies from peri-urban to rural production. The share of peri-urban percentage of supply is highly variable according to the city under study and season. Dry onion, which is even less perishable, originates only from rural areas or from imports in the investigated cities of Africa. As regards staple food such as rice, plantain banana, and maize, the situation is highly variable according to the cities. In Asia, the share of rice supplied by the city to urban residents ranges from 7% (in Phnom Penh) to 100% (in Vientiane, where pressure on land is low), Hanoi being an intermediary case with 58% (Mai Thi Phuong Anh et al., 2004; Ali et al., 2006), and a steady decrease in the production of rice in favour of vegetables.

### **Complementarities in time**

A comparative advantage of urban agriculture may be in the period of the supply compared with rural areas, either because of specific natural conditions (the positioning of cities is sometimes related to the agricultural potential of the hinterland, as in the case of Dakar), or because the urban farmers are able to have more continuous supply because of more specialised and irrigated production— a characteristics they may share with some specialised rural areas. This comparative advantage is especially observed in areas of dry climate and in the dry season for the temperate vegetables. In the rainy season, the access to non-flooded areas is easier in rural areas. In Mauritania, urban agriculture is able to supply the market with vegetables on a more continuous basis than the rural areas (Laurent, 1999). In Bangui (David, 1992) and Bissau (David and Moustier, 1993), the share of UA in the vegetable supply increases by 10% in the dry season. In Hanoi, while 75% of tomato is grown less than 30 km from Hanoi during the cold dry season, 80% of tomatoes originate from China, and, in the rainy season, 15% from Dalat which is located more than 1000 km from Hanoi (Hoang Bang An et al, 2003). In Phnom Penh and Vientiane, the market is supplied with peri-urban tomatoes in the dry season, extending from November to April, and by a combination of peri-urban, imported and rural sources the rest of the year (Sokhen et al, 2004).

### **The characteristics of proximity in market organisation**

**1. Short marketing chains.** Urban-produced commodities are distributed through short marketing chains relative to rural commodities (see Figure 2). The extreme case is direct producer involvement in retail sales. This is the case of 30% of all transactions in Bangui (David, 1992) and 70% in Bissau where private trade had just been legalised (David and Moustier, 1993). More often than not, the producer sells to retailers. This transaction takes place in the field or in night wholesale markets, in Brazzaville, Bangui, Bissau as well as in Hanoi, Phnom Penh or Vientiane (Moustier and David, 1997; Sokhen et al, 2004; Kethongsa et al., 2004). In Hanoi, more than 40% of all wholesale market sellers are also producers. This percentage goes up to 100% for water convolvulus (kangkong).

Quantities collected are small: between 5 and 10 kilos of collected and sold produce per day per retailer/collector in Brazzaville. In Hanoi, producers bring 100 to 200 kilos per day to wholesale markets on overloaded bicycles or scooters. For Vietnamese rural producers, the wholesaler/collector step is more systematic, as it exists for more than 70% of all produce from rural areas. Wholesalers bringing vegetables between the North and the South of the country can sell up to 100 tons a day (Bui Thi Thai, 2000). In Phnom

Penh, the marketing chains of kangkong are short, and 57% of retailers are directly supplied by the farmers who get more than 50% of the final price. Hence the kangkong-growing areas are important from the poverty point of view of both farmers and consumers (Sokhen et al, 2004). On the other hand, tomato, which mostly originates from Vietnam, is traded through collectors and wholesalers while on the retail stage for more than 60% of transactions.

Some cities display variations relative to the described situation of short marketing chains between production and consumption for peri-urban vegetables. In Vientiane, despite the short distance between farms and markets, the marketing chains are characterised by a certain complexity. The combination between wholesale and retail, collection and wholesale, is frequent. More than half of the traders combine different functions. The typical chain involves farmers, collectors, wholesalers, and retailers. More than 65% of quantities traded involve more than one intermediary between farmers and retailers, even for a perishable vegetable like water convolvulus. The frequent overlapping of functions may be explained by the absence of a specific location for wholesale marketing which happens in the same places where retail transactions are held, and also by the small volumes transacted (less than 200kg/day for wholesalers and retailers), and the modes of transport (tuk-tuk is dominant).

The strong involvement of farmers, or their relatives, in the marketing of their products can be termed as vertical integration which bears a positive impact on the reduction of transaction costs implied with the marketing of perishable products, of varying quality characteristics (see basic theory on the relationship between transaction cost reduction and institutional arrangements in Williamson (1985) and applications in the horticultural sector in Jaffee (1995), Lyon (2000), Moustier (1996)). It is also explained by the small-scale production and low final prices, which makes it attractive for producers to prefer spending longer hours in transport to get as much products as possible for cheaper final price. Yet these characteristics contribute even more to the fragmentation of the final supply, while economies of scale could be reached by more collective marketing. Experiences of collective marketing are little developed in peri-urban areas though, or little successful, given the variability of production in quantity and quality that makes farmers reluctant to “put their eggs in the same basket” as other farmers who may be unsuccessful and draw marketing results downwards. Yet there are some successful examples when farmers share similar characteristics and have identified reliable marketing outlets, e.g., the safe vegetable cooperatives in Hanoi and Ho Chi Minh City (see Moustier et al., 2006), as well as vegetable farmers’ groups in Yaoundé who have organised themselves to sell by a rotation formula. The cooperative horticultural marketing by HOPCOMS in Bangalore is another example (Premchander, 2003). Yet such experiences, and especially their economic efficiency relative to individual marketing, are not enough documented. Besides, the lack of concentration of production in place and time makes the circulation of market information difficult among farmers as regards the state of market supply. A solution to this problem is the reliable information to both producers and traders regarding untapped outlets, and also to facilitate discussions among them on strategies for adapting supply to demand. Such a vegetable market information and consultation system has been set up in Vietnam (Moustier, 2006).

**2. Relational proximity.** Relational proximity is a common feature of the relationships between farmers and traders in developing countries, especially for perishable products. It has been documented by a number of researches for marketing chains from rural as well as urban areas (see Lyon, 2000; Cadilhon et al., 2006), and as such is characteristic of

urban areas as perishable products are more frequently found there. What may be more specific of urban areas is the existence of relational proximity between farmers and consumers, and the possible existence of direct relationships between them. Farmers' markets where farmers meet consumers directly have been especially well documented by Kirwan (2004) in England. In developing countries, direct sales are also observed as a way of promoting organic or IPM vegetables, such as the farmers' direct delivery to a list of consumers organised in Hanoi and in Phnom Penh with the support of a marketing company and of an NGO respectively. This has also been observed in mushroom farmers in Accra with their door-to-door delivery of fresh mushrooms to targeted consumers (Danso and Drechsel., 2003). Marketing chains are all the more short that farmers try to promote the safety of their products (see below).

### **The advantages of proximity**

**1. Low price differential.** Short marketing chains enable low price differential between farm and final consumption. These account for 30 % of leafy vegetables in Hanoi, 35 % to 50% of cabbage, and 75 to 80 % of tomato, while they are more than 100% of vegetables brought from Dalat or China, and more than 200% of vegetables traded from Red River Delta to Ho Chi Minh City (Gia B.T., 1999; Thai, 2000; Son et al., 2002; Moustier, 2006). In the rural chains, wholesalers' incomes may be up to ten times higher than that of farmers (but the risks of bankruptcies are also higher for wholesalers and they also make more investment). Price differentials are higher for rural products due to higher transportation costs and higher wholesalers' margin rate. While the prices of peri-urban vegetables in Congo shifted from 1 to 2 from farm to retail, the price differential was 1 to 3 for rural vegetables, 20 to 80% of the marketing margin being absorbed in transport costs (Moustier, 1996). And in Havana, Cuba, the price of tomato, onion, pork, and fruits fell from 3 to 1 between 1999 and 1994, the period when the urban agricultural programme was launched (Novo, 2002). The government has provided free land access for more than 26,000 gardeners, including technical training on organic and hydroponic cultivation (Moskow, 1999).

**2. Freshness.** In a situation of limited access to fridges, freshness is especially valued by urban consumers. In Thiès (Senegal), more than 90% of 150 interviewed housewives declared they thought it is important that vegetables are grown nearby, for freshness and quick access (Broutin et al., 2005). In Vientiane, freshness is the criteria of vegetable choice quoted by the highest number of consumers (71% out of 100 interviewed, in Potutan et al., 1999). In Hanoi, freshness is the advantage of peri-urban vegetable production quoted by 74% respondents out of 500 in 2003 (Figuié, 2004).

**3. Information and control of food safety.** It is commonly believed that food safety risks are higher in urban area productions than in rural areas because of the various sources of pollution (e.g. heavy metal in water used for irrigation) and limited land area, pushing the farmers to excess use of fertilisers and pesticides. Yet studies comparing safety risks in urban and rural areas are difficult to find. When measuring pesticide residues in peri-urban Hanoi, Phnom Penh, Vientiane, as well as in Dalat, a rural area of Vietnam, excess pesticide residues were found in some types of leafy vegetables in all locations, apart from peri-urban Vientiane (Sokhen and al, 2004; Kethongsa et al., 2004). Besides, many variations were found in peri-urban Hanoi according to the location of the vegetable field depending on farmers having gone through regular IPM training. Yet

growing vegetables in wastewater is indeed a source of concern. In Mean Chey district of Phnom Penh, there is a specific production of 35 hectares of water spinach in the wastewater basin (Boeung Tumpon), where 838 families of fishermen are living (according to the statistics of department of statistics in 2001). Some analysis of water spinach carried out by Susper project shows excess residues of heavy metal in the water spinach. A project of the municipality to treat the waste water for reuse in agriculture may solve this problem.

On the other hand, the proximity of production areas with consumers provides them with advantages for easier quality control. In Hanoi, supermarkets, shops, and restaurants are mostly supplied by three cooperatives located in the peri-urban areas where production along IPM or organic standards is certified by government bodies (Moustier et al., 2006). Proximity enables frequent contacts between farmers, traders, and consumers and the checking of the production process. This is particularly the case of Van Tri cooperative whose members retail vegetables directly to consumers, or of organic farmers who may deliver directly baskets of vegetables to households. Proximity between farmers and consumers is not a perfect substitute to public independent control which is still deficient in Vietnam, but it indeed reinforces incentives for farmers not to deceive their purchasers' trust. The Van Tri cooperative is an interesting example of successful collective action and vertical integration in the chain. It comprises thirteen members who grow about 100 tonnes of vegetables per year on an area of 3 hectares, which is within the guidelines on safe vegetable production developed by the Ministry of Agriculture. In 2004, the Van Tri cooperative's vegetables were retailed via ten points of sale managed by a member of the cooperative, selling an average of 200 kilograms of vegetables per day. The direct sales of Van Tri vegetables by the producers allowed regular contact with the consumers who ask questions and are given answers concerning the production methods used by the cooperative. The collective action of the Van Tri producers allows them to create a collective good, the reputation for quality, which could not be achieved through individual actions (Tallec and Egg, 2006). Currently, the system needs some improvement as regards to the control of vegetable quality, as it is mostly directed by an internal system of control by farmers themselves and extension agents. A similar involvement of a peri-urban farmers' group in the production and marketing of safe vegetables, with the labelling including the origin of product and methods of production, and delivery of a supermarket, is observed in peri-urban Ho Chi Minh City (Phan Thi Giac Tam and Le Thanh Loan, 2005).

In India farmers located around Aurangabad sell their vegetables through urban organic bazaars organised on a fortnight basis. Local certification is obtained through "eco-volunteers", people usually working in the vicinity of the vegetable farmers (den Braber, 2006). The irregular nature of vegetable production is a major drawback of all direct sales by organic or IPM farmers, as they are tempted to buy from other sources than their own, which then creates more difficulties in guaranteeing the safety of the product (den Braber, 2006).

## **DISCUSSION AND CONCLUSION**

The importance of peri-urban areas in supplying fresh, perishable products, while the rural areas supply more bulky and easy to store product is in line with Von Thünen predictions. Besides, peri-urban areas have transport cost advantage compared with rural areas which translate into lower final price. Yet it could be argued that the situation is distorted by land costs which do not reflect the real value of land if the free land market

was in operation. But in the same way, it could be argued that the cost of transport from rural to urban areas is distorted by not taking into account the externalities created by negative environmental impact of transport by road. The growing shortage of oil will indeed make corner food supply even more valuable than its present status.

The paper shows that rather than opposing either rural or urban area horticulture, it is better to consider them in a complementary way as none of them taken separately can entirely provide for the urban consumption needs (illustrated in Figure 3). It also suggests that in addition to the reduction of physical transport costs, bringing production close to consumption reduces the information and transaction costs related to marketing by favouring direct contacts between producers and consumers. This is especially important when guaranteeing food safety.

Other factors than distance also give specific advantages to urban agriculture. In certain cases the hinterland of cities is especially favourable for agriculture, and there are cases when a city was established in a given location because of a rich agricultural hinterland. Besides, compared with rural areas, farmers are motivated to earn regular cash income all year-round out of small plots in order to be able to buy food and ensure a regular livelihood, while in rural areas some land can be reserved for subsistence food production. This explains why urban production tends to be less seasonal than rural production, which is an important factor for guaranteeing food security in urban areas.

The possibility for citizens to exert control on the way food is produced can indeed be considered as a legitimate right. “From a food-democracy viewpoint, one’s right to be fed needs to embrace one’s right to feed oneself” (Koc et al, 1999). Yet, the development of international trade, as well as the globalization of capital in food distribution, is now widely documented (see in particular Mc Michael, 1984; Reardon and Berdegúé, 2002). This creates risks of growing distance between producers and consumers. Durability of food is developed at the expense of its sustainability (Friedmann, 1994). “More rapidly and deeply than before, transnational agri-food systems disconnect production from consumption and relink them through buying and selling (Friedmann, 1994). The pressures to regionally reconstruct links between producers and consumers is apparent in many places, whether from economic desperation or from urban politics that place a higher priority on ecologically sound land use and uncontaminated foods than on the social and technical imperatives of monocultural farming” (Friedmann, 1994).

The impact of supermarkets and restaurants development on the characteristics of supplying chains including proximity versus distance should be paid greater attention. As seen in the previous section, the proximity between production and distribution can give advantages to urban farmers in terms of promotion of their product quality. This is itself an advantage for the supply of supermarkets if urban farmers can ensure regularity of product supply through large-scale production with the characteristics of entrepreneurial or farmers’ group production.

Finally, in addition to its role in urban food supply, urban agriculture plays a number of environmental, social, and economic functions, which still has to be recognised by the urban authorities. Multifunctionality, usually defined as the multiple roles or objectives that society assigns to agriculture, including economic, social, and environmental roles, is a typical characteristic of urban agriculture (Vollet, 2002; Véron, 2004; Duvernoy et al., 2005; Ali et al., 2006). Urban agriculture creates landscape, i.e. a public good, in which users cannot be excluded. This makes land management of little interest to the private sector (Donadieu and Fleury, 1997). Urban agriculture produces other things of value to the public, such as food security (in both Southern and Northern



counties, as well as with family gardens); social insertion, and jobs. Within cities, other sectors create landscape, such as parks, to which UA can be compared. The advantage of urban agriculture over other 'landscape producers' is that its functioning is supported by market forces, even if these markets are imperfect. It is thus a less expensive landscape producer than a public park. It also provides jobs and social inclusion.

The multi-functionality of urban agriculture makes it a 'cheap' producer of public good. Table 4 compares the 'scores' of three urban sectors - industry, parks, and agriculture - in terms of production of different goods and services. It shows that agriculture gets the highest combined mark.

Increasing distances between urban centres and agriculture is, however, irreversible, if market forces are given a free hand. This is due to the fact that it is more economically sound to develop land than farm it, other than such exceptions as swamps. Hence, from a political economy viewpoint, it is legitimate that the public sector supports UA. In fact, for urban agriculture to be successfully maintained in the city, farmers and non farmers should share some objectives, duties, and rights to examine (from the urban residents' side, on landscape and environment; from the farmers' side, on protection relative to land development). Instead of claiming a specific space for urban agriculture, farmers have to negotiate its sharing with other users (Mbiba and van Veenhuizen, 2001). In the Southern Holland city of Delft, a farmer was able to negotiate a 12-year term lease for 35 hectares of land with the municipality, thanks to his commitment of producing organic vegetables and milk, and also the setting aside of 5 hectares of land for nature preservation (Deelstra et al., 2001).

Four areas of support are particularly relevant for public support to UA: (i) integration in urban planning; (ii) financial support, (iii) research and extension for more profitable and sustainable intensive commercial vegetable and animal systems (Midmore and Jansen, 2003); and (iv) innovative marketing, including quality labelling. The municipality has a crucial role to play in organising such a support, in collaboration with national and international programmes.

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Table 1. Percentage given to urban production in urban supply in various cities of Africa and Asia

	Leafy vegetables	Tomato	All vegetables	Maize	Plantain banana	Rice	Milk	Dry onion	All
Brazzaville (1)	80%	20%				0%		0%	
Bangui (2)	80%	40%				0%		0%	
Yaoundé (4)	80%	25%		90%	60%	0%		0%	
Bissau (5)	90%	50%				0%		0%	
Nouakshott (6)	90%	10%				0%			
Dar es Salaam (7)			90%				60%		
Dakar (8)			60%					0%	
Kumasi(9)		60%	90%	10%	15%				
Accra (10)			90%						
Hanoi (11)	70%	0 to 75% according to season	40%			58% (12)			44% (12)
Phnom Penh (13)	100%	0 to 50% according to season				7%			
Vientiane (14)	100%	20 to 100% according to season				100%			
Shanghai (15)			60%				90%		
Havana (16)			58 %						

(1) Moustier, 1999

(2) David, 1992

(3) Mbaye and Moustier, 2000

(4) Dongmo, 1990

(5) David et Moustier, 1996

(6) Laurent, 1999

(15) Yi-Zhanh and Zhang, 2000. See also Urban Agriculture Magazine 2002 special edition for world food summit for other figures.

(7) Jacobi et al., 2000)

(8) Mbaye and Moustier, 2000

(9) and (10) Danso and Drechsel,2003  
;Cofie et al.,2003

(11) An et al., 2003

(12) Mai Thi Phuong Anh et al., 2004

(13) Sokhen, Dianika and Moustier,  
2004

(14) Kethongsa, Khamtanh and  
Moustier, 2004

Table 2. Typology of vegetables according to their origin in Phnom Penh - Origin represents more than 90% of flows in 2002 and 2003 (Surveys done in January, April, July, and October). Source: Sokhen et al., 2004; Moustier et al., 2005.

Phnom Penh vegetables	Kandal vegetables	Vietnam vegetables
0 to 20 kilometers	20 to 40 kilometers	400 kilometers
Kangkong	Choysum	Tomato (*)
	Lettuce	Cabbage
	Yard longbean	Chinese cabbage

(\*) except in January 2003 and 2004 when tomato originates from Cambodia (peri-urban and rural areas).

Table 3. Typology of vegetables according to their origin in Vientiane - Origin represents more than 90% of flows in 2002. Source: Kethongsa et al., 2004.

Vientiane vegetables	Thailand vegetables
0 to 30 kilometers	30 to 500 kilometers
Kangkong	Tomato, Chinese kale and cucumber (between July and September)
Pakchoi	
Chinese mustard	
Lettuce	
Eggplant	
Tomato, Chinese kale and cucumber between September and July	

Table 4. Comparative Multi-functionality of three urban sectors. Source: Moustier, 2003; Donadieu and Fleury, 1997.

Products	Sectors		
	Industry	Parks	Agriculture
Landscape	-	++	+
Economic good	++	-	+
Jobs-Social insertion	+	-	+
Food Security	-	-	++

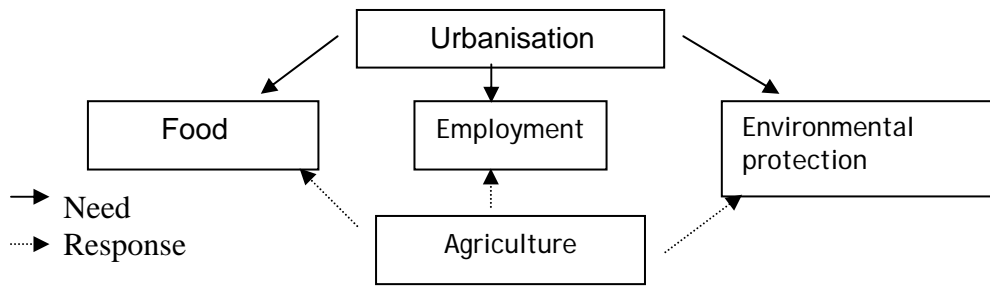


Figure 1. Urban agriculture, a response to urbanisation challenges.

<b>Short urban vegetable Commodity Chain</b> Farmer → (Collector) → (Retailer) → Consumer
<b>Long rural vegetable Commodity Chain</b> Farmer → Collector → Wholesaler → Retailer → Consumer

Figure 2. Marketing chains for UA and rural agriculture.

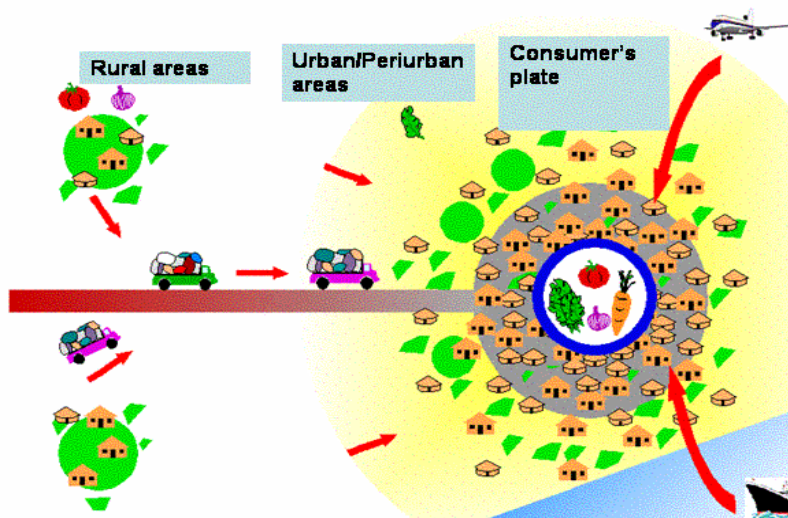


Figure 3. Complementary rural and UA vegetable flows.