Lynch, Kenneth (1995). *Sustainability and urban food supply in Africa.* Sustainable Development, 3 (2), 79-88. ISSN 1099-1719

Sustainability and Urban Food Supply in Africa

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This is a draft of a paper later published later as:
Lynch, Kenneth (1995) Sustainability and urban food supply in Africa. *Sustainable Development.* 3(2), 79-88. ISBN:1099-1719 DOI: 10.1002/sd.3460030205

ABSTRACT

Agenda 21 has made a major contribution to a range of aspects of development initiatives, of which one chapter, Chapter Seven, focuses on sustainable human settlements. There is a growing literature on issues relating to food supply to urban areas in the Third World. This literature has a number of focuses, particularly fruit and vegetables, urban agriculture and food marketing. This paper discusses the main aspects of the chapter of Agenda 21 relating to sustainable human settlements and of the role that the emerging research on urban food systems suggests can be played in establishing sustainable development in Third World cities. This paper will pay particular attention to Dar es Salaam Tanzania, and the author will draw on both his own research and related research.

INTRODUCTION

African cities are growing very rapidly. African urban population was 210 million in 1990 and has been estimated to increase to 766 million by 2020. Evidence from the recent past would suggest that much of this growth will take place in a small number of cities (Simon, 1992). The challenge for African countries will be to provide for the needs of this rapidly growing urban population. One of the most fundamental needs of this population will be food (Drakakis-Smith, 1991).

The 1988 Census of the population of Tanzania reported that Dar es Salaam had a population of 1.4 million and a population growth rate of 4.8 per cent (United Republic of Tanzania, 1989). Assuming continued growth at this rate, the population of Dar es Salaam will reach 2 million by 1996 and 3 million by 2003. Indeed the census may have underestimated the population of Dar es Salaam (Briggs, 1993) which may already be over 2 million at the time of writing. The city draws on a wide hinterland for its food needs, putting pressure on the existing food system. Figure 1 shows that food crops are transported considerable distances to Dar es Salaam, some coming from as far away as Mbeya a journey of up to 12 hours by lorry. The cost of food is consequently relatively high. The proportion of income spent on food by low income groups in Dar es Salaam was 50 per cent in 1940, which rose to an estimated 85 per cent by 1980 (Sawio 1994; Bryceson, 1985).

There is a growing literature on urban agriculture, fruit and vegetable production and food retailing and consumption, however much of the literature is produced for specific clients rather than being more easily available in the public domain (Guyer, 1992; Egziabher *et al*, 1994). This body of research suggests the potential for urban agriculture is significant. For example in 1981 Shanghai's *neichiao* (inner zone) provided 76 per cent of vegetables consumed in the city from only 16 per cent of the cultivated land (Mougeot, 1994). In 1980 Karachi provided 50 per cent of its own fresh vegetables

(Wade, 1987). Similar levels of importance are reported in both Latin America and Africa (Egziabher *et al*, 1994). Maxwell (1994) estimates that in Kampala 36 per cent of the population within a 5km radius of the centre of the city are engaged in some kind of agriculture. In Dar es Salaam almost half of 260 surveyed by Sawio (1993) urban producers reported that urban agriculture contributed 20-30 per cent of the households' food supply. Aerial photography suggests that the area devoted to urban agriculture in Dar es Salaam accounts for 31,000 Has or 23 per cent of the city area (Schippers and Lewcock, 1994).

This paper sets out to review the main problems of providing food for the growing urban population. Agenda 21 is the main action document to have resulted from the United Nations Conference on Environment and Development, and has been the focus for much attention in the sustainable development efforts. This paper will evaluate the potential role of food systems, drawing on the author's and others' research in Dar es Salaam and the broader research literature.

Urban agriculture, is not a new phenomenon. There is considerable archaeological evidence which suggests that agriculture was an important pre-colonial urban activity in Africa, Latin America and parts of Asia (Mougeot, 1994). Atkins (1992) reported that as late as the nineteenth century, 80 per cent of London's milk consumption was met from production within the built-up area. This began to decline as the Victorians began to believe that cattle may be important carriers of disease. At about the same time the Victorians were also planning and building colonial towns and cities. One of the reasons for the lack of urban agriculture in Africa is because of a bias in the externally imposed European models of urban land use that were in vogue at the time, which were based on economic theory. The plans for the colonial towns and cities attempted to reproduce 'ideal' urban environments as islands of health and security. Lee-Smith and Memon (1994) argue that it is only in the post-Industrial Revolution period, especially as modern

capitalism has developed, that agriculture has been displaced from urban areas because it proved uncompetitive in relation to demand for housing and industry or because it was not considered a "city" activity. An exception to this is where it appears as a leisure pursuit in the form of allotments (Lawson, 1994), or at times of crisis, for example, in the UK many parks and golf courses were turned over to fields to produce food as part of the war effort during the Second World War.

Some of the concerns about health have persisted to the present day. Blame is attached to urban agriculture by some for the persistence of malaria in cities in East Africa because there is a belief that the malarial mosquitoes lay their eggs in maize stalks (Sawio, 1994; Mlozi, Mvena & Lupanga, 1991) . Sawio claims that this is not sufficiently proven and that the available evidence in fact suggests otherwise.

The predominantly male and temporary nature of the urban population in many African cities under colonial rule is another important explanation for the limited attention given to urban agriculture (Lee-Smith and Memon, 1994). These transient males supplemented their food requirements with food brought from their rural households, where their wife or wives and older children cultivated the households needs (Bryceson, 1985; 1987**)**. Had women been more prominent members of early African urban society, their important role as household reproducers in many African societies, would have ensured urban agriculture was a more prominent urban land use and activity today. Newly Independent African city authorities were reluctant to allow their cities to appear underdeveloped and backward, as they aspired to demonstrate development and growth. Under these aspirations urban agriculture, like shanty towns and slums, were not encouraged (Gilbert and Gugler, 1992).

Finally, urban agriculture, fresh foods and non-market supply are neglected as aspects of the urban food system. However, if urban agriculture in Dar es Salaam were stopped

tomorrow, not only would it raise prices of certain foods, it would result in an almost complete end in the availability of some foods such as leafy vegetables, for example, Amaranth, which form an important element (especially as a source of iron) in the Dar es Salaam residents diet (Mvena, Lupanga & Mlozi, 1991)

There is, therefore, a growing call for further research into the importance of urban and peri-urban agriculture (Briggs, 1992; Drakakis-Smith, 1992; Egziabher *et al*; Barrow, 1995). In addition there is a growing need for research into non-staple food crops and particularly their role in the food supply systems of urban areas in developing countries (Mascarenhas, 1984).

THE ROLE URBAN AGRICULTURE IN OBJECTIVES OF AGENDA 21 FOR SUSTAINABLE HUMAN SETTLEMENTS

Agenda 21 was one of the key documents to have come out of the United Nations Conference on Environment and Development, which took place in Rio de Janeiro in June 1992. It involved all signatory nations in a programme of 'global partnership for sustainable development' (UNCED, 1992, p.1). Agenda 21 had four overarching aims for the international economy which were intended to facilitate a climate for achieving environment and development goals. These were: (a) promoting sustainable development through trade liberalisation; (b) making trade and environment mutually supportive; (c) providing adequate financial resources to developing countries and dealing with international debt; and finally (d) encouraging macroeconomics policies conducive to environment and development.

One of the key difficulties frequently highlighted in this global approach relates to the appropriate scale for sustainable development action. The *World Development Report 1992* (World Bank) focused on environment and development issues and suggested that there is a general trend in the distribution of different environmental problems which corresponds roughly with the trend in the distribution of wealth. In parallel, Drakakis-Smith (1992) suggests that there is an increasing trend in the internationalisation of food systems in middle income countries, while in low income countries the problem is more about being able to provide sufficient food to feed the urban population. In both cases there will be an increase in demand, but with the poorer cities this will be closely tied to the growing population, while in the middle income cities this will be due to increased demand because of economic growth.

One of the chapters of Agenda 21 focuses on sustainable human settlements. The opening sentence acknowledges the scale and complexity of the problems to be tackled. For

example, there is an additional difference between the problems faced by industrialised and developing countries:-

> "In industrialised countries the consumption pattern of cities are severely stressing the global system while settlements in the developing world need more raw material, energy and economic development simply to overcome basic economic and social problems.
>
> (UNCED, 1992, p.6)

Nevertheless, the Chapter goes on to tackle the issues of sustainable development of human settlements in eight separate sections:-

> **A provide shelter for all;**
> **B improve human settlement management;**
> **C promote sustainable land use planning and management;**
> **D promoting integrated provision of environmental infrastructure;**
> **E promote sustainable energy and transport systems in human settlements;**
> **F promote human settlement planning and management in disaster-prone areas;**
> **G Promote sustainable construction industry activities;**
> **H promote human resource development and capacity-building for human settlements development.**
>
> (UNCED, 1992, p.6)

The remainder of this section will discuss each of the aims of Agenda 21 in relation to food supply and the possible policy and management measures which could be brought to bear to increase urban food sustainability. In each case examples of such approaches will be cited to support.

A provide shelter for all

This section involves the widespread use of financial funds to provide credit necessary for up-grading and the regularisation of land. Maxwell (1994) argues that when plans are proposed to regularise land and develop land tenure policies, which are frequently included in housing up-grading schemes, these plans should integrate issues of urban

agriculture. Failure to account for this land use, may have serious implications on the food self-sufficiency of the city. This has happened under modern planning paradigms, which have reduced the role of urban agriculture from their models of urban environments. Due to the current sparse base-line data it is not always easy to accurately assess the likely implications of such drastic changes to land availability. Where urban planning is taking place in cities with a high level of urban poverty, unemployment or underemployment, careful planning for urban agriculture can provide the low income residents with opportunities for ensuring household reproduction and at the same time release funds for self-help programmes, such as self-help housing.

B improve human settlement management

The Agenda envisages this aspect of action to take place specifically through urban management. It divides the main activities into three categories which will be discussed separately.

(a) management & planning (environment, infrastructure, etc.)

Lee-Smith and Memon (1994) point out that the urban agriculture producers, while they make up 30 per cent of the Kenyan urban population are not represented at the national level. Street hawkers, on the other hand, who make up an estimated 6 per cent of the Kenyan urban population, have a nationally organised representative organisation with an office in Nairobi. There is a similar organisation in Tanzania organised under the umbrella Federation of Small Business Associations for street traders, but no similar organisation for urban farmers. There is a suggested need for the organisation of urban producers and traders to ensure representation at the level of national policy and at the level of city or district planning, management and governance. Sawio (1994) quotes respondents in his survey: "These days everyone is a farmer, the street boy and the General Manager." This illustrates the prevalence of urban agricultural activities by people from a wide range of socio-economic backgrounds in Dar es Salaam. This might

suggest that urban agriculture draws on a large constituency, but also a potentially influential and articulate one. However, it would be remiss to assume that urban agricultural producers are a homogenous group, rather than an amalgam of the urban population with different and often conflicting motivations. Maxwell (1994) clearly demonstrates the different household 'logics' involved in why particular families get involved in urban agriculture. These range from those engaging in commercial crop production to those with 'no other means' available to ensure household food provision. Clearly it is important to involve producers in the planning and management to ensure that conflicts of interest can be resolved both between urbasn farmers and other land users and amongst the urban farmers themselves.

Not only at the national and urban level is the issue of governance important. Local negotiations of conflicts of interest and enforcement of agreements was illustrated in a recent visit the author made to Dar es Salaam. During the course of interviews with urban residents and local leaders some of the incompatibilities of particular urban agricultural activities were discussed. One example reported was that of goat keeping and vegetable production. In one area of Dar es Salaam, goats became an important problem for the vegetable producers, where they would eat the crops before they were ready for harvest. The local party representative brought the residents of the area together and they discussing the problem, eventually agreeing to ensure that all goats could be identified. Thereafter any goat owner whose goat was caught eating vegetable crops would be fined and the vegetable producer compensated, with the elected party official acting as ultimate arbiter. This reportedly made the problem disappear overnight. Here is a situation where local urban governance has apparently worked, but this requires the community to accept the fairness of the decision and the authority of the arbiter.

(b) reduce poverty - focus:

A second key aspect of the proposals put forward in this section is the aim of reducing poverty. This is intended to take the form of self-help approaches, building up cities' capacity to provide employment opportunities. Agenda 21 identifies three key areas:-

* *women* - Lee-Smith and Memon (1994) argue that it is important when planning urban agriculture initiatives to ensure that low income groups have access to land for subsistence production. This is especially important for female-headed households who often find it more difficult to obtain employment, and for women who often have the role of food procurer.
* *social services* - O. Mascarenhas (1994) reports that research carried out in Dar es Salaam suggests the importance of social networks in supporting the urban poor. She suggests that these networks could be used to improve the conditions of the poor possibly through self-help projects, such as the sort of urban agriculture projects being proposed.
* *hunger/homelessness reduction* - There is growing evidence that ensuring affordable access to a range of food procurement strategies reduces the likelihood of malnutrition (Mougeot, 1994). Finally, urban agriculture may also contribute the problems of under- and unemployment by giving those affected the chance to provide for themselves and by applying their labour, developing their productive skills and, if community-based, engendering a greater community consciousness.

(c) innovation in management to address environment and social issues.

This section of the Agenda specifically addresses the following four aspects: water, sanitation, waste and roads. The main aim of these initiatives is to reduce the costs of these mainly infrastructural investments in high income areas and to spread the benefits of such investments to the poorer areas.

Smit and Nasr (1992) argue that the waste by-products of urban areas should be perceived and utilised as resources for agricultural production. Waste, both in solid and in water forms, will be discussed in more detail in section D below, however, the proposals put forward by Smit and Nasr involve considering waste production as a positive aspect of urban development. This is achieved by making use of waste products by recycling them, thus moving cities from open loop (input/output) systems to closed loop systems, converting waste outputs into inputs for activities such as agriculture. This has implications for issues relating to human resources which will also be discussed later. The innovative use of in waste outputs may require high levels of expertise to ensure safe use of wastes in this way. If waste is to be used as a resource then this may reduce the cost of its disposal and if demand for waste products were encouraged then rich and poor areas alike may benefit from its collection. However, a number of authors point out that much of the waste is produced in central areas, while urban agriculture tends to be far more dispersed (Smit and Nasr, 1992; Mougeot, 1994; Barrow, 1995).

C promote sustainable land use planning and management

This section of Agenda 21 aims to promote environmentally and socially appropriate land management policies & legislation. In addition, its focus on the poor, women and indigenous people and ensuring environmentally appropriate land use, overlaps with many of the themes already covered. For example it may be argued that by enabling the poorer urban residents to earn a livelihood and reduce household costs, particularly in food, frees up their cash to invest in accommodation.

D promoting integrated provision of environmental infrastructure (water, sanitation, drainage, & solid waste management)

This section of the Agenda reinforces the view that careful use of waste is important. As mentioned earlier, research suggests that urban agriculture is one way in which waste can be used as a resource, thus closing the loop of waste production and recycling it within

the urban area. The following brief discussion of waste recycling will discuss first waste water and then solid waste.

Smit and Nasr (1992) suggest that the potential for using urban waste water can be viewed in terms of the problems to be overcome. These problems they divide into the three main categories which now follow.

(a) chemicals and toxins

They suggest that the problem of chemically toxic waste water should be less of a problem in Third World countries as fewer industries use such materials. However, even small scale activities can produce pollutants which adversely affect water supply. For example the *garimperos* (gold diggers) of Brazil have produced widespread mercury pollution of river basins across large parts of Brazil (Barrow, 1995). As Third World countries build up their industrial capacity, there is a need for effective monitoring and assessment of waste products for their toxicity and recycling potential. For example, Pye-Smith *et al* (1994) report that some urban agriculture activities can cleanse waste water. Water hyacinth leaches out heavy metals, while some other plants can absorb grease or oil, thus allowing the return of clean water into the water system. Schippers and Lewcock (1994) report that evidence so far suggests that any pollution effects in Dar es Salaam are minimal.

(b) pathogens and vectors

These problems can be tackled by treating water either biologically using sunlight, time or a plant or animal intermediary, such as duckweed or algae, which can be used as organic fertiliser for food crops. Alternatively the crops themselves can be specially selected because of their ability to absorb or retain pathogens, thus introducing a stage into the process. For example it may be possible to grow animal feed crops. It may be possible to produce non-food products such as timber, fuel or for shade. Finally, some

plants are less susceptible to passing on pathogens, for example fruit trees, because only the fruit is consumed, while leafy vegetables where the whole plant is eaten, such as amaranth, are more likely to pass them on.

(c) cultural taboos

The third and perhaps most difficult group of problems to overcome is that of cultural taboos. These, according to Smit and Nasr (1992) are both western and traditional in origin and there no easy method of overcoming these, as in the more scientific problems relating to chemicals and health. The cultural taboos relate to such things as the use of particularly human waste water for food production. Smit and Nasr conclude that some cities will simply have to accept that they may have to produce at less than technologically possible to take account of local cultural norms.

However, where it may be possible to overcome all these problems there is potential for improving conditions for most urban residents, and for the poorest in particular. Waste water can substitute for fresh water, thus increasing available fresh water for human consumption. A number of examples of the use of waste water already exist. An estimated 10 per cent of the world's population currently eats food produced using waste water (Smit and Nasr, 1992). Pye-Smith *et al* (1994) report on a co-operative in Calcutta which uses waste water to supply lagoons where seaweed is produced. This seaweed is then used to feed farmed fish which are sold to the urban population. Mexico City has a programme which pumps more than half of its sewage 50 miles to 100,000 hectares of land producing livestock (Smit and Nasr, 1992). Dar es Salaam has difficulty meeting demand for water, however there is some potential as at present very little waste water is recycled for any purpose (Schippers and Lewcock, 1994).

The second category of waste is solid waste. This can be divided in turn into two categories, inorganic and organic. Smit and Nasr (1992) argue strongly that solid waste

has great potential for recycling. Careful use of solid waste can enhance and improve agricultural activities in a umber of ways.

Inorganic solid waste can be used as soil improving inputs. Some of these may include chemical by-products from manufacturing processes, however, careful monitoring and experimentation is necessary to ensure that only non-toxic wastes are used and that harmful side effects do not result. This clearly has implications for the section covering human resources, as highly trained and competent staff are required. Other types of inorganic waste may be used in the construction of field marking, boundaries, pond building, planting containers or water containers.

Organic wastes can also be used to enhance soil quality. For example, food wastes, and some packaging materials. Lynch (1992) reports that there is a growing problem of disposing of vegetative materials used in the packaging fruit and vegetables the Dar es Salaam markets. Clearly there is potential for this large volume of waste to be composted and used as soil improver or as mulching. In addition, some paper products may be used especially as mulch, although care must be taken of the lead content in some inks, as this may be passed on to consumers by the food plants (Smit and Nasr, 1992). Schippers and Lewcock (1994) suggest that with an estimated chicken population of 1 million in Dar es Salaam, there is a large supply of under-utilised, nitrogen-rich chicken manure which is ideal for the popular crop, amaranth. The cattle population produces up to 350,000 kilograms of manure much of which is not used productively (Mvena, Lupanga and Mlozi, 1991).

The use of such solid waste products could reduce the use of expensive often imported chemical agricultural inputs, which may also have the effect of contaminating soils or water courses. Wade (1987) suggests micro-composting at sites near to farms, while Lee-Smith and Memon (1994) call for extension support for linking waste and agricultural input demands.

E promote sustainable energy and transport systems in human settlements

Internal supply sources reduce the transport required to feed a growing urban population. The alternative is that as the city grows - as most third world cities will do - at a very fast rate then the hinterland from which it draws its food supplies, or the foreign exchange it spends to import its food needs, will expand.

Expanding cities draw on food supply areas at an increasing distance from the city as the population grows. This continues the dominance of the primate city in many third world countries. A similar situation occurs with other, non-food agricultural commodities, for example, charcoal for fuel, or wood for timber. In Quezon City, in the Philippines, an urban agriculture project included fuelwood production to meet the demand for cooking fuel in the nearby neighbourhoods (Wade, 1987). This is a model which Dar es Salaam could emulate to reduce the pressure on nationally and internationally important forest reserves within its hinterland

F promote human settlement planning and management in disaster-prone areas

As well as making productive use of land, urban agriculture can make strategic use of land not suitable for building including steep slopes or flooded land. Agricultural plots may act as buffer zones in planning activities. For example, Sawio (personal communication) has suggested areas in spontaneous settlements could be zoned temporarily for urban agriculture which could be used in future as sites for vital infrastructure as the settlements mature. This would have the dual purpose of ensuring the residents of the settlement have access to the land to provide food for their household and as the settlement matures and the households became more established,

these could be used for roads, schools, medical facilities. In addition, areas prone to environmental hazards, such as land slip, or flooding could be set aside for activities such as agricultural production, thus reducing the vulnerability of the population and preventing unsustainable construction on otherwise vacant land.

Cities that are more self-sufficient are less prone to problems as a result of disruption to supply, for whatever reason. In Kampala, Uganda UNICEF & Save the Children Fund studies (1981 & 1987, reported by Mougeot, 1994) found cases of nutrition-related child health problems were much less than expected during and after the war with Tanzania and the post-Amin unrest. Both reports suggested that the prevalence of urban agriculture in the city are an important explanatory factor.

G Promote sustainable construction industry activities

The contribution of food supplies of urban agriculture to this section is likely to be limited. However, urban forestry could provide timber products, thus reducing the impact on forests in the urban hinterland. If household food costs could be reduced through this subsistence production, urban food production for sale or improved market provision, this would make greater proportions of household income available to improve housing and accommodation.

H promote human resource development and capacity-building for human settlements development

This section identifies three shortfalls found in many Third World cities which need to be tackled. Firstly, an enabling policy is required which is capable of integrating, on the one hand, the resource use and demand and, on the other hand, the apparent conflicts of the public & private sectors. Secondly, there is a need for specialised training and research, particularly in the form of institutions which can provide the training domestically. Finally, Agenda 21 identifies the need for a sufficient capacity for technical training. A common theme envisaged in this training agenda was the

enhancement of human settlement development at the community level, particularly strengthening social mobilisation, targeting women and youth, addressing social, economic, as well as environmental aspects of human development. The importance of women in providing the urban households with food, fuel and other necessary raw materials of reproduction, should bring aspects of food production and food procurement firmly into this aspect of the Agenda. The need for research, appropriate to the needs of Third World cities, is underscored by the fact that on a global scale most food research focuses on biotechnology appropriate to developed economies, while the needs in third world countries are quite different.

In urban agriculture Lee-Smith and Memon (1994) argue that technical training is particularly important if the efforts of urban residents are not to be wasted. They estimate that in Kenya, losses of livestock due to death, rather than selling, amounted to KShs36 million (US$2.4 million) which is 50 per cent greater than the value of livestock consumed as subsistence (KShs23 million). This represents a major loss of subsistence food and capital investment for poorer households and they argue that there is an urgent need to avert this level of loss through extension, particularly for the urban poor.

As discussed above, Smit and Nasr (1992) argue that it is important that pollution levels are monitored to ensure that urban food crops are not contaminated by the wastes of other urban activities. Clearly there is a role for increased training and training capacity in this regard. Smit and Nasr argue further that there is a need for further research to assess the potential of particular agricultural activities in reclaiming contaminated lands and in making efficient use of scarce or expensive resources. For example it may be necessary to ensure that cities such as Dar es Salaam, which already suffer from water shortages, even if periodic, can sustainably support both population expansion *and*

growth in agriculture. There is a need to assess whether agricultural food production should only take place in parts of the country where water is less of a problem.

CONCLUDING DISCUSSION

This concluding section will be separated into three parts, covering aspects of consumption, production and distribution.

Evidence suggests that aggregate food consumption in Dar es Salaam, as in other African countries, will increase. Given current evidence, there is a need for food supply to increase just to ensure that all today's urban residents have healthy diets. The fact is many cities in Africa are increasing in population very rapidly, indeed, some at a rate which will double their size in less than 10 years. This is clearly unsustainable where these cities are already very large and already draw on very large geographical areas for their food and fuel needs, or where they draw on significant proportions of the country's foreign exchange to import food and fuel.

Analysts writing on Dar es Salaam suggest that there is the capacity to expand domestic production in both the urban areas and in the rural areas (Sawio, 1994; Schippers and Lewcock, 1994). However, in the rural areas there is the problem of encroachment into natural forest areas in the Usambaras and Uluguru Mountains, both of which are important to the current food supply for the city, and of unsustainable agricultural practices in some other regions under pressure (Lynch, 1992; Stocking and Perkin, 1992). Much labour and capital is lost in some areas where crops are produced, but not distributed, because of poor transport infrastructure, leading to high costs, or unattractive market prices. In addition, the Dar es Salaam food supply system has high post-harvest losses due to poor transport infrastructure and poor, or no, storage facilities. Post-harvest losses affect the prices of some crops. Where *matenga* (woven reed baskets) of fruit or vegetables fetch lower market prices if they are known to have travelled on bad roads from certain areas of origin and significant proportions are expected to have been damaged in-transit. For example, research carried out in 1989 and 1994 has found that in Dar es Salaam it is generally assumed that up to 30 per cent

of tomatoes from Tanga Region area may be lost due to in-transit damage. In addition, considerable losses result from the lack of storage in Dar es Salaam. Even the 'formal' sector fruit and vegetable wholesale market, Kariakoo, does not have working cold storage rooms. In high humidity levels and temperatures in excess of 30 degrees Celsius, perishability rates are very rapid.

Many of these problems could potentially be reduced without initiating urban agriculture. Indeed research suggests that the economic difficulties and the policies of economic liberalisation have brought about a transition in the trading of food, in the city. Part of this is due to the the fact that the length of time some commodities may take to get from producer to consumer has been reduced (Lynch, 1992). However, much of the wastage could be reduced through investment in improved transport infrastructure. Alternatively many of these problems could be alleviated through the encouragement of urban and peri-urban agricultural activities, thus reducing the role of transport and of the rural production areas. More local production would have the effect of reducing the time between harvesting and consumption, thus reducing post-harvest losses and the city's vulnerability to disruptions in supply due to rainy season flooding, environmental hazards or civil or military disruption.

The whole system of distribution involves a cost, both economic and environmental. This adds to the prices of the food commodities, raising the issue of whether the city's poor can afford to buy food and this may affect their nutritional intake. Poor transport infrastructure may also adversely affect the country's foreign exchange bill as the bill increases for fuel, vehicles and spare parts, along with the cost of equipment and expertise for road maintenance and construction. The environmental cost relates to the use of non-renewable natural resources, and the increase in vehicle emissions, and this affects areas beyond the city and produces a cost which the urban residents do not pay.

The aim of promoting urban and peri-urban agriculture is to increase consumption in the urban areas and to decrease costs and potential disruption. The research suggests that a planned expansion in urban agriculture may also have the positive externalities of making productive use of vacant unproductive land and of potentially hazardous and otherwise unusable waste products. In addition, it could benefit the population by providing opportunities for subsistence production, increasing food security at both the household and the city level. Finally, it provides opportunities for generating cash and increasing employment. However, it is important to learn from experience of rural agricultural development, urban development and from food marketing. Rural agriculture, if reformed can have both beneficial, redistributive and negative exploitative outcomes. Technological urban agricultural solutions may result in ambiguous outcomes in the same way as some of the effects of the Green Revolution. Initiatives in urban development have gone through important transition as a result of both positive and negative experiences. It is important that urban agricultural innovations should learn from previous urban development programmes such as those to improve housing and infrastructure. Experience and research suggests that technical and economic measures are extremely useful, but successful replicability between different cities depends on social, cultural and political factors, as much as on technology and economics. Centralised planning for food marketing results in a large and unwieldy market system which is inflexible in the face of changing economic circumstances. By contrast a free market focus on cash earning export crops and food crops can involve foreign exchange and initial capital investment, and leave producers and consumers more vulnerable to the vagaries of the market.

It is important to be clear what the needs of the urban population in the city are and to negotiate the solution with them providing as much information as possible. The emerging research suggests that some of the needs of the urban population may be met by increases in urban and peri-urban agriculture. However, what is less clear is what

the consequences are of promoting urban agriculture on a wide and sustained scale to such things as rural production, the physical environment or the ability of the poor to obtain the nutrition they require. This is particularly important in Dar es Salaam, where there are already difficulties in meeting current demands. It is important to be aware that most African cities will double within the next twenty years and affordable supplies of food will have to be found for them. Urban agriculture may be one of the range of options available to meet this demand.

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