URBAN AGRICULTURE INDICES IN SELECTED TOWNS IN TANZANIA AND SOME ISSUES ON TECHNICAL EFFICIENCY: IMPLICATIONS FOR URBAN AGRICULTURAL EXTENSION SERVICES

KIZITO KAYANDA MWAJOMBE

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ABSTRACT

Determining Technical Efficiency Index (TEI) of urban farming is central to selection and profit realization by urban agriculture farmers. It has been populated that technical efficiency indices can be useful tool in planning for Urban Agriculture (UA). This study was conducted in three selected municipalities to assess Urban Agriculture (UA) indices and some issues of Technical Efficiency. Municipal and city bylaws for regulating and controlling UA practices and their contradictions were examined. Socio-economic factors influencing UA and extension services provision were assessed. The technical efficiency levels of the selected UA enterprises were determined and compared. Data were collected from 270 respondents in the three studied municipalities. Results showed that UA was found across all density areas and majority of city dwellers practice it. Municipalities recognized UA and set regulations for regulating and controlling it. Despite of urban farmers having entrepreneurial acumen, they faced several challenges in resources and marketing. Land size, total variable costs, and extension service charges impacted on TEI. The highest TEI was achieved by keeping broilers, followed by keeping dairy cattle. Keeping layers ranked third and growing vegetables had lowest TEI. TEI levels declined as one moves from low to high density area. TEI were relatively higher with lower UA units in large animals (cattle) and higher for those who kept larger numbers of poultry. It was recommended to; (a) revisit the set municipal bylaws for regulating and controlling UA; (b) revamp a sound agricultural extension delivery system; (c) Improving support services delivery for promoting uptake of innovations by UA farmers. Further, Exploring profitable innovations for promoting UA in urban setting, carrying out TEI analysis of all UA practices to ascertain TEI levels and UA units for profitable UA enterprises combined with thorough market analysis of UA products and undertaking feasibility study on possibility and profitability of undertaking other types of UA enterprises like fish farming in tanks and or concrete ponds, would highly enhance UA in our cities.

DECLARATION

I, **Kizito Kayanda Mwajombe,** do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is the result of my own original work and has neither been submitted nor being concurrently submitted for a degree award in any other university.

Kizito Kayanda Mwajombe — Date: 15. 11. 2011

The above declaration is confirmed by:

Prof. Malongo R. S. Mlozi — Date: 15. 11. 2011

Supervisor

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DEDICATION

This work is dedicated to my wife Jovita, my mother Mrs. Monica Ndumbaro and the late Mr. Francis Xavery Mwajombe for their loving care to me and hardship they faced during my upbringing and education.

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LIST OF ABBREVIATIONS AND ACRONYMS

AMC	Arusha Municipal Council
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
DMC	Dodoma Municipal Council
DMUs	Decision Making Units
DSCP	Dar Es Salaam Sustainable City Programme
EPMP	The Environmental Planning and Management Process
FGD	Focus Group Discussion
FPF	Frontier Production Function
HD-UA	The Harare Declaration on Urban Agriculture
KMC	Kinondoni Municipal Council
ML	Maximum Likelihood
OLS	Ordinary Least Squares
SFA	Stochastic Frontier Analysis
TE	Technical Efficiency
TEI	Technical Efficiency Index
Tshs	Tanzania Shillings
UA	Urban Agriculture
UALEAs	Urban Agriculture and Livestock Extension Agents
US$	United States Dollar
VRS	Variable Return to Scale

CHAPTER ONE

1.0 INTRODUCTION

1.1 Introduction and Background Information

Improving production efficiency remains a credible means of increasing productivity when resource reallocation, and the creation of and adoption of technologies are limited. Production in Urban Agriculture (UA) involves transformation of inputs into outputs in which resources are organised to produce outcomes for profit maximization, or output maximization and cost minimization. In this process, the urban farmer or the manager or the entrepreneur targets on arrangement on use of inputs to achieve an economic efficiency. Efficiency is achieved when the cost of producing a given output is as low as possible. The objective of efficiency in urban farming is to provide some basic rules about the manner by which the urban farmer utilises inputs to produce goods and services.

UA in varying forms and types is currently a common activity in most cities and towns globally. UA supply food in cities and towns and complements rural agriculture. Urban Agriculture Network (UAN) estimated that approximately 800 million people worldwide engage in urban farming (Drescher and Iaquinta, 1999; CTA, 2006). In Tanzania, data on different types of urban farming activities undertaken within cities and its growth so far has been documented by varying scholars (Stevenson *et al.*, 1994; Mlozi, 1995; UNDP, 1996; Mlozi, 2004; Tuvana, 2004).

Although the number of urban dwellers practicing in urban farming has been dramatically increasing, more data is required to quantify its efficiency. This is to help in isolating the sources of inefficiencies for its improvement so as to better plan for extension services

needed to support it within towns and cities into profitable, environmentally friendly and sustainable undertaking.

The common question that most people ask is: How should extension services be provided to urban farmers given the environmental issues. Also, related issues include processing and marketing techniques of UA products to be applied in space limited areas and safe use of urban resources such as organic wastes and waste water. Other issues include the land use (e.g. combining UA with recreation, landscape management, and water storage). The other burning question is whether successful rural extension and training methodologies can be adapted to urban areas conditions? These questions are addressed by this study though quantifying the technical efficiency levels of different UA enterprises, as well as determining the knowledge gaps and the existing extension packages and services. Again, the study described the by-laws, their dilemma and trade-offs relative to the sustainability of UA in towns and cities in Tanzania.

1. 2 Problem Statement

UA is neither a new nor declining activity in most of the Tanzanian towns (Mlozi, 2005). Agricultural goods produced in towns and cities are becoming cornerstone of many urban economies and could increase agriculture if extension agents advised urban farmers to undertake efficient and environmentally friendly UA. This will change the negative perception of UA as some "claim that urban farms are not only unsightly but are blamed to promote diseases and pollution" (IDRC, 1994; CTA, 2006). Although the motivating factors for some urban dwellers to engage in UA are economical (IDRC, 1994), more data is required to ascertain the extent of these activities in towns and cities, and quantify their levels of technical efficiency. In Tanzania, most studies have so far been exploratory and descriptive lacking quantification of crucial economic elements required in the

decision-making process and production rubric (Sawio, 1994; Mlozi, 2005; Foeken *et al.*, 2004). Equally important, the information on the entrepreneurs' needs for extension services for addressing sourcing of resources, production processes, distribution and marketing of UA produce are not well documented. Therefore, this study sought to empirically analyse UA from the agribusiness point of view focusing on the production and marketing sub-sectors by quantifying the technical efficiency levels of selected UA enterprises, determining knowledge gaps, existing extension packages and services and .describe bylaws, their dilemma and trade-offs on the sustainability of UA in towns and cities.

1.3 Justification of the Study

Despite the plethora of studies on UA, data is lacking on the activities' technical efficiency levels. Generally, lack of empirically supported information has led to town/city planners, government officials and policy makers to doubt on the potentiality of UA activities, despite the findings (Mvena *et al* 1991; Sawio, 1993; 1994) which show that it produces food and give extra income to urban dwellers practicing it. Before municipalities can begin to develop interest and therefore support UA, they have to be convinced by empirically backed data on UA efficiency levels on the different density areas. The study findings sheded light on the potentials of UA in generating income efficiently, addressing urbanisation problems, and meeting food demands to urban dwellers. Similarly, the study findings will indicate bottlenecks inherent in the extension delivery system and address the existing knowledge gaps for ecologically sound UA.

Further, the study documented the efficiency levels of UA and recommend types of enterprises that urban farmers in different density areas could profitably embark on. Problems related to extension service delivery system, farmers training needs, by-laws

dilemma and trade-offs in UA were also be explored. This formed a basis for UA field extension officers, city planners and policy makers to collectively develop an environmentally sound UA, which are regulated and controlled to bring about a revolutionarized urban land use system in Tanzanian towns/cities. Such findings augers well with the country's agricultural and urban development policies, which seek to incorporate UA in the town/city plans with an emphasis on regulating and controlling it. The study findings immensely will help town planners and policy makers to recognize UA as a valuable urban land use especially in areas that cannot be built or put to other urban uses. This study uncovered, among other things, issues of UA production, marketing and major problems facing urban farmers in Tanzanian town and cities.

1.4 Objectives of the Study

1.4.1 General objective of the study

The general objective of this study was to investigate UA indices and its implications for agricultural extension services to urban farmers in municipalities.

1.4.2 Specific objectives

The specific objectives of the study were to:

1. Examine municipal and city bylaws for regulating and controlling UA practices and their contradictions in the three studied municipalities of Dodoma, Arusha, and Kinondoni.
2. Identify socio-economic factors that influence UA efficiency and decision making in the study areas.
3. Assess UA extension services provision to urban farmers in the study areas.
4. Determine and compare the technical efficiency levels of the selected UA enterprises in the study areas.

1.4.3 Study hypotheses

Based on the above objectives the following hypotheses were tested:

Ho_1: There is no statistically significant difference of the influence of municipal by-laws for regulating and controlling UA enterprises and decision making on the number of UA units to undertake in the three plot density areas (low, medium, high) in the three municipalities.

Ho_2: There is no statistically significant difference of the influence of the respondent's socio-economic status on UA technical efficiency levels of UA enterprises and decision making on the number of UA units to undertake in the three plot density areas (low, medium, high) in the three municipalities.

Ho_3: There is no statistically significant difference of the influence of agriculture extension provision on UA technical efficiency levels of UA enterprises and decision making on the number of UA unit to undertake in the three plot density areas (low, medium, and high) in the three municipalities.

Ho_4: There is no statistically significant difference of UA technical efficiency levels of UA enterprises undertaken in the three plot density areas (low, medium, high) in the three municipalities.

1.5 Empirical Model for Analysing Efficiency

1.5.1 The theoretical framework

UA in the context of this study is viewed as an informal lay down of activities focusing on efficient farm production in the urban environment. Some investigations on potentials of UA in Tanzanian towns conducted by Sawio (1993) and Mlozi (1996) indicated that UA is gaining momentum. Currently, the government and other institutions are beginning to show support to the activity as a livelihood strategy. An increasing number of city and town councils are promoting UA and agricultural projects are found in townships such as

Dar es Salaam. Therefore, an empirically oriented perspective on UA in Tanzania is needed to provide information on technical efficiency indices of the current UA practices for planning and prioritization in urban land use.

From the economic point of view, economic value of production hypotheses supports the view that UA is a rational and a useful profitable activity within the urban development context. For example, von Thuneun theory of spatial location (Barlowe, 1978) adopted by van Rooyen *et al.* (1995) represent a viable framework of the economic efficiency analysis of UA for this study. Von Thuneun's model shows an economic rationality on land use around a central market place. According to this model, the value of land determines its use and its distance from the market place determines its value. UA land use patterns are assumed to follow von Thuneun's model as perishable products such as vegetables and milk are produced close to city centres (Smith, 1998).

According to van Rooyen *et al.* (1995) land should be zoned based on economic rational land use. Zoning is expected to provide space for undertaking different agricultural enterprises determined by economics, land quality and other resources available. The assumptions of von Thuneun as adopted by van Rooyen *et al.* (1995) and Kekana (2006) provide a theoretical framework of this study to investigate the economic rational of urban dwellers to undertake UA in selected municipalities in Tanzania. The main assumptions guiding this framework for analysing UA efficiency as adopted from van Rooyen *et al.* (1995) are as follows:-

1. UA is derived from the logical resource allotment of (poor) city dwellers that are not in a position to make adequate returns from non farming to proffer a sustainable urban family livelihood.

2. UA can be explained by price reduction and decrease in transaction expenses from a consumer view point (point of consumption to point of food acquisition).
3. UA can be explained by the preliminary relative advantage of newly urbanized groups with well-known rural food production skills.
4. UA is often a provisional survival strategy to permit a fallback position if sufficient urban income is not created.
5. UA is a realistic response to existing opportunities in terms of the market for produce.
6. UA is undertaken mainly to address family food security with surpluses sold in the market.
7. UA occurs because there is a possibility of utilizing uncharged resource use. That is, UA farmers can make use of land and water without paying (the full price) for these resources.
8. UA could be scaled-up according to the available resources (land, presence of inputs) and market propinquity.

Moreover, the three alternative economic theories (profit maximizing theories, utility maximization theories, and the risk averse) are also employed for understanding the urban farmer household production choices and efficient behaviour. These standard theories of farm household production choices assume that farmer households have an objective function to maximize, with a set of constraints. As hypothesized by Schultz (1964), farm households are poor but efficient and target for profit maximization. However, profit maximization has both a behavioural content (motivation of the household) and a technical economic content (economic performance of the farm as a business enterprise).

The classic models commonly referred to as agricultural household models that incorporate consumption goals of households into micro-economic models of farmers households' have become popular in explaining the behaviour of farm households (consumption and production units) (Taylor *et al.*, 2003; Mendola, 2007). The utility maximization theories encompass the dual character of farmer household as both a family and enterprise and thereby take account of consumption side of farmer decision making. Thus, the household maximizes utility through the consumption of all available commodities (home-produced goods, market purchased goods, leisure). According to Ellis (1992), farmer households produce under very high levels of uncertainty induced by natural hazards (weather, diseases, and pests), market fluctuations and social uncertainty (insecurity associated with control over resources, such as land tenure and state interventions). Similarly, these conditions create threat to UA farmer's production and make them more cautious in their decision making. These economic theories address farm households as Decision Making Units (DMU) which are concerned with questions such as; what levels of different resources should be devoted to each urban farming farm enterprise? What technologies to apply in the production processes? In the process of making such decisions farm households are influenced by their production objectives, which determine their compliance to devote resources in various production activities, including the desired production technologies.

Further, according to the profit maximization theory of household behaviour in decision making, households, apart from having other production costs, attempt to maximize profits. With profit maximization, it is assumed that DMUs, in the short run will increase the amount of variable inputs as long as the additional revenue exceeds the additional costs sources. It is further assumed that UA farmers would not produce at all if the price of an input exceeded the maximum average value of a product. Profit maximization

theories describe DMUs as economic agents in the sense that they are efficient in the allocation of resources with an objective for maximizing profits (Anderson and Ross, 2005). This implies that when UA farmers make investment decisions they tend to address important questions such as: how much of an output to produce, at what level of each input to apply in order to maximize net returns? This theory is supported by many neo-classical economists including Shultz (1964), Haswell (1970), and Ellis (1988), who defined the farm households as being both efficient and profit maximizing.

Prospects to get higher incomes induce UA farmers to produce more and adopt the recommended agricultural technologies. However, farming efficiency which is the ability of a firm to produce a given level of output with minimum quantity of inputs under a given level of technology affects UA farmers and sometimes is overlooked even in setting urban by-laws for regulating and controlling UA activities in Tanzanian towns and cities. The efficiency of UA farmer is achieved by having succeeded in producing large amounts of outputs from given sets of inputs. Maximum efficiency is attained when it becomes impossible to reshuffle a given resource combination without decreasing the total output. An UA farmer efficiency analysis should determine elements that lead to inefficiency. Extension service delivery system should enforce by-laws that regulate and control UA to improve UA efficiency. The setting of by-laws should be based on UA data that is empirically derived - one of an endeavour of this study.

In analyzing urban farm efficiency, an individual farmer is considered as a DMU and becomes a basis for determining efficiency. Generally, what is measured is the Technical Efficiency (TE), which is the ability of a firm or enterprise to obtain the best production from a given set of inputs (output-increasing oriented), or the ability to use the minimum feasible amount of inputs given a level of output (input-saving oriented) (Greene, 1980;

Atkinson and Cornwell, 1994). Since the seminal work of Farrell in 1957, several empirical studies of farm efficiency have been conducted using several approaches, which fall under two broad classes of parametric and non-parametric methods. However, all approaches focus on improving output of a firm or enterprise and minimizing inputs. An UA farmer in Tanzanian towns/cities is faced with a number of constraints that hinder to achieve efficient production. These constraints need to be addressed by the extension delivery system in order to allow sustainable UA that will achieve efficient urban food production while preserving the environment.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1. Definition of Urban Agriculture (UA)

UA or urban farming as a basic urban function seems to be as ancient as cities themselves. Although different scholars differ in defining UA, the following key descriptions qualify it. (a) UA as the name suggests, is undertaken both within the urban boundary and its side line. (b) UA mainly involves the keeping of animals and growing crops, but it may include agro-forestry and fuel production. Madden and Chaplowe (1997) defines UA as the practice of crop cultivation and domesticating animals within the boundaries or the immediate periphery of a city.

Further, with increasing attention and that it draws more urban dwellers, UA currently is defined as "an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes, to yield a diversity of crops and livestock (Egziabher *et al.*,1994; Mougeot, 1994; Tinker, 1994; 1999 Smit *et al.*, 1996a,b; UNDP, 1996; Mougeot, 1999; Dongus, 2001; Mlozi, 2004). However, defining UA is difficult because of the changeable milieu in which it takes place, the resources involved and the people undertaking it. The decision on what to produce and technicalities applied is surrounded by culture, traditions, water supply, rainfall, market, soil condition, plot size and distance from residential areas. Again, the type of UA practiced is constrained by individual resources, land availability, location and access, and the ultimate goal for starting UA. UA nature and magnitude vary depending on agro ecological conditions, national, regional, and local policies; market conditions; and

household characteristics. UA activities include horticulture, field crop, floriculture, forestry, aquaculture, and livestock production. According to Drechsel and Dongus (2010), UA can be seen in different forms varying from backyard gardening to animal and poultry farming.

2.2 Urbanization and Urban Food Needs

Urbanization is an important development process that is linked to land access, food production, and food security. The world predictions indicate that by 2050 the world's population will reach as far as nine billion people, of whom more than 60% will be urban dwellers (Hagmann, 2001; UN, 2009)). The city's spread out creates challenges and problems in providing adequate municipal services, increased demand for food, environmental degradation and unemployment of the newly migrating individuals from rural areas. UA contributes significantly in feeding the ever expanding urban populations in many cities. Kiguli *et al,* (2003) revealed that of the Kampala city's population of nearly 1.5 million inhabitants, 40 percent consumed food products produced within the city, while 70 percent of all poultry products consumed were produced within the city. In Cairo, the rearing of small livestock, practiced by over a quarter of households, provides more than 60 percent of household income (Mougeot, 2000). In Dar es Salaam, UA is the second largest employer (Ratta and Nasr, 1996; UNDP, 1996; FAO, 2001; Bryld, 2003). Studies in Harare, Kampala, and Nairobi found that urban agriculture can improve nutritional status of household members, as measured by caloric and protein intake, meal quality, or children's growth rates. Studies indicate that women predominate in UA, which conveniently enables women to earn in-come, improve household diets, perform household chores, and exert greater control over household resources, budgets, and decision making (Maxwell, 1994).

Amazingly, to date most council in municipalities have no food policies, in spite of the increasing problem of urban food insecurity and growing urban poverty. Current trends regarding urban food insecurity in municipalities reveal that reliance on food produced in the rural areas is not sufficient, especially for the urban poor (FAO, 2001). Despite food being a basic human need (and right), urban food security issues are low or not on the agenda of municipal policy makers and planners. Putting UA on the agenda and integrating it into urban planning, should be done by giving attention to urban food systems (availability, origin of food and linking to the rural areas around cities) (FAO, 2001). In Kenya, urban and peri-urban agriculture is not a recognised urban land use and there is no category for it in land use zoning in Nairobi (Musoga, 2004). This gap flies in the face of some international donor community promoting UA. For example, Development programmes such as Cities Farming for the Future (CFF), and the International Development Research Council (IDRC) AGROPOLIS programme, are currently trying to put urban agriculture onto the policy agenda through the development of policy sheets and planning guidelines. One problem is that despite these programmes, there is still a relative shortage of information and thorough analyses available on efficiency levels at which UA is being operated.

Municipal authorities also face troubles with solid waste management and wastewater disposal. However, UA if well coordinated and planned can play an important part in addressing some of these problems. Through UA, food can efficiently be produced and made available to urban dwellers and environmental quality can be improved, and employment opportunities for poor families provided.

City or town planning is the discipline of land use planning that deals with the physical, social, and economic development of metropolitan regions, municipalities and

neighbourhoods (Chapin and Kaiser, 1979). City planning in most developing countries has tended to be associated with rigidity and lacking responsiveness to social issues and these have negatively affected the integration of UA in the overall town/city master plans. Urban planners therefore, need to shape patterns of land use and the built environment in and around cities to solve and prevent challenges of urbanization, including providing shelter, food and other basic needs of life, protecting and conserving the natural environment and assuring equitable and efficient distribution of community resources, including land (Quon, 1999). An urban area is made up of complementing and conflicting uses and demands that have to be properly managed. This scenario is made worse by the fact that land is a finite resource and the demands on a particular piece of land are many and varied. Land use planning is viewed as the process of organising the use of land and its resources to best meet the people's needs over time according to the land's capabilities (Chapin and Kaiser, 1997). It is in this context that UA ought to be considered in the town/city master plans so as to meet urban dwellers' needs of producing own food.

Land use planning can also be viewed as the development of an arrangement for the future use of land, for instance, through zoning. Land use planning is not a haphazard event but should be a well thought-out process. Thus, if certain use of land, for instance, UA, is not considered during the planning process, it then becomes difficult to include it in the implementation phase of the plan. Currently, UA is increasingly becoming an important activity in third world countries, and the growth of human settlements brings about UA creating a competition between the traditional urban land uses. Whilst regional and urban planners have generally accepted the peri-urban zones as a mixed zone in terms of land use categories (including UA), but these zones are poorly supplied with infrastructure, hence becoming less attractive for most urban farmers to move there.

Policies to support the development of UA are still very rare as urban planners tend to exclude UA from their sights since to them UA should not be practiced in town/cities, and is often seen as an economically a temporary phenomenon (Drescher, 2000). A key factor perpetuating this thinking against UA is embedded in their western ways of their training. Currently, planners are heavily involved in issues of land use, housing, transportation, the environment, the urban economy and recreation, amongst other things. And the urban food systems however, are notable by its absence in the writings of urban planning scholars, in the master plans and in lecture rooms in which planning students are taught. As opposed to other commercial or private activities in towns/cities, urban food production has never been addressed properly by legal regulation and planning (Dresher, 1996; Robert and Drescher, 2005). Yet, urban farmers seek alternate sources of water and land. Unavailability of canal water and brackish groundwater further induce farmers to use untreated wastewater for food and fodder production to sustain their livelihoods.

With proper planning for its integration, UA has the potential to flourish in modern towns/cities because of its multiple functions and relations with urban issues. For example, towns/cities provide easy access to markets following a prevailing high demand for fresh foods. More advantages that could be accrued from UA in the town/city are reduced transport costs for produce and an abundance of resources and opportunities (such as recycled waste, under-employment, the availability of urban labour). In verity UA practices have always been part of towns/cities, but the integration into the urban economy is what is lacking in today's urban planning and policies (Mposho, 2005; Mubvami and Mushamba, 2006). UA should be seen as an issue, in which different sectors and institutions are involved, and requires the development of new thinking and planning practices. Major issues and challenges that need to be considered in planning for

the UA include the distribution, location, control of and access to the use of land and other resources, conflicts between uses and users and the regulatory framework for UA. Food system is defined as a chain of activities connecting food production, processing, distribution, consumption and waste management, as well as the associated regulatory institutions and activities (Pothikuchi and Kaufman, 1999). There are conceptual and practical reasons why planners should devote more attention to the food system, since it is paramount in the improvement of human settlements to better serve the needs of the people, and in incorporating linkages between various aspects such as physical, natural, housing, transportation, land use, and economic empowerment (Kaufman and Bailkey, 2000).

As earlier mentioned, urban planning is continuing to develop and in many towns/cities planners are experimenting with new approaches and tools, based on different views or paradigms (Kaufman and Bailkey, 2000). There is little information available on what these different visions imply for UA, although issues of its importance are mentioned in various texts (Quon, 1999; Kaufman and Bailkey, 2000). Participatory approaches are becoming more popular. Other approaches brought in by the donor communities are also taking root. It is against this background that UA can be made much more visible than it is currently.

Most city authorities use the potential health risks of UA as a justification for prohibiting it. However, most of the UA potential depressing effects can be minimised if it is properly managed through having policies and by-laws that are enforced. For instance, in Cuenca in Ecuador, the policy thrust has been to regulate use of chemical fertilisers and pesticides in urban areas through training on ecological farming practices, providing licenses and incentives (e.g. tax reduction) to micro-enterprises that produce and supply

ecologically-friendly inputs (compost, bio-pesticides, quality seeds etc.) and promoting secure hygienic conditions for crop handling, food processing and vending of food (IDRC, 2009).

2.3 The Harare Declaration on UA (HD-UA)

The HD-UA was a result of Minister's Local Government Conference on Urban Agriculture - Opportunities for Food Security held on 28-29 August 2003 in Harare, Zimbabwe. The Harare Declaration on UA (HD-UA) was signed by SADC Minister Millicah W. Thairu of Kenya, Honourable Henry Midiani of Malawi, Honourable Mizengo Pinda of Tanzania, Honourable Albert Shabangu of Swaziland and Honourable Ignatius Chombo of Zimbabwe for their governments in September 2001 in Harare (see Appendix. 2) following a conference that was convened among other things, to share experiences on the issues of urban & peri-urban agriculture in the sub-region. The other was to come up with strategies to augment urban food security, nutrition and local economic growth and development through intensive high value (peri) UA development. Other things discussed were strategies for improving the nutritional status of HIV/AIDS sufferers through UA; to identify key policy issues for UA in the region; and to formulate a regional development programme on (peri) UA focusing on the technical, financial and legal institutional aspects and support (Ayaga *et al.* 2005; Mubvami and Mushamba, 2006).

HD-UA acknowledged that urbanization is one of the major challenges for mankind today. Urbanization rates in the Eastern and Southern Africa region have been given at between 3 and 8 % per annum and towns/cities in sub-Saharan Africa are growing at an exceptional rate of about 5% annually. It is estimated that by the year 2020, half of the population in the region will be urban (UN-Habitat, 2006; IDRC, 2008; IWMI, 2008;

Drechsel and Dongus, 2009). As the urban expansion continues the overall cost of supplying, distributing and accessing food is likely to increase with the number of urban households that are food-insecure also increasing (FAO, 2003; IDRC, 2008; IWMI, 2008). The challenge of feeding cities therefore lies in enhancing consumer access to food by ensuring that the required investments for increasing food production, processing and distribution are accessible under affordable, good quality, hygienic and environmentally sound conditions. The Local Governments identified huge food deficits, with only one country, South Africa, reporting a cereal surplus. The role of urban and peri-urban agriculture in the food supply for cities and towns, as a compliment to rural agriculture, is therefore becoming an important issue in the Eastern and Southern Africa region economy (MDP, 2003; Ayaga *et al.*, 2005; Mubvami and Mushamba, 2006). There is evidence that UA has been expanding in many urban areas, especially in Zimbabwe, Zambia and Tanzania. The HD-UA was adopted by the heads of delegations present on the 29 of August 2003.

2.4 Models for Integrating UA in Town Plans

UA can play an important role in urban planning by linking to environmental, social and economic issues. All of the different approaches to urban planning provide specific opportunities and linkages to facilitate and catalyse the integration of UA into urban planning. There are five models of integrating UA in town/city plans. According to Chapin and Kaiser (1979), the models include; the ecological model; new urbanisation, the collaborative or communicative model, just city perspective, and new life model.

2.4.1 The ecological model

This model is the most current among environmental health and transport planners. It applies a systems view, in which the city is seen as a system of inter-related parts similar

to a biological system. Planning here is used as a move toward making cities healthy and disease free. Therefore, vacant and green spaces are seen as purifiers of pollutants from the surroundings. It is dominant in environmental planning and management approaches, as promoted by Local Agenda 21 (as developed after the Earth Summit in Rio de Janeiro of 1992). The model has been applied in Dar es Salaam-Tanzania and Lusaka-Zambia. The implications of the Ecological Model for UA are that: urban farming is seen as an instrument for environmental management through nutrient and waste recycling; nutritional and health conditions of residents can be improved through UA; UA can constitute a good use of derelict and open spaces and city gardens can help to beautify the town/city. However, there is a potential health risks for consumers for use of waste water.

2.4.2 New urbanism

This propagates the idea of an impenetrable city and relies on design, engineering and architecture. Its main characteristics are to turn around the trend of the urban spread out by learning from conventional urban development patterns. It promotes small plot sizes and building up open spaces within the city, but also uses recreation. The model is applied in many new cities like Lilongwe in Malawi, Dodoma in Tanzania, and Abuja in Nigeria. The implications of the New Urbanism approach for UA are that: economic imperatives in the new urbanism militate against UA; it has been criticized by those who see that home spaces become multi-functional production areas, and not just as a place to sleep; the model follows the World Bank idea for the reduction of urban residential plots, leaving very little space for UA.

2.4.3 The collaborative or communicative model

This recognizes the divergent social-political and at times ethnic groups in the city, and encourages a process of consensus building in addressing problems and developing a

vision for the city. The supposition is that with compromise, problems in the city can be resolved as it promotes multi-stakeholder processes in planning. Consensus among stakeholders is admitted to challenge the blue-print plans as in the new urbanism model. The implications of this model for UA are that: the mainstreaming of multi-stakeholder processes may give a voice to urban producers and places emphasis on UA being a demand driven; pays attention to issues of who has power and influence among stakeholders and on how a common position on UA can be negotiated and UA can emerge as a community need and be expressed hence finding its place in urban development (Mubvami and Mushamba, 2006).

2.4.4 Just city perspective

This is characterised by democratic intolerance and calls radical form of participation that goes beyond stakeholder involvement. It places emphasis on governance by the civil society, and makes explicit the differences in power and the need for the "excluded" to fight for power and influence change. The implications of the perspective for UA are that: urban farmers need to organise themselves so that they can effectively lobby to local authorities; the local (municipal) authorities need to be engaged in debates for the rights of urban farmers for them to earn a living out of a legitimate and honest means and negotiation is necessary for the use of any open spaces available for UA activities.

2.4.5 New life model

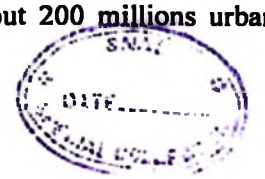
This argues that development institutions have realised that UA can facilitate the formation of new institutions. It links UA to different aspects of urban development initiatives such as poverty alleviation, urban nutrition and environmentalism, informal sector employment and gender, and argues UA inclusion and enhancement. The implications of this model for UA are that: UA is considered as a new field of progress

for sustainable city development and be included in the urban development discourse; emphasis is on the inter-linkages between UA and other city development sectors; UA can attract international development assistance if properly organised and well promoted; and in town/city dynamics UA can adapt and build up itself based on urban dwellers needs. By clarifying the linkages and the potential role UA can and should have in urban development, it should be possible to integrate UA and articulate it clearly in urban development policies.

2.5 Development of UA in Tanzanian Towns/Cities

Tanzania like many other third world countries has realised high rate of urbanisation during the four past decade's consistently surpassed forecasts (IDRC, 1994).This has happened hand in hand with an expansion of informal and UA activities and an increasing ruralization of towns. This has occurred together with a declining economic growth and waning organisation setup and physical infrastructure. Hence, urban centres have witnessed increased poverty levels and massive growth of slums and squatter settlements. UA has, on the same period recorded a significant growth as a survival strategy by the poor urban dwellers.

The continued encroachment of farmers by urbanisation, ineffective agricultural policies, crippled domestic food-distribution systems, inhibited public spending and subsidies, towering inflation, wage cuts, unemployment, declining purchasing power, and laxity of urban land use regulations or enforcement together have accelerated the growth of UA as means for endurance (IDRC, 1994). Urban food production has now shifted from being a scientific curiosity to being an urban policy issue and a development tool in the same way as did squatter housing and informal employment in the 1960s and 1970s for which its harmonisation and/or regulation of the same is highly and urgently called for (Mougeot, (1994). About 200 millions urban dwellers in developing countries are reported to be



urban farmers and by cultivating small plots nearby or within cities, they are able to provide food to 700 million people (Basler, 1995). Besides the impact in terms of quantity, UA produces an important qualitative effect of diversified food picnic basket for the urban population. In relation to rural agriculture, UA in developing countries has the following characteristics: high productivity per unit space, low capital per unit production, low energy consumption, low marketing cost and freshness of the products (Smit, 1980 as cited by Mlozi, 1995).

Despite of the realisation of the growing importance of the practice, the growth of UA has occurred in the countenance of socio-economic intolerance in form of planning standards and set of laws that exclude agriculture from urban land use systems (IDRC, 1994; IWMI, 2008). Although UA is tolerated in some urban areas, town/city planning law-making provisions does not honour UA as a legitimate land use that should be provided for in the urban areas. Similarly, a growing appreciation of the significance and importance of UA has taken place worldwide (Dubbeling, 2003). Based on recent studies, the significance of urban cultivation in Tanzania can be illustrated as follows:

- UA is a fundamental part of the inner-city economy (Mvena *et al.*, 1991).
- UA is established far and wide in Tanzania's cities and towns (Mlozi, 1996).
- The cultivation of crops in towns is a common and widespread phenomenon (Sawio, 1993; 1994; Tesha, 1996; Jacobi, 1997).
- It has been claimed that urban dwellers embark on UA because of unpleasant economic conditions (Smith and Olaloku, 1998).

In the case of Tanzania, efforts have been made to integrate UA into the urban land use system, but little has been done to actualise the legislative necessities and hence, harnessing the full potential of UA in employment, income and food supply (UNDP, 1996). Local authorities are responsible for ensuring urban food security and addressing

urban poverty for which UA if properly regulated could form a niche as a response to addressing food security and poverty reduction issues among the poor urban dwellers (Jacobi *et al.*, 2000).

UA is practiced by two groups, the traditional farmers caught by urban expansion, and recent incoming urban occupants. Urbanisation as a pressure from within has caused changes on rural demarcations and engulfed areas that were predominantly rural in setting with agriculture as the dominant land use. The second major group of urban farmers are the urban migrants and their families, for which some are employees who practice UA to top up their skimpy incomes from their employment earnings (Foeken *et al.*, 2004). Majority of scholars on UA state that, although these urban farmers come from all income groups, the poor dominate. Failure of most urban household to feed themselves adequately from their earnings, prompt them to farm in backyard spaces near their residence, on roadside brinks, or on other municipal owned unoccupied land. In addition to household setting, UA also occurs in large strips of public or private land that remain immature for landscaping, urban expansion, or because they are incongruous for improvement.

Madden and Chaplowe (1997) said that UA is commonly located in spaces in and around the home, of recent there has been a pragmatic trend on some urban farmers buying land on city outskirts (Plate 1) to undertake UA enterprises. Initially, satisfaction of basic needs seemed to be the principal motivating factor that directed their behaviour into UA. However, recently UA goals have been, at an individual level geared towards profit making and capital accumulation and in contrast to previous aims of producing for domestic consumption to meet food security needs of the farmers (Mlozi, 1994).

Plate 1: A vegetable garden project at Ubungo maji KMC

There are several positive effects of UA in the urban settings, but as with health, however, proper management is necessary to lessen potential health risks. The Environmental Planning and Management Process (EPMP) was a UN initiative implemented in 1998 in several cities including Dar es Salaam and aimed to achieve sustainable development by having all actors to recognise the interconnectedness of the environment and other growth actions. It became a framework for implementing the Local Agenda 21 and the Habitat Global Plan of Action, and Dar es Salaam implemented it through the Dar es Salaam Sustainable Cities Programme (DSCP) based on participatory approaches (see box 1.1) (IDRC, 2009). The Local Agenda 21 promotes development of action plans for sustainable development by local authorities jointly with stakeholders and citizens. It provides planning guidelines, incentive grants, training workshops, seminars, and promotes exchange of experiences in drafting local policies

and action plans. UA if properly planned and integrated can assist to reduce environmental pollution through the recycling of solid and liquid waste. For example, in the City of Harare, Zimbabwe waste water from its Crow Borough and Firle sewer works irrigates pastures on three large-scale commercial farms, which support over 10 000 cows and later the water filters down and eventually finds its way back to the city reservoir after a natural purification process (Toriro, 2003).

In most Tanzanian towns/cities, the problem of environmental degradation caused by UA is substantial. For example, at the end of 1993, Mlozi (1995) found that the three municipal councils of Kinondoni, Ilala and Temeke in the region of Dar es Salaam had 18 286 cross-bred dairy cattle, 1.2 million exotic laying hens and 0.6 million broiler chickens, 131 891 local fowls, 27 326 ducks, 37 327 pigs and 40 930 goats. Urban dwellers in the urban wards kept over half of these animals while crops covered about 1500 hectares of land. For instance, domestic animals transmit zoonoses or animal diseases that can afflict humans and circulate among other animals (Mlozi, 2005). Crops are also blamed for making towns/cities look ugly and can harbour disease causing mosquitoes. According to Mlozi *et al.* (1992; 1989), in the year 1985, the city of Dar es Salaam, had 3318 head of dairy cattle and they grew to 7105 in 1988 and four years later they had increased to 9081. Further surveys in Dar es Salaam, Mbeya and Morogoro towns showed that cattle increase was mainly an attempt to lessen the economic hardship that urban dwellers endured (Mlozi and Hella, 2001). Those keeping dairy cattle received high incomes from milk sale. However, a dairy cow produced somewhere between 20 kilogrammes and 45 kg of dung per day. According to Mlozi, (2005), given the poor feeding regimes of cattle in the city, 20 kg of dung per day is used to calculate dung produced per cow per day. The 9081 herd of dairy cattle kept in 1993 would have produced about 181 620 kg (181.6 tonne) of waste daily.

Box 1.1 The integration of urban farming into urban planning- the case of Dar es Salaam

In 1992, the city of Dar Es Salaam adopted the Environmental Planning and Management (EPM) approach in its City Consultation. This new approach has been the engine of change in many aspects and also related to UA. Under this new approach the city held a mini-consultation in 1993 to deliberate on UA and stakeholders agreed that UA in the city contributed substantially (about 30 percent) in household food supplies and that it had become an integral part of urban livelihoods strategies. A Working Group was formed to work out strategies for putting UA on the city agenda. The Working Group used a participatory approach to come up with a strategic plan on UA for the city.

The results of this process are good: from action, plan preparation, implementation of demonstration projects and further integration of UA in the city's urban zonification. Findings of the working group included results of these projects and were a basis of deciding on where and to what extent UA can be practiced in the city as reflected in the Strategic Urban Development Plan (SUDP). In this plan, special land zones have been designated for UA. Ideas necessary for revising municipal bylaws and regulations were also worked out and a platform for coordination established and enhanced. The SUDP also has deliberately set apart several areas to be used for large- and medium-scale UA in the future and gives corresponding development conditions. This is contrary to the earlier "zonification" where an area could only be considered for agricultural activities while awaiting to be assigned other to other uses such as residential or industrial areas. The major difference with the earlier Master Plan which considered UA as a transitional land use, SUDP considers it to be an important activity with a very important contribution to its citizens. Recognition is reflected in several laws and regulations, among them are the Agricultural and Livestock Policy of 1997 and the National Human Settlements Development Policy of 2000.In Dar Es Salaam, it is seen, that UA can be effectively integrated in urban land use plans.

Adopted from Kitilla and Mlambo (2003), Integration of UA in City Development in Dar es Salaam

This single aspect created a serious environmental degradation because most livestock keepers dispose off animal dung haphazardly. About 72% of livestock keepers in the city of Dar es Salaam dumped the animal dung along roadside, 12% used the city council dump trunks, and the remaining used their own transportation to dispose off animal waste (Mlozi, 2005). UA integrates the urban poor and officially unemployed into the urban economy, which contributes immensely to improvement of self-esteem and safety among the urban poor. Therefore, UA if properly regulated can be turned to be one of the important industries undertaken by both poor and commercial urban farmers and due to its multiple functionalities, help address issues of food security to the majority of urban farming households and equally contributing significantly to employment and income generation (Mireri, 2002; Mireri *et al.*, 2007).

Keeping improved dairy cattle is common in Tanzania towns because most urban farmers can earn extra income if cattle are kept under good husbandry practices. A study by Mlozi (2005) in Dar es Salaam, Morogoro and Mbeya revealed that 69.1 percent of the respondents indicated to keep improved dairy cattle, 67.4 percent and 24.2 percent kept between one to four and five to nine cattle in urban areas respectively. The implication of this data was that about a quarter of the respondents had contravened one of the town council bylaws of local government (Urban Authorities) Act of 1982 No.8 section 80 that allows urban dwellers to keep four animals in their compounds. Further, Mlozi (2005) found that, in Dar es Salaam city, farmers kept more cattle in the range of one to four than in the other two towns, and fewer in Morogoro. According to Mlozi (2005) primarily, urban farmers kept dairy cows to get milk most of which was sold to earn money. However, evidence shows that milk yields per cow per day were declining because of external factors such as the prevalence of diseases, lack of markets and high cost of inputs. Milk production ranged from one to nine, ten to 19 and 20 to 29 litres of milk per day, respectively. The maximum range of milk received per cow per day was six litres, while the minimum was one litre with a range of five litres of milk per day per cow (Mlozi, 2005).

The average price of milk per litre was Tanzanian Shillings (Tshs) 205 (US$ 0.21) while the maximum price was 400 (US$ 0.50) with a minimum price of Tshs 100 (US$ 0.1). In the year 1998/99 seasons, the average earnings per person from milk sales were Tshs. 3 million (US$ 3000) implying that an urban farmer earned Tshs. 8219 (US$ 8.20) per day from milk sales. The maximum earnings from milk sales were Tshs. 68 million (US$ 68 000), while the minimum was Tshs. 2452 (US$ 2.5), and the range was Tshs. 68 million (US$ 68 000). These figures explain the palliative nature of this enterprise and its persistence in most urban areas (Mlozi, 2005).

According to Mlozi (2005) study in the towns of Dar es Salaam, Morogoro and Mbeya it was indicated that 16.2% and 16.6% of the respondents kept improved layers and broiler chickens, respectively. The number of improved laying hens kept ranged from 20 to more than 200 with an average 261 birds, while averages were 336, 288, and 175 for Morogoro, Dar es Salaam and Mbeya, respectively. The average number of egg trays that a person produced per day in the surveyed towns was 2.0, with averages of 3.3, 2.0, and 1.5 for Morogoro, Dar es Salaam and Mbeya, respectively and the number of trays sold per day was 3.3, 1.5 and 1.4 in the respective towns. The price of eggs varied from Tshs.1500 to 3000 (US$ 1.5 to 3.0) per tray of 30 eggs, and poultry keepers in Dar es Salaam received higher prices per tray than those in Mbeya and Morogoro in that order. The average price of a tray of eggs was Tshs. 2600 (US$ 2.60), while the average earnings from selling eggs ranged from Tshs. 950 to 11 000 (US$ 0.95 to 11.0) per day. The mean revenue from eggs sales per day in the study towns was Tshs 3667, 4125 and 3909 (US$ 3.70, 4.10, 3.90) in Dar es Salaam, Mbeya and Morogoro, respectively (Mlozi, 2005).

In Tanzania, urban vegetable production is carried out in three spatial environment systems: the peri-urban, open spaces, and home gardens (Mlozi, 1998). Vegetable production in the urban areas takes place in home gardens or on open spaces. Home garden production is by far the most important production system practiced throughout the urban areas. As Mlozi notes that a number of studies on vegetable production show that open spaces produce vegetables for sale, while home gardens are mainly for home consumption. In Dar es Salaam, 90% of leafy vegetables *Amaranthus* in particular come from the open spaces and home gardens (Stevenson *et al.*, 1994). The broad diversity of vegetable crops allow year round production, may improve food security and offer employment opportunities and income to the urban dwellers. A study in Dar es Salaam,

Dodoma and Arusha towns showed that the reason given by urban farmers to produce horticulture crops was for home consumption, to reduce food expenditure, and for income or employment (Stevenson *et al.*, 1994).

Another study by Mlozi (2004) in Dar es Salaam city shows that ***mchicha*** growers can earn a minimum, maximum and mean of Tshs. 193 396 (US$ 277.50), 1 389 780 (US$ 1635) and 700 272 (US$ 823.80). This indicates that the contribution of ***mchicha*** production is not only for providing additional income, but is a source of capital that can be invested in other projects such as building houses and paying school fees for their children. Nevertheless, consumption of fresh vegetables supplement the diet of the household, in addition consumption from their own production reduces their expenditures on food and leaves them with extra cash for buying other house items. Vegetable production has now turned to be a lucrative business in urban and peri-urban especially for women and youth during the dry seasons (Dongus, 2000). Most of the vegetables in urban areas are produced on open spaces found within and fringes of cities. Agricultural open spaces are intra-urban production areas that are surrounded by residential, industrial or institutional areas cultivated by more than one farmer, not necessarily working together as a group and production is market-oriented (Dongus, 2000).

For several reasons leafy vegetables like ***Amaranthus ssp***, sweet potato leaves, pumpkin leaves, cassava leaves etc. are the main crops on urban open spaces because of the following reasons:

- The demand is high because they are one component of the traditional meal with maize stiff porridge (***ugali***).
- These leafy vegetables are very perishable and do not tolerate long transport, hence the closeness of the open spaces to the city markets offers the urban farmers

a market niche. This means that the vegetables reach the markets in fresh condition, and also the transportation costs are low.

According to (Dongus, 2000), the importance of vegetable production on urban open spaces is because of the following reasons:

- It is the source of income for a large number of poor people in towns.
- UA and especially vegetable production on open spaces contributes to the improvement of the urban microclimate, beautification of the city (urban greening) and prevention of illegal dump-sites and squatting.
- UA offers new potential for recycling urban wastes (composting).

Market proximity is a major incentive for the intensification of any farming systems or change of systems to more profitable ones (Danso *et al.*, 2002). Agriculture production, which is not consumed, is either processed or marketed through various channels (Yoveva *et al., 2000*). Studies show that, women play a major role in vegetable marketing in both urban and peri-urban areas (Potutan *et al.*, 2000; Danso *et al.*, 2002). Vegetables are highly perishable, as a result, cannot be stored for long periods of time. The brief storage period means most produce is marketed soon after harvest. The sooner it is marketed the higher the quality of product. Vegetable produce can be sold directly at the farm gate to the consumers or traders (middleman) or at the market (retail/wholesale). Prices vary significantly from buyer to another and from one season to another. In Dar es Salaam, Mlozi (1998) found that 20% of the vegetable buyers transported produce to various city markets, eight percent and four percent stated that women and men sold the vegetables to the markets, respectively, while 11% said that gardeners in low-density areas organized transportation of vegetables to the markets, especially when the price offered by itinerary buyers was low (Mlozi, 1998). Wholesale selling is an option for

growers who produce larger volumes of vegetables and usually involve the ability to store the crop over extended periods of time. One of the drawbacks of wholesaling produce is that one gets only a fraction of the price received by direct selling to consumers. This is not usually attractive to urban farmers who are small and have higher costs of production than larger growers. However, it does provide an option to sell excess produce that they normally would not have been able to market. Vegetable marketing knowledge is a key determinant of profit maximization but most small scale urban vegetable producers lack such knowledge (Drechsel and Kunze, 1999), which impedes their access, to the market or may prevent them from producing for the market.

2.6 Role of UA in Tanzanian Towns/Cities

In the face of continual economic growth around the world, food insecurity and unemployment are still critical troubles in many parts of Africa (UN Habitat, 2006; Mougeot, 2005), and more noticeably in and around cities (Satterthwaite, 1999). For example, FAO estimated that on average 800 million people were unable to obtain an adequate and secure supply of food year round (FAO, 2001; 2004). The FAO (2002) suggests about 33% of people in sub-Saharan Africa is undernourished, and United Nations (United Nations, 2009; UN-Habitat, 2006) reported that the percentage of urban residents in sub-Saharan Africa was expected to rise from 39.7 to 53.5% between 2005 and 2030. This will bring new and severe challenges for assuring household food security and access to basic services (Amar-Klemesu, 2000; Haddad *et al.*, 1998). Against this scenario, UA in or around urban regions, seems to provide a realistic and pragmatic solution (Mougeot, 2001; 2005; Pothukuchi and Kaufman, 1999).

For example, reports indicate that UA is an important source of food throughout developing-countries' food systems and a critical food security strategy for poor urban

households (Mougeot, 2000; Nugent, 2000; Klemesu and Maxwell, 2000). UA may improve household nutrition as it provides a source of fresh, locally grown crops that increase the micronutrients in poor households' diets (Maxwell, 2001; FAO, 2001), and it can increase household incomes (Smit, 1996; Sanyal, 1985; Sabates *et al.*, 2001; Henn, 2002; IFPRI, 2002). Such needs are more evident in Tanzanian towns and cities where persistent poverty and rapid urbanization have brought huge numbers of poor and hungry people into towns/cities. Currently, majority of the population is living on less than $1 per day (USAID, 2005) and from this alarming statistic, it seems fair to assume that increased food production in Tanzania's cities could help the chronic problems like child malnutrition as well as improve livelihoods for the majority of the poor now being attracted to live in towns/cities.

Despite the promise offered by UA, however, there is a real gap in Tanzanian policy and UA seriously not being considered as a viable livelihood option. For example, Tanzania was a signatory to the Harare Declaration on UA and that it statutory recognized (Mlozi, 2001) but there are still no strategies to incorporate it in the town/city master plans.

Despite the fact that urbanisation in Tanzania was initially being responsible for deteriorating economic performance, and that it heightened urban poverty, the same pressures on the contrary accelerated emergence of UA for the survival of poor urban. UA became an occupation to arrest negative impacts and problems emanating from structural adjustment policies that led to retrenchment of employees from civil services and thereafter an activity of the unemployed and urban new comers.

It is evident that UA in Tanzania is considered as an avenue for employment, income generation and food supply. In 1988 national census data ranked UA as the second

prevalent employer after petty traders and was found to occupy 11% of the population aged ten years and more, practiced by 20% of those employed and contributed about 100 000 tonne of food crops per annum (DSM/ARDHI, 1992). Satellite images revealed that a good deal, about 23% of the city was used for agricultural production and data on other Tanzanian cities showed a similar trend of UA (Mosha, 1991; Mvena *et al.*, 1991; DSM/ARDHI, 1992). For example, in Dar es Salaam a larger proportion of the urban dwellers practiced UA with varying production systems and was an exemplary important survival strategy by the urban poor (Jacobi, 1997; 1998).

UA documented mostly involves crops and livestock production of different kinds and livestock include poultry (broiler, layers, and improved local chicken), dairy cattle, sheep, goats, pigs and fish farming both for domestic and sale. A study by IDRC in 1994 found that, poultry was the most widespread livestock in all towns, though sheep, goats and cattle were moderately abundant in the smaller towns and the minority were found to keep fish, pigs and bees (IDRC, 1994). A similar survey in Nairobi city found that approximately 23 000 cattle were kept and most owned by medium-high income dairy farmers. Similarly, findings in Dar es Salaam city showed that, business-related dairy farming was found practiced mainly by middle-high income urban dwellers.

2.7 Integration of UA into Urban Setting

Recently, it has been recognized that there is a need to reconsider our towns/city plans to accommodate farming activities to tape the potential benefits of UA as expressed out in the Harare Declaration on UA. In this regard policy formulation is paramount integrating UA into sustainable urban development. To-date town councils and municipalities in most third world countries planning authorities have powers and functions to plan and implement local development plans, including enforcement of development controls.

Furthermore, town councils and municipalities have powers to specify or formulate development policies. As policy making bodies, town councils and municipalities, therefore, determine and shape the process of development at the local level. It is, therefore, within the ambit of town councils/municipalities to promote or prohibit UA. A policy framework for UA would encompass planning, legislation and regulating guidelines. However, as Foeken (2006) put it, in most towns/cities, UA is ignored, not addressed in national and municipal policies or is not acknowledged as a valid urban land use. And wherever bylaws on UA exist, they are interpreted differently by different stakeholders. Zeeuw de *et al.* (2000) and Wolfgang and de Zeeuw (2002), therefore proposed for specific policy formulation on UA to replace the existing ones which would set out different types of UA activities for different types of land. Such policies should target locating entitlements to food production and should distinguish between profit-driven (UA often capital-intensive) and the subsistence one. UA policies should be related to pro-poor poverty reduction; local economic development; environmental management; integration of disadvantaged groups; promotion of participatory governance and democratic cities (Wolfgang and de Zeeuw, 2002).

2.7.1 Land for UA

UA has become an important coping strategy not only for resource poor families but also for varying categories of city dwellers (UNDP, 1996). A number of NGOs are seeking ways to work together productively with urban farmers to promote sustainable and environment- friendly urban agriculture. Commercial farmers practice high value intensive urban agriculture on farms in and surrounding the city. Land is the basic resource for UA, it has to be obtainable, it has to be suitable and it has to be reachable (Mubvami *et al.*, 2003). UA in most Tanzanian towns/cities can be classified as "on-plot" and "off-plot" types (Flynn, 2001). The on-plot type is usually practiced on the

residential stand itself. The off-plot urban farming practices on the other hand take place on open spaces reserved for future uses, and along riverbanks, dams and catchments areas, along roadsides, railway reserves and hills. These types of activities can either be legal or illegal depending on whether permission from the local authority has been granted or not. The key issues here, especially for informal UA, are its recognition as an official urban land use, access to land and other resources, and security of tenure. Most town councils/municipalities either have city development structure plans, strategic plans or city development strategies, but most of these plans fail to take UA into account and or have accepted inclusion of UA in urban plan as a transitional way (see Box.1.1).

The policy mechanism for integrating UA into urban land use planning is zoning in which layout plans could indicate areas within the city in which UA is allowed. In Botswana, for example, the city of Gaborone has set up poultry zones on land considered of low potential for development of other land uses (Ministry of Agriculture, Botswana, 2006). Other policy options could involve allowing temporary use of vacant public and private land for UA. Municipalities can, for example, allow undeveloped land to be used for urban agriculture, subject to negotiation between the owner and the user (Botswana Ministry of Agriculture, 2006).

Furthermore, municipalities have the option of promoting multifunctional land use through encouraging community participation in the management of open spaces, where food can be grown in combination with other urban functions such as recreation and city greening as is the case of Rosario in Argentina (Lattuca *et al.*, 2005). Therefore, for the purpose of accommodating the multifunctional aspects of UA and protecting urban farming and farmland there is a need for promoting UA coexistence with other activities, collaborating among stakeholders, and educating city dwellers are crucial. UA and other

city land use could coexist as farmers and other urban residents take full advantage of living side by side. Increased collaboration of farmers, residents, local institutions, and municipal administration will be required for peaceful coexistence (Lattuca *et al.*, 2005). As more urban residents become conscious of the importance of healthy food, sustainable farming, and environment preservation, there will be a fair chance for the survival of UA and farmland with expanding urbanization.

UA requires some land space, whether the farming system is soil based or not. Land is one of the most controversial issues associated with UA as it involves scarce urban land, water and other resources. There are a lot of complexities with land for UA (Mushamba *et al.*, 2003). Land for UA is either not available, or when available it may not be accessible, and when accessible it may not be usable for a particular form of agriculture. A compromise is therefore crucial between high demand for land for residential, commercial and industrial development, among others. In some African cities such as Accra, Ghana, Setif in Algeria, Divo in Ivory Coast a lease for agricultural use of the land was only given for one year, because of claims for other uses (Mushamba *et al.*, 2003). This made availability of land, and other resources associated with land such as water, a great concern for the urban farmers.

UA uses institutional land (belonging to hospitals, schools, and churches), riverbanks, roadsides, parks, lands under high-voltage electrical towers that cannot be used for buildings and those surrounding refuse dumps that make up much of a municipality's territory. Planning the use and exploitation of these spaces requires mapping their location as a first step and then assessing their potential. It is important to assess the availability of land for UA in a given city in the short-, medium- or long-term period (Mushamba *et al.*, 2003). Again, land for UA may be available but not reachable because

of social or political reasons. Accessibility relates to the chance for the actual utilisation of available land by needy households or groups, taking into account administrative procedures and conflicts that may arise. Access may refer to the land itself or the use of the land.

However, complexities related to land accessibility and use may inhibit promotion of urban farming practices in many cities. Often ownership and tenure patterns are not known because of lack of records or frequent change of hands. Urban land for UA may also be far from where farmers live and public transportation and roads could be inadequate or not available, and even if land is available, may be too costly for urban farmers to rent. Urban farmers may not have the social or political connections necessary to gain access to the plots that are available; especially the poor and recent migrants in towns often lack access to land for UA. Planning policies and legislation that deem UA as an illegal activity can prevent urban farmers from accessing land. Nuwagaba *et al.* (2003) in Kampala, Uganda, found that the poor accessed land for UA using different ways like squatting (46%), borrowing (34%), inheriting (11%), renting (5%), co-owning with spouses (4%). Less than two thirds, (60%) of urban farmers in Kampala, Uganda, for example, claimed that they were aggressively probing for land, and pointed out that they planned to borrow from the government or relatives, or even seek funds to buy plots for expanding their UA activities.

The usability of existing and accessible land for UA can be determined by factors such as topography, size of plot, soil texture and quality, availability of water and security of tenure. Also, services such as water for irrigation and inputs or market facilities, transportation infrastructure are factors that determine a plot's usability. The suitability of the land will be judged based on its environmental quality, potential agronomic use,

actual use (and previous use if the area has been used as a dump or for other hazardous activities), current regulations for land use, urban and city projects planned, water supply, ownership, and population groups interested in UA (Dubbelling, 2003; 2004).

2.8 Bylaws for Regulating and Controlling UA

An argument against UA to city's environmental fitness in the sense of quality and quantity of urban natural resources maintenance is doubtful. Essentially, basic resources (water, soil) required for UA compete with other equally important developmental urban needs such as drinking water, industrial water use, infrastructure construction. There are threats involved in UA just as there are opportunities for improving the urban environment if food production was properly managed and regulated. The concerns arising from UA not to be practiced in urban areas mainly arises from the use of resources and its externalities (smells, noises, pollution). Due to resource constraints, some urban farmers undertake farming activities in polluted environments, which can cause food contamination.

Urban farmers sometimes apply solid and liquid wastes to their plots which can contaminate food, soil as well as water resources used for drinking and food processing. Evidences indicate that UA can respond opportunistically to demographic, economic and land use changes by inventing new modes and rediscovering traditional modes of providing food for urban population (Maxwell, 1994). The long term viability of UA relative to environmental concerns will depend on how successfully urban farmers and urban officials can collaboratively minimize the environmental problems. Optimal management of urban resources requires land use planning which views UA as an integral component of the urban natural resources system and balances the competitive and synergistic interactions among the users of natural resources (IDRC, 1994).

UA has long been viewed as a tassel activity that has no place in towns/cities; however, its potential is beginning to be realized. In fact, UA is about food self reliance, it involves creating work and is a reaction to food insecurity, particularly for the poor. Contrary to what many believe, UA is found in most towns/cities globally where it is sometimes hidden, sometimes obvious. If one looks carefully around towns /cities, one sees that there are few open spaces in a major city are unused. Valuable vacant land rarely sits idle and is often taken over – either formally, or informally – and made productive. UA is a long-established livelihood activity that occurs at all scales, from the small family-held market garden to the large agri-business located on the fringe of a city. It supplies food to the city and income to those who farm. Above all, UA is making an important contribution to food security for those who do not have easy access. In essence, UA is the true realization of the statement that 'necessity is the mother of invention' (IDRC, 2009).

The advancing mechanized farming and the increased yields linked with fertilizer and pesticide usage have highly reduced employment in the rural sector. Accordingly, farmers are relocating to cities in search of alternative livelihoods. With expanding urbanization areas that are turning from rural setting to urban have often ignored UA and devalued it to an insignificant economic undertaking at best or even completely hindered at nastiest (Mougeot, 2006; Van Veenhuizen, 2006) In general, policies has followed the setup. Many towns, for diverse reasons, have overlooked the contribution of urban farming and settled on disingenuous prohibition of the activity. But this is changing for the better, since acceptance of UA is growing in many municipalities. According to the International Institute for Sustainable Development (IISD), the fourth World Urban Forum of 2006 recognized the crucial importance of UA in cities of the 21st century (IISD, 2006). The acknowledgement of UA and its presence at such a major event is

indicative of wide changes that are taking place with regard to the politics of how cities are viewed and how the value of land – and food production – is perceived.

According to Foeken (2006) throughout the 1990s farming in Nakuru was officially illegal but was tolerated by the authorities. The main legal control mechanisms were the Public Health Bylaws of the Municipal Council of Nakuru (The Municipal Council of Nakuru (Public Health) By-laws, 1994 (approved in January 1995 by the Minister for Local Government). Thus, under this bylaw, any farming activity that was either considered detrimental for public health and/or safety or that other people complained of was dealt with by the municipal authorities.

In early 2000s, under the influence of developments elsewhere and of research activities conducted in Nakuru itself, there has been a mounting responsiveness amongst the local authorities that UA was crucial for the living of many municipal people in Nakuru and that a need arised to try to normalize the sector instead of maintaining a rigid prohibitive attitude (which is seen in many African cities and towns) towards something that is officially illegal. A good option to translate this awareness into policy was to provide training for the development of a new move towards city planning and management, focusing on environmentally-mindful growth of Nakuru, with particular attention to the low-income groups. This resulted into an Urban Agreement acknowledging UA as a verity of life that cannot be ignored when planning for sustainable urban progress (Foeken, 2006) (see Box 1.2).

Changes made on bylaws on different periods are indicators of the contradictions between local legislation, on one hand, and the urban farming activities, on the other. The situation on periodic changes on bylaws is similar in most of the African cities (Martin *et*

al., 2000; Foeken, 2006). As with the national legislation, the situation in Tanzania concerning local legislation in relation to UA is completely different from that in Kenya. Bylaws regulating both crop cultivation and livestock keeping exist in all Tanzanian towns and municipalities. The first urban bylaws for regulating and controlling crop cultivation and livestock keeping in urban centres were enacted by the British colonial authorities in 1928. These bylaws had three main objectives: (a) to disallow citizens of African descent to grow crops and to keep animals within the city; (b) to prevent UA practices, especially rising crops taller than one metre, in urban areas because they were thought to harbour malaria-carrying mosquitoes; and (c) to maintain a dirt free urban setting.

Box 1.2 Examples of by laws on Urban farming in Nakuru Municipality
Initially, the formation and acknowledging operations by Nakuru Urban Agriculture Project (NUAP) proved the integration of UA as fruitful and an essential urban utility. UA was to secure agricultural lands from the threats of development of other built-up land uses in Nakuru. However, the amendments on bylaws to the new Environmental Management Bylaws in 2004 led to the prohibition of anything causing a nuisance to the people's health or polluting the environment. With the changes made on bylaws varying forms of UA activities were again prohibited. For instance, Bylaw 180 dealing with the growing of food crops, states that (i) Any person found growing food crops within the Council's jurisdiction shall be guilty of an offence. (ii) Any person who grows (...) tall grass or vegetation of more than half-foot high in his or her plot or within a radius of five metres from the boundaries of the plot shall be guilty of an offence. The Control of Stock By-Laws of 2004, Bylaw 4 states: No person shall keep or graze any stock or horse within the boundaries of the Municipal Council of Nakuru unless he is in possession of a permit (...) This permit, however, is issued only in respect of stock held for slaughter at the Council's slaughterhouse, stock to be offered for the Nakuru Agricultural Show, or stock that has been "lawfully impounded" (Bylaw 5). In other words, it is not possible to obtain a permit for livestock kept in the way many Nakurians currently do. Even so, Bylaw 6 prohibits the construction of any stable or shed or whatever building for keeping livestock. Bylaw 7 provides that "no stock shall be kept (...) in or under any portion of any building (...) used for the purposes of human habitation", so keeping chickens in a room in the house, as some people do, is illegal.

Adopted from Foeken,(2005), Urban agriculture in East Africa as a tool for poverty reduction: A legal and policy dilemma?ASC Working Paper 65 / 2005

However, after independence in 1961, most of these by-laws became dysfunctional. By early 1980s, policies that cheered UA, especially livestock keeping, started to have negative effects on the urban environment and town councils/municipalities bylaws

regarding UA had to be revised. According to Mlozi (2001) two bylaws namely the 1987 bylaws on crop cultivation in Mbeya city council and the 1999 bylaws on livestock keeping in Morogoro municipality were revised and other town councils/municipals followed suit. (see Box 1.3). There are specific bylaws forbidding growing of crops in certain chosen areas. For example, crops taller than one metre are not allowed and these include maize, plantains, cassava and sugarcane. Bylaws on livestock keeping allowed one to have a special permit from the Town or City Director and a maximum of four head of cattle kept under zero-grazing and in specialized structures were allowed and owners were to compulsorily remove manure, liquid waste material and other animal waste (Kitilla, 2001; Kitilla and Mlambo, 2001; Mlozi, 2001).

In practice, current bylaws are contradictory and meaning that UA is still viewed as an illegal activity in most of the urban areas in Tanzania. However, it is familiar to see crops of all varieties planted in most municipality areas, on road reserves, riverbanks, in open public spaces and on surveyed plots meaning that bylaws are ignored with impunity. The extent to which urban farmers are knowledgeable about the bylaws is doubtful. But, the reality is that there are many senior government and council officials who pay no attention to enforcing bylaws, leading to most urban dwellers to practice UA. As described by Mvena *et al.* (1991), in all Tanzanian municipalities practically all the bylaws are not adhered to by most urban farmers. Besides the fact that the municipal authorities do not have the means to effectively enforce them, the very people who are supposed to see to the enforcement of the laws are the ones violating them (Sawio, 1993). The great questions remain; to what extent do existing bylaws and policies convince the urban poor to take on UA? Can we set basis upon which the decision on which types of UA activities to do relying on their relative efficiency in terms of resources utilization, social acceptability and environmental sustainability.

Box 1.3 Examples of bylaws on UA in Tanzania towns/cities

The Mbeya bylaws on crop cultivation apply to 15 of the 36 wards within town and other wards in the city's periphery. In the built-up areas the bylaws differentiates between areas where growing crops is completely forbidden (bylaw 3) and where it is allowed (bylaw 4). Growing crops is forbidden on road reserves up to a distance of fourteen meters from the road bank as well as in all public spaces including children play grounds and all surveyed plots held under any law. As for the river valleys, crop cultivation is not allowed within fifteen metres.

In the Morogoro bylaws on livestock keeping stipulate that, "animals" are cattle, donkeys, goats, horses, mules, pigs and sheep. Small livestock like chickens, ducks, rabbits and turkeys, most of which are now raised in urban areas are left out. Bylaw 3 stipulates that it shall earmark certain areas to be known as 'specified areas' within the urban area for the purpose of keeping animals [and] along which to move an animal or animals and permits shall be issued by the Council in respect of animals authorized in the urban area. Bylaw 5 forbids keeping animals outside "a building, structure or enclosure". According to by-law 8, animals are not allowed to be kept "in a building or part of such building that is used for human habitation. Bylaws 5 and 6, require that urban dwellers remove manure, liquid filth and other animal wastes. Bylaws 8 and 9 forbid ways of crop cultivation, including for instance the use of machinery, planting time, the use of inputs, weeding, the use of certified seeds, planting on slopes, as well as what to do in case of pests or diseases. Bylaw 11 stipulates the penalties for not adhering to these regulations, including fines, imprisonment and the destruction of crops. Although these by-laws exist and clearly stipulate the penalties for infringement, they are rarely enforced.

Adopted from Mlozi (2001), Political economy of urban agriculture in Tanzania. In The political economy of urban and peri-urban agriculture in eastern and southern Africa. Proceedings of the MDP/IDRC workshop, Harare, Zimbabwe, 28 February to 2 March, 2001, pp. 50-56.

Note: bylaws do not specify the numbers and types of animals that urban dwellers are allowed to raise in different density areas.

.As previously reported in Tanzanian cities of Dar es Salaam, Arusha and Dodoma, trials had revealed that production of leafy vegetables can be raised considerably to levels much higher than at present (Jacobi *et al.*, 2000). UA in urban areas for the urban poor is a means of survival and should be approached cautiously. Based on the Harare Declaration, UA should, among other things, be integrated in urban food security, environmental and health policies and be given technical assistance and credit services.

2.9 Institutional Support for UA

Tanzania had been losing jobs in the formal and immigrants to urban areas resort to produce UA. As towns grow into cities, UA practices within and outside also changes. One outstanding institutional support of UA in towns and cities is Urban Agricultural and Livestock Extension Agents (UALEAs) who are employees of ministries of agriculture and Livestock, but work under the local government authorities. However, these

individuals were not specifically trained to work in urban areas. UALEAs, in urban areas face challenges related to UA need to be ecologically friendly, that need processing and appropriate marketing techniques, limited space, safe disposal of UA wastes, UA that is demand driven, proper choice of UA enterprises.

UA is omnipresent in Tanzanian towns and cities. In many towns and cities in Tanzania, for example, farming is practiced in the urban and per-urban areas and towns and cities master plans for such peri-urban areas that are allocated for cultivation and livestock keeping are known as "green belts". However, with population increase, and increased urban sprawl "green belts" have been built up... an example is Mkundi in Morogoro municipality. The example of UA in Dar es Salaam city is very illustrative. Here UA is practiced in the open spaces, undeveloped plots, road reserves, swampy areas, riverbanks and flood plains in residential houses and areas designated as hazardous.

Improved dairy cattle keeping feature more in low-and medium density areas due to large plot sizes. In Buguruni and Manzese wards, about 40 percent of the low income people who left formal employment in the 1980s went into urban farming (Tripp, 1990). As time went on, UA in Dar-es- salaam changed to include people of high and medium social economic status (Mlozi, 1995). In the city of Dar es Salaam, Mlozi *et al.* (1989) found that in 1985 there were 3318 heads of improved dairy cattle, which rose to 7105 in 1988. In the year 1991, in Oyster Bay, a salubrious area of the city of Dar-es- Saalaam, 90% of the elite kept an average of eight improved dairy cattle (Mvena *et al.*, 1991). In 1991, in Dar es Salaam city, an urban farmer got average annual revenue of Tanzania Shillings (Tshs) 241 300 (US$ 965.20) and 115 000 (US$ 460.00) profit from UA activities (Nyambaya, 1991). This amount was 1.6 times more than from an annual income of a minimum salary of Tshs 72 000 (US$ 288.00). Furthermore, in 1991, 10 229 UA

enterprises realized an annual gross output of Tshs 6.8 billion (US$ 27.4 million) and the annual value added was Tshs 2.8 billion (US$11) (Nyambaya, 1991 cited in Mlozi, 2003). The average gross output was Tshs 583 billion (US$ 2.3 billion) with average value added of Tshs. 239 billion (US$ 956 million) (Nyambaya, 1991 cited in Mlozi, 2003).

In 1993, Mlozi (1995) found that improved dairy cattle in the city of Dar es Salaam had increased to 9 081. In 1993, in Kinondoni District, 49% of the urban farmers indicated that UA provided them with between 20-30% of household food (Sawio, 1993). Furthermore, in 1993, some 44% of the low-income urban dwellers in Kinondoni District indicated to have farms (Sawio, 1993).

Mlozi (1995) carried out a survey in Kinondoni Block A, Kinondoni Block 41, Kalenga, Shaaban Robert, and Oyster bay areas of Dar es Salaam city and found that farmers earned profit amounting to Tshs. 37.4 million (US$ 77,917), from raising livestock such as improved dairy cattle, exotic crosses of layers and broiler chicken. The study showed that of the total profit, 79.1% was earned by those in Oyster bay (a low density area) followed by Kalenga and Shaaban Robert areas (medium density areas). The profit that each respondent made from UA was about seven times higher than the annual salary of a senior government official earning Tshs. 240 000 (US$ 500), and ten times higher than the annual minimum wage income of Tshs 72 000 (US$ 150) (Mlozi, 1996).

2.10 The Future of UA in Towns and Cities

Future urban human congestion brings about a re-thinking of how UA activities by the year 2050 will be as "nearly 80% of the earth's population will reside in urban centres" (Hagmann, 2001; UN, 2009). Applying the most conservative estimates to current

demographic trends, future human population will increase by about three billion people (UN-Habitat, 2006). And UNDP estimates that 800 million people are currently engaged in urban agriculture worldwide, with the majority in Asian cities, and of these, 200 million are considered to be market producers, employing 150 million people full time (UNDP, 1996).

According to Mougeot (2000) in the next decade, urbanization will build up in many parts of the world, but Africa and Asia will eyewitness the largest part in urban expansion, and these countries are the leas well-prepared to assure their food desires, and many already depend riskily on food imports. Therefore, UA could remain one way to augment city food supplies, while also increasing the incomes of the poor. The potential of UA will be on its uses of resources, products, and services found in and around the city area and, in turn, often supplies resources, products, and services to that area. UA is therefore, an important supply source of food for some poor municipal households because it affords a cheap, simple, and flexible tool for productively using open urban spaces, treating and recovering urban solid and liquid wastes and generating employment and income. Also, it can add value to products, manage freshwater resources more sparingly, and resolve otherwise incompatible urban land use issues.

UA complements, rather than supplants, rural supplies and imports of food and will continue to do so, and UA can provide significant amounts of food at small scales(Plate 2), can generate goods valued at tens of millions of dollars in any given major city (Nugent, 2000). By growing their own food, town and cities will lower their food deficits and obtain an important source of fruits, vegetables and livestock products. UA provides an estimated 15% of all food consumed in urban areas and is likely to double that share in the next couple of decades (Smit *et al.*, 1996). Cities with more advanced UA sectors,

particularly in Asia, have become largely self-sufficient in higher-valued, nutritious perishables and some cities even export surpluses abroad.

Plate 2: A Chinese vegetable garden at Mabwe, Pande- KMC in April 2008

2.11 Efficiency of UA

2.11.1 Measuring efficiency in farming

Technical efficiency in production is defined as the ability of the farmer to produce at maximum output, given quantities of inputs and production technology (Aigner, *et al.*, 1977). Production efficiency is concerned with the relative performance of the process employed to transform inputs into outputs. Efficiency in farm production is a way to

ensure that products are produced in the best and most profitable way using a given level of output with minimum quantity of inputs under a given technology. There are mainly two types of efficiency measures the allocative and technical efficiencies. According to Olayide & Heady (1982) allocative efficiency is a measure of the degree of success in achieving the best combination of different inputs in producing a specific level of output considering the relative prices of these inputs while technical efficiency reflects ability of a farmer to maximize output from a given level of input(s). Technical efficiency measures the firms' ability to use the available technology in the most effective way while allocative efficiency is dependent on prices and measures the firms' ability to make optimal decisions on product mix and resource allocation (Farrell, 1957). Economic efficiency is a product of technical and allocative efficiency. In one sense, the efficiency of a firm is its success in producing as large an amount of output as possible from given sets of inputs. Maximum efficiency of a firm is attained when it becomes impossible to reshuffle a given resource combination without decreasing the total output.

Since the seminal work of Farrell (1957), several empirical studies have been conducted on farm efficiency to prevent waste of resources. The basic purpose of any measurement system is to provide feedback, relative to the intended goals, that increases your chances of achieving these goals efficiently and effectively (Udoh, 2000; Udoh and Etim, 2009). The ultimate aim of implementing a performance measurement system is to improve the performance of any undertaking and imposing necessary changes to the investment made to rip more profit and make the enterprise more sustainable (Jahansson, 2005). Being efficient entails the best use of resources, so that the highest numbers of quality products are produced for the lowest cost possible per item.

Basically, the performance of any production unit is quantified by the efficiency measures, which are of primary interest in productivity analysis. Its distance to the frontier built by the best production scenario usually defines the efficiency of producer at any given locale. The production scenario is composed of two factors: input factors and output factors. For example, labour and capital are most typical input factors, and profit is an output counterpart. UA farmers aim to maximise household welfare, given household resources, prices and access to needed foodstuffs, inputs and risks and uncertainty about markets, policies and weather. Interviews with urban farmers (from several case studies) reveal that the kind of behavioural and economic incentives facing the household vary, even within the same city and culture (Nugent, 2000). The decision to farm and the level of effort spent on UA sometimes does not have a clear relationship to income, wages, prices or employment opportunities. Despite these complications, modelling household behaviour, factors and other incentives will help to better understand household decisions towards engaging in UA and predict the upcoming behaviour on UA in the country. According to Yoveva *et al.* (2000), urban farming does have diverse elements that could equally be looked into whenever evaluating its efficiency in terms of its performance in the given locale. Such elements include:-

- Efficiency could be measured in terms of cost savings that can be achieved because of UA immediacy to consumers, has less need for extensive and expensive infrastructure for transportation and preservation of the perishable UA products.
- Efficiency could also be measured in quality of products from urban farming that seem to increase because of greater responsiveness to consumer preferences as well as availability of products that cannot be supplied by rural producers.

- Diversity of its products in terms of crop species (especially horticultural based) allows year round engagement in urban farming activities albeit on small plots, hence creating permanent employment and income source.
- Efficiency also could be realized through making productive use of under-utilized resources such as open spaces, treated waste water, other recycled wastes, and unemployed labour.
- Urban agricultural production links farm cultivation with small-scale enterprises such as street food stands, fresh milk outlets and street food vendors all contributing to municipal economies.

2.11.2 Measuring efficiency in UA activities

UA has relatively expanded in and around towns and cities in many developing countries, which allows for year-round production, employment and income. Urban dwellers have realized that intensive UA can be practiced on small plots, by making efficient use of limited water, land and other resources. Horticultural species for example, have considerable yield potential and can provide up to 50 kg of fresh produce per square metre per year, depending upon the technology applied (FAO, 1996, Mwakaje, 2007). In addition, due to their short production cycle vegetables provide a quick response to emergency food needs (several species can be harvested 60 to 90 days after planting.) Leafy vegetables provide a quick return that helps families meet their daily cash requirements for purchasing food (Jacobi *et al.*, 2000; Mwakaje, 2007). Urban producers also achieve real efficiencies by making productive use of under-utilized resources, such as vacant land, treated waste water, recycled waste, and unemployed labour. Productivity can be as much as 15 times more compared to the output per hectare of rural agriculture, although yields often suffer from inferior or insufficient inputs, use of poorly adapted varieties, poor water management, and lack of farming knowledge (FAO, 1996).

In addition, urban farmers often use low-input processing and storage techniques in search of more profit from their investments. They will take all the opportunities to minimize extra charges in production costs. Additional charges like, transportation, distribution and marketing costs incurred limit the quantities that can be produced and delivered into the market. Micro-credit support for storage and refrigeration and setting up specific market for urban produced agricultural products could raise the income potential of urban farmers, and improve the safety of food sold by street vendors who rely heavily on urban food production.

As pointed out in Alvarez and Crespi (2003) various degrees of inefficiency in production seem to be the rule rather than the exception. A study on efficiency (technical and allocative efficiency) on a sample of New England dairy farms using the stochastic frontier approach (SFA) and a Cobb-Douglas production function, found an overall economic inefficiencies of an average 30%. However, the study revealed little difference between mean technical efficiency of 83.0% and mean allocative efficiency of 84.6% (Bravo-Ureta and Rieger, 1991.) A study by Lansink *et al.* (2002) on technical efficiency of Finnish farms, using the data envelopment analysis (DEA) found that the livestock farms had technical efficiency scores of 69%. Heshmati and Kumbhakar (1994) carried out a longitudinal study to examine the technical efficiency of four panels of Swedish dairy farms using the stochastic frontier approach and found that the mean technical efficiency indices were lying between 0.81 and 0.83 for all four panels. This indicated technical inefficiencies of almost 20% in the Swedish dairy farms.

However, as commented by Coelli *et al.* (2002) the efficiency indices obtained by different methods only measure the relative efficiency within the sample. There are a number of factors exerting influence of efficiency of an enterprise in question. For

example Bravo-Ureta and Rieger (1991) found that farm size was a parameter, which revealed to have a significant influence on efficiency. They found a significant positive relationship between technical efficiency and farm size in the sample of New England dairy farms. Bailey *et al.* (1989), who estimated technical, allocative and economic efficiency on a sample of Ecuadorian dairy farms, also found a positive relationship between farm size and technical efficiency. In contrast to the New England study, medium-sized Ecuadorian farms were found to be as allocatively efficient as large farms (Bailey *et al.*, 1989).

Although various studies have examined the issues of productivity and technical efficiency of farmers, only a handful of them spotlight on Sub-Saharan Africa (SSA) and of these even fewer focus on Tanzania. Of the few studies that have analyzed efficiency in SSA agriculture include Shapiro and Muller, (1977); Seyoum, *et al.*(1998); Duvel, *et al.* (2003); Msuya and Ashimogo (2006); Tchale and Sauer (2007). In Tanzania, little empirical work has been undertaken to quantitatively study the efficiency levels of smallholder farmers with a purpose of identifying ways of improving their efficiency. Msuya and Ashimogo (2006) determined the technical efficiency of sugar cane smallholder farmers, while Shapiro and Muller, (1977) looked at cotton. According to Msuya *et al*, (2008) there are a few studies, if any that have determined the efficiency of smallholder farmers in Tanzania focusing on food crops. Several studies on efficiency have been carried out in Nigeria like that of Udoh (2000), Okike (2000), Amaza (2000), and Udoh and Akintola, (2001). Udoh employed the Maximum Likelihood Estimation (MLE) of the stochastic production function to examine the land management and resource use efficiency in South-Eastern Nigeria. The study revealed a mean output-oriented technical efficiency of 0.77 for the farmers, 0.98 for the most efficient farmers and 0.01 for the least efficient farmers. Okike's study investigated crop-livestock

interaction and economic efficiency of farmers in the savannah zones of Nigeria. The study found that average economic efficiency of farmers was highest in the low-population-low market domain and crop-based mixed farmers farming system.

As has already been indicated, the results of an efficiency study can be sensitive to the methods selected to estimate the efficiency scores. The two most popular techniques used to measure farm efficiency are the DEA and the SFA (Aigner *et al.*, 1977; Charnels *et al.* 1978, Coelli and Batesse, 1996). DEA uses mathematical linear programming methods, whereas the latter uses econometric methods. The choice of method to use is in no way evident, but has to be decided in every case. The quality of data, the appropriateness of various functional forms, and the possibility of making behavioural assumptions will heavily influence the relative appropriateness of DEA and SFA. For example, the DEA approach, compared to the SFA doesn't require any specific functional form to be selected, neither are any behavioural assumptions needed as long as allocative efficiency is not considered.

However, DEA is a deterministic approach, meaning that it doesn't account for noise in the data. All deviations from the frontier will thus be accounted for as inefficiencies. Therefore, the DEA efficiency scores are likely to be sensitive to measurements errors and random errors. The SFA on the other hand accounts for random errors and has the advantage of making inference possible (Coelli *et al.*, 2002). However, SFA is sensitive to the choice of functional form. Obviously, choosing between parametric and nonparametric methods is a delicate matter and some studies comparing the results of two approaches found that choice of method had no influence on the results (Coelli and Perelman, 1999). In agriculture, an example is Irises *et al.* (2003) who compared

technical efficiency results on a sample of Spanish vegetable producers, and found correlation between the parametric and nonparametric approach.

However, a study by Sharma *et al.* (1999) found that on average, the estimated technical and economic efficiencies were significantly higher in the SFA compared to the DEA under the assumption of constant returns to scale (CRS). Under the assumption of variable returns to scale (VRS) however, the measures were quite similar. As DEA reports all deviations from the frontier as inefficiency, and thus should report lower efficiency scores compared to SFA it is possible to assume that DEA is the better choice whenever the reported scores are higher under DEA. A higher DEA result is an indication of miss specification of the functional form used in SFA. When analysing the technical and allocative parts of economic efficiency, as in the example of Sharma *et al.* (1999), a dual functional form (i.e. Cobb-Douglas) has to be chosen. Higher scores under DEA imply that restrictions of functional form under SFA are inappropriate. The issue on which method should be employed when analysing technical, allocative and economic efficiency in different farms is still unexplored. The aim of this study, therefore, was for determining efficiency to compare the relative efficiencies of the various UA activities to improve future choices of enterprises and allocation of production inputs for improved productivity.

2.11.3 Resource use efficiency in UA

Few studies have determined efficiency of UA activities. Although agriculture is primarily a rural based activity, with the increasing demand for food and jobs for many urban dwellers, it has became necessary for some urban dwellers to practice UA as a means of supplying their food needs and earning extra incomes for their families. In addition, UA practices have increased for the past decades due to rise in food prices,

increased urban population, lack of formal employment and economic crises. Perhaps this may be due to the fact that UA is a relative new undertaking that has in recent times started gaining attention as a complementary practice of rural agriculture. Likewise empirical research in UA is also new. Udoh (2000) used MLE of the stochastic frontier production function to analyse the resource use efficiency of urban farmers in Uyo, South-eastern Nigeria and found that 65% of the urban farmers were 70% technically efficient with maximum efficiency of 0.91 and minimum efficiency of 0.43. The urban farmer, typically produce to satisfy household food needs and to make some profit.

Where production is for home consumption only, farmers optimise yields. If production is for the market, the cost of production and the returns become important measures of performance, which entails efficient use of scarce farm resources. However, if not properly planned, the poor will be constrained from doing well with UA for many reasons, including lack of access to land, credit, water, and other inputs or legal obstacles arising from concerns about public health. Urban farmers often use public spaces, and if they lack title to the land they use, they cannot be assured if they will actually reap the benefits of their investment. Aridity, unreliable supplies of piped water, and unreliable rainfalls can all critically constrain many production systems. If improperly managed, UA can even intensify environmental degradation, including soil erosion, loss of vegetation, and depletion of water resources.

Public health concerns stem from misuse or mishandling of agrochemicals such as the application of untreated or improperly treated wastes to food crops, land pollution, including possible contamination from heavy metals; and unsafe disposal of vegetable and animal wastes. Legitimizing UA will help low-income practitioners gain access to land, needed extension services, and credit. Governments can provide land for greenbelts

for UA, lease out public land, and assign undeveloped public land to farmer organizations. Urban bylaws and regulations be revised to be compatible with people's survival options, as in Kampala, where bylaws now allow for certain kinds of farm production in certain zones and provide loans (e.g. Tanzania) (Dongus, 2000). Urban farmers can be educated and empowered to reduce environmental risks and gain financially by boosting productivity and decreases the use of potentially contaminated water.

Efficiency is at the heart of any agricultural production because the extent of agricultural production can be expanded and sustained by farmers through efficient use of resources (Udoh, 2000). Efficiency, therefore, remains an important subject of empirical investigation particularly in developing economies where majority of the farmers are resource-poor and are constrained by a number of other factors influencing efficiency. Literature on Tanzania UA shows that, in spite of its increase most studies have been exploratory with non that has investigated on UA efficiency. UA in Tanzanian towns and cities is diverse and hence, this study investigated the technical efficiency of mixed UA activities.

2.12 Conceptual Framework for Analysis of UA Efficiency

The conceptual framework as adopted from Rooyen *et al (1995)* and modified to suit this study is presented in Fig. 1 shows the scenario under which UA is conducted in Tanzania towns/cities. UA in Tanzanian towns/cities is operated in three main areas namely high density areas with high concentration of people and smaller plot sizes, medium density areas with relatively spacious plots and low density areas with bigger plots and less concentration of people. For realising improved efficiency in UA practices, several elements need to be investigated on the way they impose inefficiency on UA and possibly

taking corrective measures such that, in a long run UA efficiency could be enhanced. There are a number of factors that influence performance and efficiency of UA activities. The factors are socio-economic characteristics, farm characteristics, and institutional support and UA products marketing system. Urban farmers who have relatively high level of education and knowledge of farming will likely adopt modern UA farming technologies and exhibit higher managerial aptitude and hence likely to operate UA with efficiency. Such UA farmers with enough experience in urban farming will show progressive attitudes towards farming in space constrained areas. However, younger UA farmers are active and enjoy relatively high standard of living and socio-economic status, participate in organizations and have greater contact with information sources and thus likely to operate UA with high efficiency. On the other hand, land ownership limits most city dwellers to engage in UA activities. Most UA farmers conduct farming activities on plots they do not own hence limiting them from planning for expansion and doing greater modifications to expand their UA production practices. Similarly, the size of plots within towns/cities are small and hence requiring modifications in UA farming technologies to be able to produce UA products efficiently. Proper selection of type of UA practice is required as it has implications on resources requirements and hence influencing its efficiency. There are types of UA practices that complement each other, like using chicken manure to fertilize horticultural plots to increase productivity.

Therefore, proper selection of the complementing UA practices influences the overall production efficiency. Enabling environments in terms of municipal bylaws and policies, provision of urban extension services, exchange of information between different actors, training of urban farmers, input supplies and provision of credits are required to facilitate efficient production in UA activities. Supported with proper marketing system in terms of price setting, reducing transport costs of UA products by reducing distances of

transporting products from production sites to consumers, and producing during a season that UA products will fetch good prices in market will highly improve UA efficiency. However, variables explaining UA farming progressiveness are a multi-variant cause/effect phenomenon. Many of the important social and economic factors influencing farming progressiveness are easily amenable to manipulation and can considerably be influenced by well planned extension services provision and good bylaws for regulating and enabling efficiency in practicing UA to be realized.

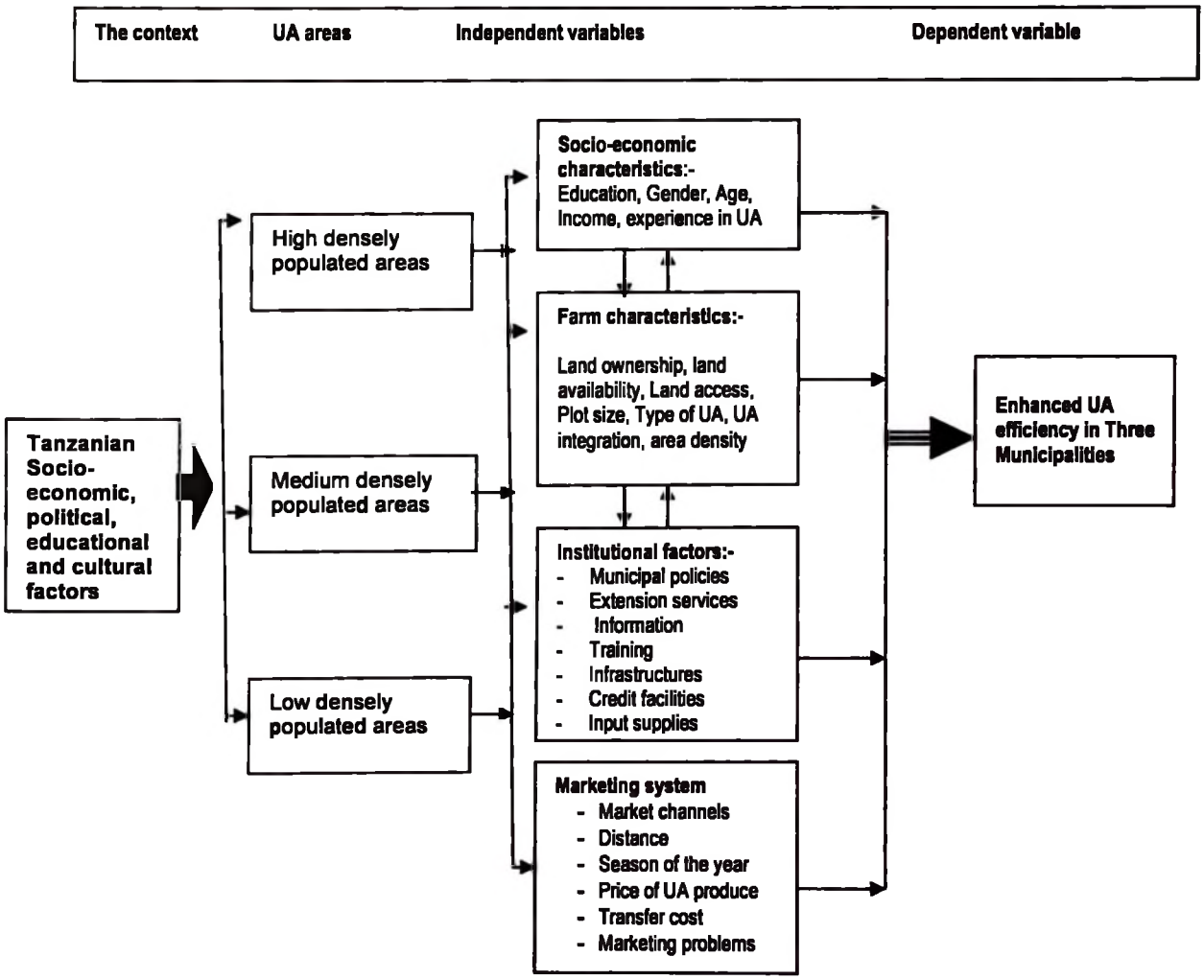


Figure 1: Conceptual framework for analyzing technical efficiency of UA

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Description of the Study Areas

This study was carried out in Arusha Municipal Council (AMC), Dodoma Municipal Council (DMC), and Kinondoni Municipal Council (KMC). These areas were purposively selected because of their economic imperative. Dar es Salaam, Kinondoni Municipal Council (KMC) was selected because of its burgeoning UA activities since the 1970s and the number of urban dwellers engaging in UA is increasing. The surveyed parts of KMC included Mwananyamala, Mikocheni, Reagent estate, Msasani, Mabibo and Makumbusho. Still other studied *mitaa* were Kawe, Kigogo, Oyster Bay, Kijitonyama, Mbezi, Sinza, Boko, Hananasifu, Kunduchi, Ubungo and Goba. Also the study had respondents from Bunju, Salasala, Masaki, Msewe, Magomeni, Kinondonishamba, Tandale, Mzimuni, Kiluvya, Kimara, Minazini and Msumi (Fig. 2).

The main economic activities in KMC include trade, formal employment, petty trading and UA activities. UA is mainly conducted at household level whereby livestock keeping was found to be prominent. KMC has hot humid climate with two seasons in a year: the short rain season between October and December, and the long rain season from March to May, and on average, KMC receives about 1,100 mm. of rainfall per annum with mean temperatures of 26^{O}C ranging from 30 to 60^{O}C. KMC boarders Kisarawe district in the northwest, Ilala and Temeke in the south, Indian ocean in the northeast, and Bagamoyo on the north. According to the 2002 Population Household Census, KMC had a total population of 1 088 567 people. Administratively, KMC is composed of 3 divisions, 27 wards with a total of 113 urban *mitaa* [***mtaa(Mitaa in plural) is a Swahili word which is used to describe*** part(s) of a town].

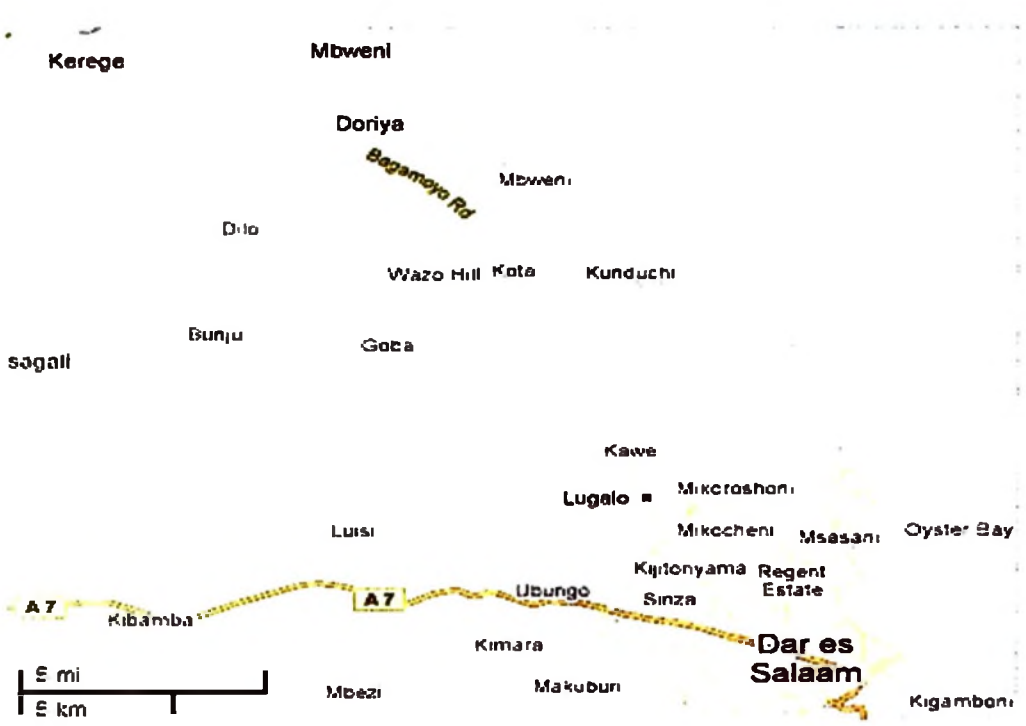


Figure 2: Map of surveyed mitaa in Kinondoni Municipal Council

Arusha was selected because of its vibrant tourist attraction which has increased demands for fresh foods and hence increases UA activities to meet the demands. Arusha Municipality is situated in northern Tanzania surrounded by some of Africa's most famous landscapes and national parks. The surveyed *mitaa* in Arusha municipal council included Lemara, Sokon I, Kimandolu, Sinoni, Olorieni, Olmatejoo, Sekei, Kaloleni, Unga Limited, Ngarenaro and Sakina (Fig. 3). Beautifully situated on the foot of mount Meru, it has a pleasant climate. Despite its proximity to equator, Arusha's elevation of 1400m keeps temperatures down and alleviates humidity. Cool dry air is prevalent for much of the year and temperatures range between 13 to 30^{O}C with mean temperature of 25^{O}C. It has distinct wet and dry seasons and has bimodal rainfall pattern with short rains from October to December and long rains from March to May.

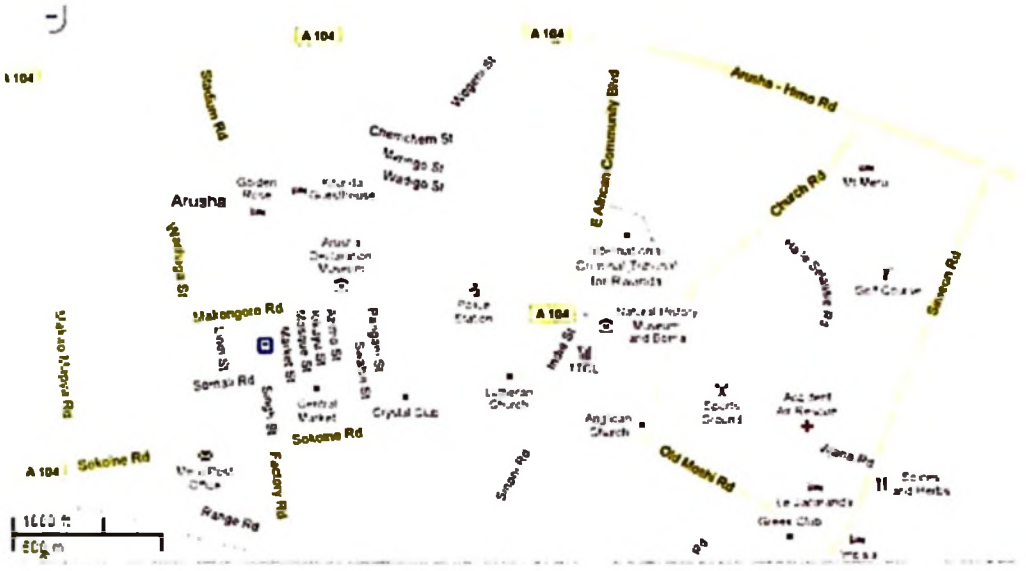


Figure 3: Map of Surveyed mitaa in Arusha Municipal Council

According to the 2002 population census, Arusha municipal had a population of 270 485 people. Although the primary industry of the region is agriculture, tourism is also a major contributor to the economy of Arusha. Given the municipal's location near popular attractions such as Mount Kilimanjaro, and a number of national parks and game reserves, Arusha has become a popular staging point for tourists visiting Tanzania.

Dodoma, on the other hand, was selected because it is a designate political capital city and UA flourish to feed the increasing population. Dodoma municipal council is located in the centre of country 468 kilometres west of the former capital city, Dar es Salaam. It covers a total area of 2669 square kilometres of which is 625 square kilometres is urbanised. The surveyed *mitaa* in DMC were *mitaa* of Area A, Area C, Chang'ombe, Kilimani, Uzunguni, Chinangali and Kiwanja cha ndege (Fig. 4)

Figure 4: Map of surveyed mitaa in Dodoma Municipal Council

Dodoma municipality is situated in an economically depressed area and although it has rich agricultural land, it is affected by harsh semi-arid climatic conditions. On average Dodoma receives 570 mm of rainfall per annum with temperatures ranging from 16 to 36^{O}C with mean temperatures of 29^{O}C. According to the population census of 2002, Dodoma urban had a total of 324 347 people. The main economic activities in the municipality include commerce, civil service employment and UA activities. In all the three studied cities, main UA economic activities include food crop-based (amaranths, plantains, cabbages) and livestock production (dairy cattle, broilers, layers); ornamental plants (trees and flowers). However, this study concentrated on food crops and livestock as trees and flowers are new upcoming UA practices. .

3.2 Research Design

The study adopted a cross-sectional approach. According to Bailey (1994) and Casley and Kumar (1987), the design allowed data to be collected at a single point in time to

capture important aspects in UA practices. Data on performance of UA activities were collected from a sub-set of urban farmers to determine whether there were relationships between types of resources used to produce UA products and the efficiency of a given UA practice. Knowledge of UA farmers on bylaws set for regulating UA activities and marketing of the UA products were also collected and relationship with socio-economic characteristics of urban farmers were determined. The design was feasible, economical and data collected were used to determine and compare UA indices between the different density areas and different types of UA enterprises.

3.3 Sampling Frame and Sampling Procedure

3.3.1 Sampling frame

The sampling frame included all urban farmers keeping dairy cattle, raising broilers, keeping layers and growing vegetables in the three density areas in Arusha, Dodoma and Kinondoni Dar es Salaam municipal areas. Data obtained from UALEAs in the three municipalities on number of UA farmers who undertook dairy farming, keeping poultry (Layers and Broilers) and vegetable growing, were as follows; Dodoma municipal had 760 UA farmers, Arusha town had 805 UA farmers and Kinondoni municipal council were about 6000 UA farmers. The three practices were selected because they are among the UA practices that are commonly undertaken in urban centres.

3.3.2 Sampling procedures

The study elicited information from small-scale urban farmers operating in the three municipalities under study. To obtain the desired population, a simplified formula for proportions by Yamane (1967) was adopted. Since majority of UA farmers undertook a combination of UA practices, Dodoma municipality which had the lowest UA farmers' population was used as the base for calculating the total desired sample size and then the

sample size was balanced to have equal number of respondents for the three municipalities for comparison purposes.

The formula was adopted assuming a 95% of confidence level and ± 5% precision. A resulting sample size was:-

$$n = \frac{N}{1+N\,(e^2)}$$

Where n is the sample size, N is the population size of UA farmers in Dodoma municipality, and e is the level of precision. When this formula is applied to the population of UA farmers in Dodoma municipality, it gives,

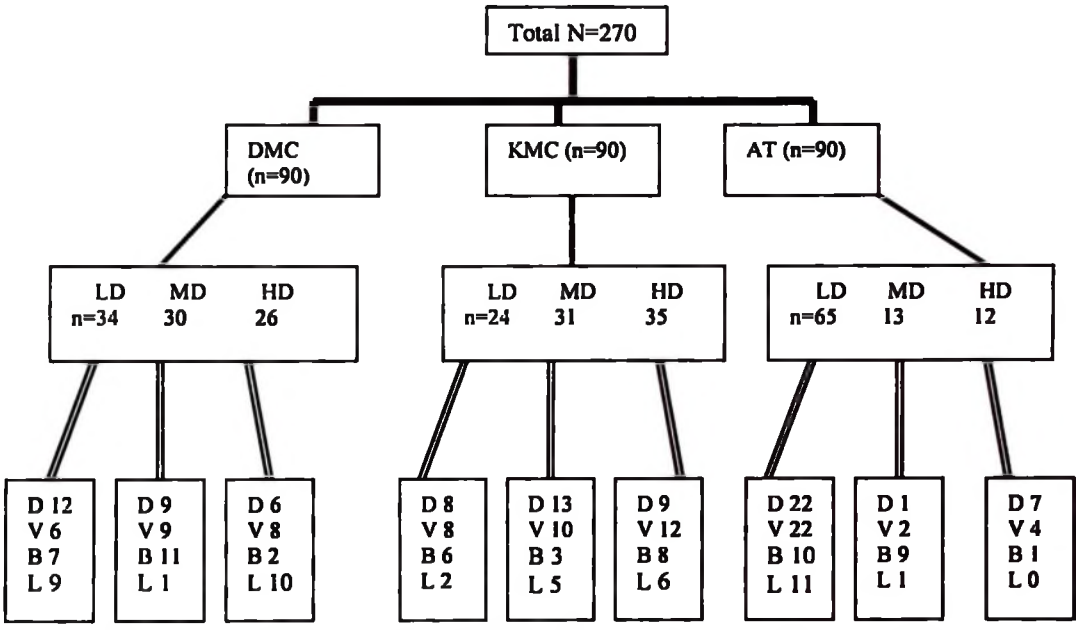
$$n = \frac{760}{1+760\,(0.05^2)} = 262.09$$

$$n \approx 263$$

At household level, the UA enterprise managers were targeted because it was expected that these would provide UA enterprise information especially on input use and production technology. A combination of probability and non-probability sampling methods were employed (purposive, random sampling). Purposive sampling technique was used to obtain three UA areas representing low, medium, and high-density areas in order to focus directly to the area of study. Farmers within the density areas were stratified according to their dominant UA enterprises and then simple random sampling was used to get UA farmers in each of the dominant UA enterprise to ensure that each UA farmer had an equal chance of being included in the study sample.

For comparison purposes, crop-based activities (amaranths, plantains, cabbages) and livestock-based activities (dairy keeping, broilers, layers) enterprises which are locally at

household level were investigated. And by considering the total research budget and distance between the three municipalities to be studied, the total required sample size for the study was n=270, as shown in Fig. 5.



(Key: DMC= Dodoma Municipal Council; KMC= Kinondoni municipal Council; AMC=Arusha Municipal Council
LD= low density area; MD= Medium density area; HD= High density area
D= Dairy farming; V= Vegetable growing; B= Keeping broiler; L=Keeping layers

Figure 5: Sampling procedure

3.4 Data Collection

3.4.1 Pre testing of research questionnaire

To address the amount of systemic or "in-built" error, the questionnaire developed was tested by administering to a sample of 20 UA farmers in Morogoro to gain their reactions to the questions and determine questionnaire content validity. The content validity under consideration was intended to see if the wording of questions was understood equally to the different classes of respondents, whether the questions as they are worded could achieve the intended results and to see if the questions are arranged in the best order.

Additionally, pre testing was carried out to eliminate unwanted questions and adding new questions needed and to make sure that the questionnaire instructions were equally understood by different enumerators.

The second and third test of the questionnaire was carried out to test for its reliability by again collecting data from 20 UA farmers in KMC that were later excluded in the study population. Reliability test was carried out to check the instrument accuracy, that is, to see if the instrument could measure consistently what was intended. Data collected from the two tests were analyzed to obtain correlation coefficients of the answers. The data gave a reliability coefficient of 0.8 which according to Norland (1990), and Radhakrishna *et al.* (2003) with correlation of 0.7 and above the instrument is considered to have an acceptable reliability.

3.4.2 Primary and secondary data collection

A structured questionnaire was designed to elicit answers from the respondents. Data on explaining various UA indices like their performances, problems and opportunities were collected. Quantitative information on land size, number of UA units, production levels, labour sources and amounts, extension service charges and other variable costs were collected and used to determine UA efficiency levels of the individual DMU. Supplemental facts were gathered through direct observations and through Focus Group Discussions (FGDs) with urban farmers, and key informants (Urban agriculture/livestock extension agents and other officials from municipal/city). Secondary data on area densities, UA practices, and UA trends were collected in Arusha, Dodoma and Kinondoni municipal offices.

This study, also documented UA farmers' views and knowledge on bylaws awareness

and how they are used in regulating and controlling UA activities, status of extension service provision and these were compared to efficiencies of different urban farming enterprises undertaken. Data on inputs used in urban farming activities, provision of extension service and by-laws were collected.

3.5 Data Analysis

Data from the primary source were verified, coded and analyzed using different qualitative and quantitative statistical software [including Statistical Package for Social Sciences (SPSS), A Computer Programme for Stochastic Frontier Production and Cost function Estimation (FRONTIER Version 4.1)] to explain the phenomenon and detect any association between the variables by making a realistic inference about UA practices and efficiency in Tanzanian towns/cities. Descriptive statistics were used for comparison purposes to construct box plots on variables of interest for explaining the phenomena. Additionally, standard deviations, standard errors were used to summarize variations between UA practices. Chi-square test was employed to determine variations between municipalities on various attributes related to UA. This included characteristics of respondents, types of UA enterprises, adopted systems and other production, marketing indices.

The frontier productivity analysis was employed to underscore the likely efficiency of individual urban farmers as Decision Making Units (DMUs) and these efficiency scores were plotted to produce Frontier Production Function (FPF) curve. Again, the efficiency score obtained by each DMU were used to compare the level of performance of the various urban farming enterprises relative to the different area density in the city in which urban farming activities occurred. Tobit regression was employed to model the technical inefficiency as a function of the individual farmer's inherent characteristics and necessary

recommendations were made for improving urban farming activities in Tanzanian cities.

3.6 Model Specification

With the aim of addressing the study objective on determination of UA technical efficiency, research questions raised in the introductory part of this study and in light of the designed analytical framework, the appropriate model specifications used are made in the following two steps.

3.6.1 The Empirical Stochastic Frontier Model

The choice of a functional form in an empirical study is of prime importance, since the functional form can significantly affect the results. A flexible functional form is generally preferred, since it doesn't impose general restrictions on the parameters nor on the technical relationships among inputs. But in this study, to make the distributional assumptions consistent with functional form used, a simple production function, Cobb-Douglas production function is selected. The analyses will be carried out as specified in the following two steps.

Step one

As a first stage in the efficiency analysis, Ordinary Least Square (OLS) estimation is made on Cobb-Douglas production function. However, Cobb-Douglas production function has some limitations in a way that it doesn't directly reflect relationship between input and output base and assumes a production status in a static time point. Based on the significance of the parameter estimates, information will be gained on which variables should be included in the stochastic frontier analysis. The OLS is based on stochastic frontier model as proposed by Battese and Coelli (1995) that enterprise effects are assumed to be distributed as a truncated normal random variable, in which the

inefficiency effects are directly influenced by a number of variables. Based on the study objectives, the choice of the variables was made because these inputs are the conventional inputs used in UA in the study sites.

The model is given as:-

$$\text{Ln } Y_i = \beta_o + \Sigma_i \beta_i \ln X_{ij} + \varepsilon_i \ldots\ldots\ldots\ldots (1)$$

Where Y_i = UA output in Tanzanian Shillings, X_{1j} = Family labour used in man days, X_{2j}= Hired labour utilized measured in mandays, X_{3j} = land area under UA (Sq. metres), X_{4j} =, Total variable costs for UA enterprise measured in Tanzanian shillings X_{5j} = Extension charges measured in Tanzanian shillings, ln = Natural logarithm, i = 1...N, N=270

Step two

After getting necessary information about the inclusion of variables for the frontier analysis, the empirical version of the stochastic frontier model described in Chapter 2 is given as:

$$\text{Ln } Y_i = \beta_o + \Sigma_i \beta_i \ln X_{ij} + \varepsilon_i \ldots\ldots\ldots\ldots (2)$$

Where the variables X_{ij} are the variables selected based on OLS estimation in the first step.

The error term (ε_i) is now defined as

$$\varepsilon_i = Vi - U_i \ldots\ldots\ldots\ldots (3)$$

i = 1...N, N=270

The systemic error component V_i, which captures the random variation in output due to factors outside the control of the UA farmer, are assumed to be independently and identically distributed as $V_i \sim iid\ N(0, \delta_v^2)$, independently of U_i which measures the technical efficiency relative to the stochastic frontier. Based on the assumption that V_i and U_i are independent, the parameters of the production frontier (equation .*1*) will be estimated using maximum likelihood method.

Four distributional assumptions, half-normal, truncated-normal, exponential and gamma distributions, will be made on the distribution of U_i. As one of the main objective of this study, effects of distributional assumptions on the technical efficiency levels of each UA enterprise representing a UA farmer as a Decision making Unit (DMU) were investigated and compared empirically. DMU specific technical efficiency representing maximum possible output (Y*) was expressed as:

$Y_i^* = f(X_i; \beta) \exp(V_i)$ .... *(4)* Equation *(4)* can be rewritten as $Y_i = Y_i^* \exp(-U_i)$
Therefore the efficiency of the i^{th} individual UA enterprise, denoted by TE_i, was given by;
$TEi_i = Y_i / Y_i^* = exp(-U_i)$ ..... *(5)*

3.6.2 Sources of inefficiency

Knowing that the UA enterprise is inefficient might not be useful unless the sources of inefficiency are examined. The source of efficiency differential that is observed among DMUs is an issue of overriding concern. Ali and Chaundry (1990), and Kumbhakar and Bhattacharya (1992) assert that socio-economic factors, demographic factors, farm characteristics, environmental and non-physical factors pose effects on efficiency of an enterprise. Therefore, source of inefficiency differential that is observed among UA farmers is an issue of concern. For the purpose of this study the second stage of analysis involved assessing UA farmers' characteristics and their magnitude of influence on the overall efficiency in UA enterprises by calculating likelihood estimates.

The expected relationship of UA farmer's characteristics and TE are mixed. For instance:-

OWNER is a binary variable that is included to estimate the impact of the sex of the enterprise manager. Most commercial UA enterprises in the study sites were managed by females for two main reasons. The first one is if the husband is not alive or has been

transferred to work in a new station and the other reason is most females left office employment after marriage and have to manage other household issues including UA. Therefore, female managed UA enterprises would have better performance as the wife will have better opportunity to follow up and supervise UA activities. For these reasons, the expected sign for this variable in the model is positive.

The variable education (**EDUC**) the number of years of schooling achieved by the UA enterprise manager is used as a proxy for managerial input. High level of educational achievement may lead to better assessment of the importance and complexities of good farming decision, including efficient use of inputs. The expected sign for education variable is positive.

YUA= the number of years a farmer is actively involved in UA activities. This variable is aimed at capturing the farming experience one has under the urban complexities. Based on challenges one came across, solved successfully and continued with UA is assumed one will have accumulated a lot of experience to run UA under urban context. The expected sign for YUA variable is positive.

EXTSER= is a binary variable that is included to estimate the impact of the extension service availability on technical efficiency level of UA enterprise. Most commercial UA enterprises in the study sites that earned higher returns attracted Urban Agriculture and Livestock Extension Agents (UALEAs) to visit them and advice them. However, such visits could have both positive and negative influence on the technical efficiency level. The first one is if the EXTSER charges were excessively high they could impact on total returns of the UA farmer while on the other hand positively could assist the farmer to

acquire more technologies on undertaking UA activities and highly increase returns for the enterprise. The expected sign for EXTSER is either negative or positive.

CREDIT= is a binary variable that is included to estimate the impact of CREDIT provision to support UA activities. Most commercial UA enterprises in the study sites that had more returns are expected to receive credit or encourage the UA farmer to acquire credit. Credit availability is expected to positively increase investment and hence positively influence the technical efficiency level of the UA enterprise. The expected sign for CREDIT is positive.

ADENSITY= the variable ADENSITY refers to a location where the UA enterprise is undertake (1= low density; 2=medium density and 3= High density) depending on the description given in each municipality, all low density areas were found to be more spacious and could comfortably accommodate UA activities and tended to decline in technical efficiency and had more challenges as one moved in high density plots which are smaller. Therefore, undertaking UA in high density plots could create more challenges (like problems of manure disposal, water scarcity etc.) which could negatively impact on technical efficiency level of a UA farmer. The expected sign for ADENSITY variable is negative.

In this study the following model is used to underscore determinants of DMU specific technical efficiency. The level of efficiency lies between 0 and 1. The model is specified as:-

$$TE = b_1OWNER + b_2EDUC + b_3YUA + b_4EXTSER + b_5CREDIT + b_6\ ADENSITY + \varepsilon_i$$

Where:

TE = level of technical efficiency obtained from equation ..... *(.5)*

b_i (i= 1 ..., 6) are coefficients (inefficiency parameters to be estimated)

OWNER = Dummy (1 for female and 0 male); EDUC = Number of years of schooling achieved by UA farmer; YUA = Number of years actively involved in UA to capture experience in UA; EXTSER = Extension services support for UA (dummy 1 for availability, 0 otherwise); CREDIT = Dummy (1 if a farmer has obtained credit for UA, 0 for otherwise); ADENSITY = Area density under which UA is performed; ε = error term that follows a truncated normal distribution.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

This chapter presents the findings of the study according to the specific objectives. The results are presented and their differences compared based on study sites (Dar es Salaam city in Kinondoni Municipal Council (KMC), Arusha Municipal Council (AMC), and Dodoma Municipal Council (DMC)). The results describe the socio-economic characteristics of UA farmers, performance of UA activities, market and price variability of UA products, challenges in marketing UA products, entrepreneurial skills and networking of UA producers, land availability and ownership for UA, municipal bylaws on UA, extension and other support services for UA and comparison of efficiency on UA practices.

4.2 Socioeconomic Characteristics of UA Farmers

Table 1 shows the socioeconomic characteristics of UA farmers in the studied cities/towns. A total of 270 UA farmers were involved in the study. In Dar Es Salaam city, KMC, UA farmers were from 30 *mitaa* of Mwananyamala, Mikocheni, Reagent estate, Msasani, Mabibo and Makumbusho. Still other studied *mitaa* were Kawe, Kigogo, Oysterbay, Kijitonyama, Mbezi, Sinza, Boko, Hananasifu, Kunduchi, Ubungo and Goba. Also the study had respondents from Bunju, Salasala, Masaki, Msewe, Magomeni, Kinondonishamba, Tandale, Mzimuni, Kiluvya, Kimara, Minazini and Msumi *mitaa*. In Arusha municipality, UA farmers were from 11 *mitaa* of Lemara, Sokon I, Kimandolu, Sinoni, Olorieni, Olmatejoo, Sekei, Kaloleni, Unga Limited, Ngarenaro and Sakina. Again, UA farmers from Dodoma municipality were from seven *mitaa* of Area A, Area C, Chang'ombe, Kilimani, Uzunguni, Chinangali and Kiwanja cha ndege.

One hundred and twenty three (45.6%) of the 270 respondents, resided in low-density areas, 74 (27.4%) resided in medium-density areas, and 73 (27.0%) resided in high-density areas. This implied that UA was practiced in all density areas. Similar observations were reported by Elias (2003) in Morogoro and Mbeya municipalities, Mwakaje (2007) in DMC and Msuya (2008) in KMC. About two thirds, 188 (69.6%) of the respondents indicated that they were migrants to the cities comprising of different tribes. Of these, 77 (28.5%), 71(26.3%) and 40 (14.8%) were migrants found in KMC, Dodoma Municipal Council (DMC) and Arusha Municipal Council (AMC), respectively.

Respondents indicated to have migrated to cities for various reasons. Of the 270 respondents, 75 (40.5%), 37 (20.0%), 38 (20.5%) 18 (9.7%) and 17 (9.2%) indicated that they had migrated to the cities/towns to seek employment, follow spouse, on official transfer, to join parents and, attend school, respectively. These results confirm findings of Tuvana (2004), who found that the majority of UA farmers in Dar es Salaam were migrants and came to cities from various regions in the country. Of the 270 respondents, 154 (57.0%) were females, while 116 (43.0%) were men. With exception of AMC, women dominated UA practices in KMC and DMC. These results are similar to Sawio (1998) in Dar es Salaam and Mireri *et al.* (2007) in Kisumu municipality, Kenya, who found that women dominated UA activities, however, the results are contrary to the results by Tesha (1996) and Tuvana (2004) in Dar es Salaam, who found male dominance in UA as women were involved in petty trades. Of all the respondents, less than half, 108 (40%) indicated to have completed primary education, 72 (26.7%) to have had finished form four, 32 (11.9%) to have had completed their first degrees. Yet, of all, 30 (11.1%), 21 (7.8%), and seven (2.6%) indicated to have had attended adult literacy classes, completed form two and had not attended any formal education, respectively. These

results implied that UA in the studied cities/towns is practiced across all density areas and different urban dwellers of varying socioeconomic status did it.

Of the 270 respondents, 87 (32.2%), 81 (30.0%), 57 (21.1%) and 45 (16.7%) indicated that their main UA practices were dairy farming, growing vegetables, keeping broilers and raising layers, respectively. Of the 270 respondents, 155 (57.4%), 43 (15.9%), 36 (13.3%) and 27(10.0%) indicated that they undertook UA activities mainly for income generation, household food security, self employment and as poverty alleviation initiative, respectively, while seven (2.6%), and one (4.0%) each, indicated that it was only for complementing meagre incomes from employments, as a culture and for utilizing the available land, respectively. This implied that UA activities served multiple purposes in the households. The results confirms findings by IDRC (1994), Mougeot (2000), Nugent (2000), Klemesu and Maxwell (2000) in Accra, Ghana, and Mkwambisi, *et al.* (2007 and 2010) and Mkwambisi (2008) in Lilongwe and Blantyre, Malawi, who found UA farmers undertaking UA activities to supply food for home use, and some as their employment.

Plate 3: A sow with a litter of 12 piglets in Nkuhungu (Kizota ward) DMC, September. 2010.

Apart from the main UA enterprises, urban farmers were found to engage in complementing additional UA activities (Plate 3) and other non-agricultural activities to supplement their household needs. The behaviour of most respondents to undertake a combination of UA activities could be an indication of their entrepreneurial acumen among most urban dwellers in trying to cope up with the economic crises in the city. Observations showed that problems faced by UA farmers sometimes necessitated UA farmers to change the type of UA enterprise for profit maximization.

Plate 4: An UALEA conducting a training to UA farmers at Msakuzi, Mbezi-KMC in June, 2010.

Out the 270 respondents in the three cities/towns, 68 (25.2%) of them indicated to have had changed type of UA they practiced due to a number of reasons. Of the 68 respondents, 30 (44.1%) indicated that they had changed their UA enterprise due to lack of capital. The other 20 (29.4), 11(16.2%), five (7.4%) and two (2.9%) respondents, indicated that they were forced to change their UA enterprises because of enterprise not being profitable, lack of markets, shortages of labour and lacking necessary inputs, respectively. Training of UA farmers by UALEAs improved their skills (Plate 4). All the parameters assessed with exception of the main type of UA practice they conducted and age of respondents, were statistically significantly different at $p < 0.05$

Table 1: Characteristics of UA respondents (N=270)

	KMC		DMC		AMC			
Parameter	**N**	**%**	**N**	**%**	**N**	**%**	**Total**	**p-value**
Area density								
Low density	24	8.9	34	12.6	65	24.1	123 (45.6)	
Medium density	31	11.5	30	11.1	13	4.8	74 (27.4)	0.004
High density	35	13	26	9.6	12	4.4	73 (27.0)	
Ethnicity								
Ethnic	13	4.8	19	7.0	50	18.5	82 (30.4)	0.012
Migrant	77	28.5	71	26.3	40	14.8	188 (69.6)	
Why migrated to the city?								
Seeking employment	24	13.0	33	17.8	18	9.7	75 (36.5)	
Followed spouse	24	13.0	9	4.9	4	2.2	37 (18.1)	
On official transfer	19	10.3	15	8.1	4	2.2	38 (18.5)	0.025
Attend school	5	2.7	6	3.2	6	3.2	37 (18.1)	
Join parents	4	2.2	9	4.9	5	2.7	18 (8.8)	
Sex								
Female	55	20.4	62	23.0	37	13.7	154 (57.0)	0.014
Male	35	13.0	28	10.4	53	19.6	116 (43.0)	
Education level								
No formal education	-	-	1	0.4	6	2.2	7 (2.6)	
Adult education	4	1.5	7	2.6	19	7.0	30 (11.1)	
Primary education	36	13.3	31	11.5	41	15.2	108 (40.0)	0.001
Form II	7	2.6	10	3.7	4	1.5	21 (7.8)	
Form IV	25	9.3	32	11.9	15	5.6	72 (26.7)	
First degree	18	6.7	9	3.4	5	1.9	32 (11.9)	
Age								
≤ 30 years	18	6.7	7	2.6	12	4.4	37 (13.7)	
31 to 40 years	18	6.7	26	9.6	12	4.4	56 (20.7)	0.25
41 to 50 years	24	8.9	29	10.7	33	12.2	86 (31.9)	
≥ 51 years	30	11.1	28	10.4	33	12.2	91 (33.7)	
Main UA enterprise								
Dairy farming	30	11.1	27	10.0	30	11.1	87 (32.2)	
Vegetable growing	30	11.1	23	8.5	28	10.4	81 (30.0)	0.30
Keeping broiler	17	6.3	20	7.4	20	7.4	57 (21.1)	
Keeping layers	13	4.8	20	4.4	12	4.4	45 (16.7)	
Reasons for engaging in UA								
Household food security	4	1.5	17	6.3	22	8.1	43 (15.9)	
Income generation	50	18.5	71	26.3	34	12.6	155 (54.7)	
Self employment	22	8.1	2	0.7	12	4.4	36 (13.3)	
Utilize available land	1	0.4	-	-	-	-	1 (0.4)	0.001
Substitute meagre income	5	1.9	-	-	2	0.7	7 (2.6)	
Culture	-	-	-	-	1	0.4	1 (0.4)	
Poverty alleviation initiative	8	3.0	-	-	19	7.0	27 (10.0)	
Reasons for changing UA								
Lack of capital	4	5.9	10	14.7	16	23.5	30 (44.1)	
Lack of markets	3	4.4	3	4.4	5	7.4	11 (16.2)	
Shortage of labour	1	1.5	2	2.9	2	2.9	5 (7.4)	0.03
Enterprise not profitable	2	2.9	1	1.5	17	25	20 (29.4	
Inputs not available	2	2.9	-	-	-	-	2 (2.9)	

NB: Numbers in parentheses are total percentages of the attributes

4.3 Performance of UA Activities

Table 2 shows the performance of UA activities in KMC, AMC and DMC. Of the 270 respondents, 161(59.6%) showed that their UA activities were undertaken on intensive system. Of the 161 respondents, 75 (27.8%), 52 (19.3%) and 34 (12.6%) were from AMC, KMC and DMC, respectively. Thirty, (11.1%) said it was on semi-intensive system, while 13 (4.8%) and nine (3.3%) made use of the available open spaces and practiced free system, respectively. The remaining 75 (21.1%) of the respondents could not describe their UA farming systems, and the differences in UA systems used were statistically significantly different at $p= 0.031$. The behaviour of UA farmers undertaking UA activities under confined areas around their homes and on open spaces were also reported by Sawio (1993) in Dar es Salaam, Mwangi and Foeken (1996) in Nairobi, Kenya and Madden and Chaplowe (1997), and Mlozi (1998) in Dar es Salaam. More than a third, (38.5%) of the respondents agreed that on several occasions they have had changed the types of animals they kept or the type of crop varieties they grew given the prevailing economic circumstances. However, the differences observed on changing breed/variety were not statistically significant at $p < 0.05$.

Of the 270 respondents, 129 (48.1%) agreed that they faced competition over resources (such as land, water and labour) that were required in UA activities. Similar findings were reported by Lado (1990) in Nairobi, Kenya, who found that despite of UA contributing significantly to food security, it led to competition on land as resource, hence requiring proper land planning. However, of the 270 respondents, most, 247 (91.5%) indicated that it was profitable to undertake UA activities, and of those, 56 (22.8%) said that it was due to increased demand of fresh foods in the cities and 80 (32.5%) said it was due to market availability. Also, 55 (22.4%) of the respondents said it was because of the proximity to markets, while, 56 (22.8%) viewed UA profitability in

terms of ensuring better food supply in the household. Of the 270 respondents, over half, 154 (57.1%) indicated that they kept records of their UA activities. However, there were no statistical differences on record keeping between cities. Of the 154 respondents, about a third 59 (38.3%) showed that they kept production records. The remaining 43 (27.9%), 38 (24.7%), ten (6.5%) and four (2.5%) showed that they kept profit and loss, sales, expenditure and general performance records, respectively. The differences on types of records kept between cities were statistically significant at p = 0.023 (Table 2).

Table 2: Performance of UA activities (N=270)

Statement	KMC		DMC		AMC			
	N	%	N	%	n	%	Total	p-value
Type of production system used								
Intensive system	52	19.3	34	12.6	75	27.8	161(59.6)	
Semi- Intensive	14	5.2	9	3.3	7	2.6	30(11.1)	
Free range	1	0.4	8	3.0	-	-	9(3.3)	0.031
Use open space	-	-	7	2.6	6	2.2	13(4.8)	
Do not know	23	8.5	32	11.9	2	0.7	57(21.1)	
Changing breed/variety used								
Yes	30	11.1	40	14.8	34	12.6	104 (38.5)	0.35
No	60	22.2	50	18.5	56	20.7	166 (61.5)	
Facing competition on resources								0.015
Yes	58	21.5	43	16.0	29	10.8	130 (48.1)	
No	32	11.9	47	17.5	61	22.7	140 (51.9)	
It is profitable to undertake UA								
Yes	88	32.6	85	31.5	74	27.4	247 (91.5)	0.025
No	2	0.7	5	1.9	16	5.9	23 (8.5)	
Profitability of UA								
Demand on fresh foods	37	15.0	8	3.3	11	4.5	56 (22.6)	
Market availability	28	11.4	35	14.2	17	6.9	80 (32.4)	0.045
Market proximity	18	7.3	17	6.9	20	8.1	55 (22.4)	
Better food supply	5	2.0	25	10.2	26	10.6	56 (22.6)	
Keeping records on UA								
Yes	51	18.9	54	20.0	49	18.1	154(57.1)	0.011
No	39	14.4	36	13.3	41	15.2	116 (42.9)	
Types of records kept								
Production records	24	15.6	17	11.0	18	11.7	59 (38.3)	
Accounts (Profit and Loss)	19	12.3	16	10.4	8	5.2	43 (27.9)	
Sales records	6	3.9	16	10.4	16	10.4	38 (24.7)	0.023
Expenditure records	1	0.6	6	3.9	3	1.9	10 (6.5)	
General performance record	-	-	-	-	4	2.5	4 (2.5)	

NB: Numbers in parentheses are total percentages of the attributes

4.4 Market and Price Variability of UA Products

Table 3 shows the UA produce marketing situation in KMC, DMC and AMC. Of the 270 respondents, most, 199 (73.7%) showed that they had no pre-arranged contracts with buyers for the UA products they produced. Of these, more than a third, 80 (40.2%) were from KMC, while 76 (38.2%) and 43 (21.6%) were from AMC and DMC, respectively. Such a situation of producing without having a pre-arranged contract with the buyers, could limit increasing production of the UA products as farmers need to be certain of disposing their products to avoid losses if produced in excess. However, on the other hand it could be an indicator that they marketed all their UA products whenever they wanted and this implied that UA produce had high demand. The results confirm findings by Stevenson *et al.* (1994) in Dar es Salaam, who found that on average about 60% of the vegetables produced under UA were sold. Of all the respondents, 129 (47.8%) indicated that they sold their products at place of production (farm gate), while 97 (36.3%) indicated to had sold UA produce to local markets, and 26 (9.6%), ten (3.7%) and seven (2.6%) showed to selling their UA produce at central market, in super markets, and in own kiosks, respectively. Of the 270 respondents, 106 (39.3%), 97 (35.9%); 41 (15.2%) and 26 (9.6%) showed that their main outlets for UA products were the retailers, individual consumers, wholesalers, and vendors, respectively. Generally, these study results agree with findings by Stevenson *et al.* (1994), Jacobi *et al.* (2000) in Dar es Salaam, Mlozi *et al.* (2003) in Mbeya and Morogoro and Mwakaje (2007) in Dodoma municipality who found that UA farmers used varying market channels to sell the UA products. Of all the respondents, 265 showed that they had varying sources of marketing information for their UA products. Of these, 127 (47.9%) and 71 (26.8%) showed that they depended on buyers and market centres as sources of market information for their UA products. However, 43 (16.2%), 23 (8.7%) and one (0.4%) of the respondents indicated that fellow farmers, agriculture and livestock extension agents and media were

sources of market information for their UA products. Of the 270 respondents, 119 (44.1%) mostly from KMC and DMC, showed that they did not face problems in marketing of their UA products, and of the 151 (55.9%) respondents who indicated to facing problems, only 145 revealed the marketing problems faced. Of these, 66 (45.5%) said it was due to poor quality (Table 3).

Other marketing problems that respondents faced were related to poor packaging, bylaws, high, many taxes and not meeting consumer preferences as indicated by 26 (17.9%), 17 (11.7%), 12 (8.3%) and 24 (16.6%), respectively. Of the 270 respondents, a few, 78 (28.9%) showed that there were city markets created for UA products and 131 (48.5%) of the respondents showed that they had access to other city markets. However, most, 226 (83.7%) of the respondents showed that they were not linked to retailing and consumer units like supermarkets, hotels and restaurants to which they could sell their UA produce directly. Again, most, 261 (96.7%) of the respondents denied being involved in the food value adding techniques (like canning, pickling).

Marketing problems in UA produce were also reported by Sawio (1993) in Dar es Salaam, who found that a one-quarter of the UA producers had problems with marketing of their products. Despite of the claim advanced by Sawio (1993) that city authority requires a license in order to be able to sell farm produce in public, proliferation of UA and being a better livelihood alternative might have pulled more residents to conduct UA and hence narrowing its marketability. The differences on marketing situations were found to be statistically significant at $p< 0.05$ in all the attributes with an exception on involvement in food value adding techniques which showed no statistical differences between study sites.

Table 3: Marketing of selected UA products (N=270).

Statement	KMC		DMC		AMC		Total	p-value
	n	%	N	%	n	%		
UA produced on pre-arranged contracts								
Yes	10	3.7	47	17.4	14	5.2	71 (26.3)	0.0123
No	80	29.6	43	15.9	76	28.1	199 9(73.7)	
Points of sale for UA products								
Farm gate	54	20.0	47	17.4	28	10.4	129 (47.8)	
Local markets	29	10.7	31	11.5	38	14.1	97 (36.3	
Super markets	4	1.5	1	0.4	19	7.0	10 (3.7)	0.002
Central market	2	0.7	5	1.9	5	1.9	26 (9.6)	
My own Kiosk	1	0.4	6	2.2	-	-	7 (2.6)	
Main outlets for UA products								
Retailers	28	10.4	41	15.2	37	13.7	106 (39.3)	
Individual consumers	26	9.6	37	13.7	34	12.6	97 (35.9)	0.015
Vendors	23	8.5	-	-	3	1.1	26 (9.6)	
Wholesalers	13	4.8	12	4.4	16	5.9	41 (15.2)	
There are problems in marketing								
Yes	35	13.0	43	15.9	73	27.0	151(55.9)	0.014
No	55	20.4	47	17.4	17	6.3	119 44.1)	
Problems in marketing UA products								
Quality of products required	20	13.8	24	16.6	22	15.2	66 (45.5)	
High/many taxes imposed	4	2.8	4	2.8	4	2.8	12 (8.3)	
Packaging of product	6	4.1	5	3.4	15	10.3	26 (17.9)	0.032
Consumer preference not mate	3	2.1	5	3.4	16	11.0	24 (16.6)	
Marketing regulation/by-laws	1	0.7	-	-	16	11.0	17 (11.7)	
Source of marketing information								
Traders/buyers	27	10.2	57	21.5	43	16.2	127 (47.9)	
Visiting market centres	34	12.8	18	6.8	19	7.2	71 (26.8)	
Fellow farmers	13	4.9	5	1.9	25	9.4	43 (16.2)	0.047
Extension agents	11	4.2	9	3.4	3	1.1	23 (8.7)	
Media (Television and radio)	-	-	1	0.4	-	-	1 (0.4)	
Aware of presence of markets for UA								
Yes	45	16.7	21	7.8	12	4.4	78 (28.9)	0.036
No	45	16.7	69	25.6	78	28.9	192 (71.1)	
Accessing existing city markets								
Yes	47	17.4	63	23.3	21	7.8	131 (48.5)	0.017
No	43	15.9	27	10.0	69	25.6	139 (51.5)	
Linked to consumer organisations								
Yes	25	9.3	6	2.2	13	4.8	44 (16.3)	0.0175
No	65	24.1	84	31.1	77	28.5	226 (83.7)	
Involvement in value adding techniques								
Yes	3	1.1	4	1.5	2	0.7	9 (3.3)	0.45
No	87	32.2	86	31.9	88	32.6	261 (96.7)	

NB: Numbers in parentheses are total percentages of the attributes

4.5 Challenges in Marketing UA Products

Table 4 shows challenges and price determinants for UA products in KMC, DMC and AMC. Of the 270 respondents, 177 (65.6%) agreed that their supply did not meet the demand, as 174 (64.4%) indicated that they were able to market all the UA products when due, and the differences between the three municipalities were statistically

significant at p= 0.028. This could be an opportunity for UA farmers to expand their UA activities if all they introduced pre-arranged contracts with consumers and/or buyers. However, most, 222 (82.2%) of the respondents showed that they have had no training on accessing markets for their UA products. Of the 268 respondents who revealed challenges in marketing UA products, slightly more than half, 143 (53.4%) showed that one of the major challenges they faced in marketing was having many similar UA products in the same market. This aspect, as a few, 34 (12.7%) of the respondents thought that it led to receiving low market prices for their UA products.

Other challenges were, consumers demanding high standard products as shown by 12 (4.5%) of the respondents, high demand than could supply and failure to meet consumers preferences was reported by 74 (27.6%) and five (4.5%) of the respondents, respectively. Differences between cities on challenges faced by UA farmers on marketing their products were statistically significant at p= 0.013 More than a third, 113 (41.9%) of the respondents, showed that market demand and supply pattern to the market was one of the determinants of selling price of UA products. Other respondents, 87 (32.2%), 32 (11.9%), 23 (8.5%) and 15 (5.6%) showed that UA products selling price were determined by cost of production, seasonality, consumer's purchasing power and sales history of the product, respectively, and the differences in price determinants between municipalities were found to be statistically significant at p= 0.024.

Table 4: Challenges and price determinants for UA products (N=270)

Statement	KMC		DMC		AMC			
	n	%	N	%	N	%	Total	p-value
Supply meet market demands								
Yes	41	15.2	24	8.9	28	10.4	93 (34.4)	0.026
No	49	18.1	66	24.4	62	23.0	177 (65.6)	
Market all the UA products								
Yes	75	27.8	47	17.4	52	19.2	174 (64.4)	0.028
No	15	5.6	43	15.9	38	14.1	96 (35.6)	
Received training on marketing								
Yes	32	11.8	10	3.7	6	2.2	48 (17.8)	0.001
No	58	21.5	80	29.6	84	31.1	222 (82.2)	
Challenges faced in marketing								
Marketing similar product	45	16.8	69	25.7	29	10.8	143 (53.4)	
Low market prices	10	3.7	6	2.2	18	6.7	34 (12.7)	
High standards required	10	3.7	-	-	2	0.7	12 (4.5)	0.013
Failure to meet preferences	1	0.4	-	-	4	1.5	5 91.9)	
High demand than supply	22	8.2	15	5.6	37	13.8	74 (27.6)	
Determinants of selling prices								
Cost of production	47	17.4	23	8.5	17	6.3	87 (32.2)	
Seasonality	19	7.0	5	1.9	8	3.0	32 (11.9)	
Demand and supply pattern	15	5.6	59	21.9	39	14.4	113 (41.9)	0.024
Purchasing power	7	2.6	2	0.7	14	5.2	23 (8.5)	
Sales history	2	0.7	1	0.4	12	4.4	15 (5.6)	

NOTE: Numbers in parentheses are total percentages of the attributes

4.6 Entrepreneurial Skills and Networking of UA Producers

The entrepreneurial skills, linkages and networking of respondents are shown in Table 5. Of the 270 respondents, 120 (44.5%) indicated that they were linked to other UA farmers producing similar products, and of these, 65 (24.0%) were from DMC and 46 (17.1%) were from KMC, however, only a third, 92 (34.1%) of the respondents were linked to other UA farmers producing different products, again, of those, 49 (18.1%) were from DMC followed by 36 (13.3%) from KMC. It seems there are good UA farmers' linkages in DMC and KMC and as such promoting UA activities. However, such UA farmer linkages are not under a defined coalition of farmer associations, hence not legal. This calls for a need to establish well set urban farmer networks that will assist them in sharing information on various issues on UA activities. As UA farmer groups, they will have more powers to negotiate and influencing proper development of UA in Tanzanian municipalities. As Malta (2005) puts forward that UA farmers' networks will among

other things, provide information, technology and market access to its members and hence promote UA activities. The differences on linkages of UA farmers within UA farmers producing similar products and between those producing different UA products between the three studied municipalities were found to be statistically significant at p= 0.011 and p= 0.029, respectively. Of the 270 respondents, about two thirds, (64.4%) indicated that they promoted their UA products to improve their sales, and more than half, 55.5%, and a few, 35.6% of the respondents indicated that there were weak networking and UA product promotions. As shown in Table 5 majority of the respondents (78.1%) showed that they set higher targets and about two third (62.2%) took risks to produce with anticipation of getting higher prices later, but they could not make it, hopefully due to lack of linkages and poor information flow between producers and consumers. However, failure of most, (91.9%) respondents to carve new market niches for their UA products might have contributed highly on retarding UA development. Differences on entrepreneurial skills and networking attributes between the municipalities (with exception of attending business events), were found to be statistically significant at $p < 0.05$

Table 5: The entrepreneurial skills and networking for UA (N=270)

Statement	KMC		DMC		AMC		Total	p-value
	n	%	N	%	n	%		
Linked to UA farmers producing similar UA product								
Yes	46	17.1	65	24.0	9	3.3	120 (44.5)	0.011
No	44	16.2	25	9.3	81	30.0	149 (55.5)	
Linked to UA farmers producing different UA products								
Yes	36	13.3	49	18.1	7	2.6	92 (34.1)	0.029
No	54	20.0	41	15.2	83	30.7	178 (65.9)	
Promote UA product								
Yes	61	22.6	48	17.8	65	24.1	174 (64.4)	0.011
No	29	10.7	42	15.6	25	9.3	96 (35.6)	
Made mistake that threatened UA								
Yes	9	3.3	49	18.1	3	1.1	61 (22.6)	0.045
No	81	30.0	41	15.2	87	32.2	209 (77.4)	
Carved a new market niche								
Yes	4	1.5	15	5.6	3	1.1	22 (8.1)	0.032
No	86	31.9	75	27.8	87	32.2	248 (91.9)	
Have targets for UA production								
Yes	72	26.7	78	28.9	61	22.6	211 (78.1)	0.016
No	18	6.7	12	4.4	29	10.7	59 (21.9)	
Take risk anticipating price rise								
Yes	62	23.0	38	14.1	68	25.2	168 (62.2)	0.022
No	28	10.4	52	19.3	22	8.1	102 (37.8)	
Attend business events								
Yes	52	19.3	59	21.9	51	18.9	162 (60.0)	0.13
No	38	14.1	31	11.5	39	14.4	108 (40.0)	

NB: Numbers in parentheses are total percentages of the attributes

4.7 Availability and Ownership of Land for UA

UA needs land that can be utilised in a short and long-term. Table 6 shows that about two thirds of the respondents, 162 (60.0%) indicated that they owned plots on which they carried out UA activities. However, of the 108 respondents, 38 (35.1%) indicated that they conducted their UA activities on plots which they rented, while 36 (33.3%), 34 (31.5%) conducted their UA activities on government plots and open spaces, respectively. The results confirm findings by Nuwagaba *et al.* (2003, 2005) in Kampala, Uganda who found that urban dwellers who undertook UA had obtained land for UA through borrowing, inheriting and renting. Of the 270 respondents, 209 (77.4%) indicated that it was impossible to access or acquire extra land within the city to expand UA activities. The reasons availed were due to land scarcity as indicated by 82 (39.2%), land

being expensive to buy, indicated by 95 (45.5%), while 17 (8.1%) mentioned that there were environmental limitations for expanding UA within the city. Again, 15 (7.2%) of the respondents indicated that city/municipal bylaws restricted issuing land for UA activities. However, about one third, 85 (31.5%) of the respondents indicated that there were possibilities of acquiring/accessing extra land for UA activities outside the city.

On the other hand, slightly more than half, 143 (53.8%) of the respondents indicated that there were constraints in accessing land for UA activities because of high price of land which most of the urban resource-poor cannot afford. Therefore, access to suitable and adequate land will ensure sustainable UA, especially by the urban resource-poor. There is a need therefore, for setting up a regulatory framework for controlling the accessibility of land within the urban settings so as to take UA on board given the ever-expanding urbanisation of African towns/cities. Results on UA competing for land as a resource with other city development plans have also been reported by Lynch *et al.* (2001) in Kano, Nigeria who found that UA was threatened by acute problems of land tenure and other encroaching land development initiatives. Also, Mubvami *et al.* (2003) Mushamba *et al.* (2003), in Harare, Zimbabwe claimed that, to improve and sustain UA activities land should be obtainable, suitable and reachable. Similarly, Lattuca *et al.* (2005) in Rosario, Argentina, proposed to promote multi-functional land use system for accommodating UA. Issues and views of respondents on land availability, ownership, access and acquisition between the three municipalities were found to be statistically significantly different at $p < 0.05$.

Table 6: Responses on availability and ownership of land for UA (N=270)

	KMC		DMC		AMC			
Statement	**n**	**%**	**n**	**%**	**n**	**%**	**Total**	**p-value**
Own land for UA								
Yes	58	21.5	69	25.6	35	13.02	162 (60.0)	0.021
No	32	11.9	21	7.8	55	0.4	108 (40.0)	
If not owning plot								
On rented plot	14	12.9	12	11.1	12	11.1	38 (35.1)	
On government plots	9	8.3	2	2.7	24	22.2	36 (33.3)	0.002
On open spaces	9	8.3	6	5.6	19	17.6	34 (31.5)	
Are there constraints for accessing land for UA								
Yes	71	26.3	58	21.5	14	5.2	143 (53.0)	0.012
No	19	7.0	32	11.8	76	28.1	127 (47.0)	
Access extra land within city								
Yes	23	8.5	25	9.3	13	4.8	61 (22.6)	0.023
No	67	24.8	65	24.1	77	28.5	209 (77.4)	
limitations to access land in city								
Land scarcity	34	16.3	16	7.6	32	15.3	82 (39.2)	
Land is expensive	30	14.4	29	13.8	36	17.2	95 (45.5)	0.042
Municipal by-laws	1	0.4	8	3.8	6	2.8	15 (7.2)	
Environmental limitations	2	0.9	12	5.7	3	1.4	17 (8.1)	
Access extra land outside city								
Yes	40	14.8	19	7.0	26	9.6	85 (31.5)	0.016
No	50	18.5	71	26.3	64	23.7	185 (68.5)	

NB: Numbers in parentheses are total percentages of the attributes

4.8 Municipal Bylaws for Regulating and Controlling UA

Bylaws on UA in the three study sites were reviewed and are as described below. Review of the bylaws was done to ascertain that there were bylaws set to control and regulate UA, narrating the types of bylaws set, compare the bylaws set in the three study sites for commonality and contradictions and determine knowledge of UA farmers on the set bylaws in the study areas.

4.8.1 Municipal bylaws for regulating and controlling UA in AMC

The Arusha Municipal Council bylaws on UA targets urban livestock keeping and are given under the government notice no. 10 of the local government Act no. 8 of 1982 (bylaw section 80) of 2003 and started being implemented in 2004. The bylaws stipulate "Animal" as cattle, goat, sheep, pig, donkey, dog, and any other animal that can be domesticated. Bylaw 3 (section 1 to 4) states, no person shall keep any animal within the

municipal unless he has first obtained from municipal authority a written permit to keep animal after being certain that such practice shall not interfere neighbourhoods. The bylaw forbids keeping animals outside "a building, structure or enclosure" and states that "livestock keeping within the urban area shall be under zero grazing (confinement) and the permit shall indicate the type and number of animals that shall be kept relative to the plot size.

Bylaw no. 4 (section 1 to 3) require urban dwellers keeping animal, to ensure hygienic practice, and shall have a waste pit and or container for waste disposal, and an authorized officer may at any reasonable time enter upon premises in which animals are kept or in which he has good reason to believe that animals are being kept for the purpose of inspecting such premises. Bylaw no. 5 states that no animal shall be moved through any part of the city area unless the owner is in possession of a permit issued by the municipal authority (excluding animals moved to abattoir that are transported in a vehicle or animals having permit issued by the central government.

Bylaw no. 8 stipulates that the city Director at any time shall order animals be removed from any area of the city if it contravenes the city planning laws, and thought to cause inconvenience to neighbourhood. Bylaw no. 9 (section 1 to 3) stipulates that the issued permit for animal keeping in the city shall be valid for one year only and no fees shall be paid to obtain permit. Permit to move animals from one are to another within city shall be valid for seven (7) days only. Bylaw no. 10 permits any authorized officer to impound animals kept without permit, not kept indoor, being moved without permit and stray animals, and the impounded animal shall be held in the city yard and registered. Bylaw 11(section 1 to 3) empowers the municipal authority to auction the animal following a notice of seven days after impounding the animal.

If the owner commits an offence for the first time, the impounded animal shall be held by the municipal authorities and released upon payment of the imposed fine stipulated under the bylaw (that is, Tshs 10 000 per animal per day), and failure to pay the stated fine within three days, the municipal authority shall auction the animal to cover the fine for the number of days the animal was held in custody and the balance shall be given to the animal owner. However, the council shall not be liable for any loss of the impounded animal whilst in its custody or any damage caused to the animal.

Bylaw no. 12 stipulates that failure to abide to any section of these bylaws; one commits an offence and shall be liable on conviction to a fine of Tshs. 50 000. Failure to pay the stipulated fine shall lead to one year imprisonment, or to both such fine and imprisonment. The Municipal Executive Director shall have power to reduce the imposed fine if the person found guilty accepts to have committed an offence and shall be liable to a fine not exceeding Tshs 40 000. These bylaws are under the Arusha Municipal Council (animal in the municipal) bylaw of 1998.

4.8.2 Municipal bylaws for regulating and controlling UA in DMC

The Dodoma Municipal Council bylaws on UA targets crop growing, urban livestock keeping and crop marketing and are given under the government notice no. 109 of 15/06/2001, amended under paragraph 288 of bylaws under section 89 of 2008 under the local government (urban authorities) Act no. 8 of 1982 (bylaw on crop growing). The bylaw defines agriculture as growing food and cash crops within the area of jurisdiction under the municipal. It states that, no one shall be allowed to grow crops that exceeds three feet high in specific wards namely; Viwandani, Madukani, Uhuru, Majengo, Kilimani, Makole, T/Reli, K/Kaskazini, Hazina, K/Ndege and Chamwino. Failure to abide to the set bylaw, the concerned shall be considered to have committed an offence and shall be liable to a fine of not less than Tshs 50 000 and not exceeding Tshs 300 000

or to imprisonment for a period not exceeding six (6) months, or to both such fine and imprisonment. The bylaw further states that, failure of the responsible officer to enforce the bylaw intentionally or unintentional, such officer shall be liable to similar penalties.

The Municipal Executive Director shall have power to impose penalty not exceeding the amount stated if convinced that one has violated the bylaw, and shall instantly destroy the crops grown. Again, under government notice no. 267 of 2004 given under Local government Finance Act, no 9 of 1982 (section 6(1) and 13 (1) known as dipping fees bylaws of 2004, the bylaws require that every owner of animals is compulsorily duty bound to send his animals to a dipping pond for dipping services and it shall be lawful for any authorized officer to enter into any premises where animals are kept for the purpose of inspecting the compliance of these bylaws and any person obstructing such officer commits an offence. The council may subject to the provision of the Act, appoint a person or persons as agents for the provision of dipping services and collection of fees imposed by council under these bylaws (that is, Tshs. 200 for Cattle, Donkey and Horse; 50 for Goat and sheep and 100 for Dog payable per dip). Any agent appointed under these bylaws shall have all the powers and obligations as to provisions of the dipping services, collection of the fees and shall be duty bound to collect and receive from each person liable for the payment of fees and shall pay all the amount collected or such sum as shall be agreed by the Council. Offence by agents by failing to pay the amount agreed, recklessly or knowingly render false returns, knowingly demands from any person an amount in excess of the amount set under these bylaws, wilfully fails to carry out any duty or obligation imposed on him, commits an offence and for any person who contravenes the provisions of these bylaws commits an offence and both shall be liable upon conviction to a fine not exceeding fifty thousand shillings or imprisonment for a term not exceeding six months or to both such fine and imprisonment.

4.8.3 Municipal bylaws for regulating and controlling UA in KMC

Kinondoni Municipal Council applies bylaws under the Dar es Salaam city (animal in city area) bylaws of 1989 made under the local government (Urban Authorities) Act No. 8 of 1982, section 80 and targets livestock keeping and bylaws stipulate that, "animals" are camel, cattle, donkey, goat, horse, mule, pig, sheep and rabbit (excluding cat and dog). Bylaw no. 3 stipulates that, these bylaws shall apply to all animals kept within the city area. According to bylaw no.4 requires one to obtain permit from the city Director before keeping any animal within the city and the owner shall be charged fees for permit to keep animals which is set at Tshs 500 per head per annum. Bylaw no.5 states that no person shall keep more than four head of cattle in any city area, and bylaw no.6 stipulates that no person shall graze any animal within the city area.

Bylaw no. 7 forbids keeping animals outside "a building, structure or enclosure", along which to move an animal or animals and permits shall be issued by the Council in respect of animals authorized in the urban area (partly covered under bylaw no. 11). According to bylaw no.8, animals are not allowed to be kept "in a building or part of such building that is used for human habitation. Bylaws no. 9 and 10, require that urban dwellers remove manure, liquid filth and other animal wastes as shall be required by the medical officer of health and that the medical officer of health or any authorized officer may at any reasonable time enter upon premises in which animals are kept or in which he has good reason to believe that animals are being kept for the purpose of inspecting such premises and any person obstructing such officer or hindering him or giving false information shall be guilty of an offence.

Bylaw no. 11 elaborates on movement of animals through any part of the city area, it requires that no animals shall be moved through any part of the city area unless the owner is in possession of a permit issued by the city Director and such permit shall specify the

number and kinds of animals to be moved, the exact route to be followed and the day or days on which the movement is to take place. This bylaw shall not apply in the case of any animal being moved through the city area by a vehicle to an abattoir or to or from any place where animals are permitted to be kept, or to any animal being moved under bylaw no. 12. The bylaw provides further that, no permit shall be necessary for the movement of animals in a motor vehicle or by rail.

Bylaws no. 12, 13 and 14 refers to a general permit to move animals for grazing. They stipulates that, the city Director may issue to any person licensed to keep animals under these bylaws who habitually moves such animals from the place where they are kept to a veterinary centre or to an abattoir, a general permit to move animals in the form of schedule of the bylaws hereto. Permit issued under this bylaw shall be valid for a period of one year from the date of issue; the owner shall be charged fees for permit to move animals which is set at Tshs 100 per head per annum. In any case where the city Director refuses to issue a permit the applicant may request that his application be put before the council for consideration at the next meeting of the relevant committee of the council. Bylaw 15, not withstanding the provisions of these bylaws the council may, on receipt of an application in writing: - (a) exempt the applicant from holding any permit required by these bylaws; or (b) remit the whole or part of any fee payable.

Bylaws no.16, 17, 18, 19 (sections 1-3) and 20 relates to impounding of animals, pound fees, keeping the pound animals till fees are paid and disposal of impounded animals, responsibility on the impounded animal. Any police officer or any authorised officer may take or cause to be taken to the pound:- (1) any animal being kept within the city area without the necessary permit; (2) any animals being moved through any part of the city area without a permit or by an authorized route; (3) any animal found straying anywhere

in the city area. The owner of any animal impounded under bylaw 16 shall be required to pay the pound fees set at Tshs 5000 per head for the first seven days and thereafter Tshs 200 per head per day. No animal impounded under these bylaws shall be released until the pound fees have been paid. In the event of an impounded animal remaining unclaimed or retained for non-payment of pound fees or retained for a period exceeding seven days, such animal may be disposed of by public auction. A notice of such auction shall be published in at least one newspaper circulating locally and in such other manner as the city Director may direct. The proceeds of sale of any animal so disposed of shall after deduction of any such due to the council: - (a) in the case of an unclaimed animal, be retained by the council in a deposit account for a period of six moths; after which period they shall, if still unclaimed, be paid into the general revenue of the council; (b) in the case of an animal retained for non-payment of pound fees, be paid to the owner of the animal. The council shall not be liable for death of any impounded animals whilst in its custody or for any damage caused to animals moved under a permit issued under these bylaws.

Bylaw no. 21 require any person permitted to keep or move animals within the city area shall on request produce his permit to any police or authorized officer. A bylaw no. 22 and 23 relate to offence and penalties and stipulates that any person who contravenes or fails to comply with any of the provisions of these bylaws or conditions of any permit issued shall be guilty of an offence. Any person found guilty of an offence under these bylaws shall be liable on conviction to a fine not less than Tshs 5000 or six months imprisonment or to both such fine and imprisonment and in addition the court may order that any permit issued to him under these bylaws shall be cancelled.

4.8.4 Contradictions on the bylaws set for regulating and controlling UA

In all the three municipalities studied it was found that the municipal authorities recognized or were knowledgeable of the presence of UA in one form or the other and bylaws are set to control and regulate it. However, the bylaws set had a lot of contradictions within and between the municipalities studied. In AMC the bylaws on animal keeping are broad and recognizes keeping all types of animals that can be domesticated as stipulated in its definition of an animal, however, it does not honour having crops grown in the city. At the same time, in bylaws set in KMC and DMC small livestock like chickens, ducks, rabbits and turkeys, most of which are now raised in urban areas are left out.

In all the municipalities studied, it is not shown clearly as to who is an authorized officer mentioned in the bylaws, in some bylaws in KMC, a medical officer is authorized to inspect premises where animals are kept leaving out UALEAs who are experts in the field. In KMC, while bylaw no. 7 forbids keeping animals outside an enclosure and bylaw 6 disallows any person to graze any animal within city, the two bylaws are contradictory to bylaws no. 11, 12 and 13 which empower the city Director to issue a permit to move animals for grazing that can last for one year. Bylaw no. 5 in KMC sets a limit to the number of heads of cattle to be kept by any person within city, however no limits are stated for other types of animals that are authorized to be kept within city and in DMC and AMC the bylaws are silent on the number of animals allowed to be kept as the bylaws in AMC states that a permit shall indicate type and number of animals to keep based on plot size.

There is also no uniformity on the bylaws as though dealing with same issue of UA their flow are different and the types of animals recognized differ from one municipality to the

other. The penalties stipulated in paying for impounded animals and for the one committing an offence differ from one municipality to the other, for example, while in KMC for any person found guilty of an offence the fine is to as low as Tshs 5000 or to six months imprisonment or both, in AMC is set as high as Tshs 50 000 or to one year imprisonment or both and DCM the fines are set to range between Tshs 50 000 to 300 000 or to six months imprisonment or both.

The bylaws on fines in DMC apply also to a responsible officer upon failure to enforce the bylaws while in AMC and KMC the bylaws are silent on responsible officer failure to enforce the set bylaws. Therefore, there is a need to harmonize the set bylaws and make them applicable to all municipalities. The bylaws on animal keeping should have a base on how they reach on deciding how many animals shall be kept under a given density area and shall include all animals that could be domesticated.

4.8.5 Views of UA respondents on the set bylaws

Table 7 shows responses of UA activities in KMC, DMC and AMC on municipal bylaws that regulate UA. Of the 270 respondents, more than half, 146 (54.1%) indicated that municipalities recognized UA activities as legal activities. Of these, 58 (39.7%), 51 (34.9%) and 37 (25.3%) were from KMC, DMC and AMC, respectively, and their responses were statistically significantly different at $p = 0.005$.

The findings confirms reports by Mougeot (2006), Smit and Bailkey (2006) and Van Veenhuizen (2006) who reported that the situation of prohibiting UA activities was changing for better as acceptance of UA was growing in many municipalities. Again, of the 270 respondents, 115 (42.6%) showed that there were no regulations for regulating

UA, while, less than a third, 77 (28.5%) indicated that municipalities have set regulations for controlling UA activities (Table 7).

Awareness about the presence of bylaws was also reported by Tuvana (2004) in Dar es Salaam who found that most UA farmers were knowledgeable of the bylaws that regulated and controlled UA activities. For example, of the 77 respondents who agreed that municipalities had bylaws for UA, 48 (62.3%), 12 (15.6%), nine (11.7%) and eight (10.4%) indicated that bylaws on UA were related to environmental safety measures, type of UA enterprises, type of inputs used and size of UA enterprises, respectively. Although urban authorities somehow have legalized and support UA as reported by URT (2000) in Dodoma municipality and Mlozi *et al* (2003) in Mbeya and Morogoro municipalities, but most doers seem unaware of the bylaws that control and regulate UA activities.

However, of the 246 respondents who answered the question on whether they received credit for UA, 33 (22.6%) showed that municipalities had helped them to obtain credits for their UA activities. Of the 33 respondents, 20 (60.6%), seven (21.2%) and six (18.2%) indicated that they got loans from banks, credit schemes, and municipal authorities, respectively. Similarly, Mwakaje (2007) in Dodoma municipality found that there were no formal ways of urban farmers to obtain credits. Of the 237 respondents, most, 193 (81.4%) indicated that they obtained capital to start UA activities from their own savings, while, few, 44 (18.6%) said from relatives. Most, 218 (80.7%) of the respondents showed that municipalities were not making productive use of the open/vacant spaces, and most, 233 (86.3%) indicated that municipalities denied them access to the vacant lands/open spaces for them to practice UA activities (Table 7).

Most, 223 (82.6%) of the respondents indicated that the three municipalities did not treat waste water nor recycle wastes for use in UA. As an indication of being aware of bylaws that control and regulate UA activities in the municipalities, most, 228 (84.4%) of the respondents agreed that their UA plots were located in areas that the municipalities had not designated the areas for development. Of the 228 respondents, 84 (39.4%), and 68 (31.9%) indicated that they carried the UA activities not based on the municipality development plans, but based on UA product marketability and UA profitability, respectively (Table 7). The remaining 53 (24.9%), four (1.9%) respondents indicated that the choice of an UA activity was based on consumer preferences, environmental safety and neighbourhood concerns, respectively. The differences on institutional responses about legalizing UA, setting bylaws to regulate and control UA, types of bylaws set, use of vacant plots, allowing access to open spaces and location of UA plots were all found to be statistically significantly different at $p< 0.05$ (Table 7).

Table 7: Responses on various aspects of bylaws on UA (N=270)

	KMC		DMC		AMC			
Statement	**n**	**%**	**N**	**%**	**n**	**%**	**Total**	**p-value**
Municipalities recognize UA								
Yes	58	21.5	51	18.9	37	13.7	146 (54.1)	0.005
No	32	11.9	39	14.4	53	19.6	124 (45.9)	
Regulations set for UA								
Yes	47	17.4	20	7.4	10	3.7	77 (28.5)	
No	28	10.4	55	20.4	32	11.9	115 (42.6)	0.047
Do not know	15	5.6	15	5.6	48	17.8	78 (28.9)	
Nature of regulations set								
Environmental precautions	35	45.5	9	11.8	4	5.2	48 (62.3)	
Types of product	7	9.1	5	6.5	-	-	12 (15.6)	0.0001
Size of enterprise	3	3.9	3	3.9	2	2.6	8 (10.4)	
Type of inputs to use	2	2.6	3	3.9	4	5.2	9 (11.7)	
Municipalities facilitate credits								
Yes	17	11.6	9	6.2	7	4.6	33 (22.6)	0.12
No	42	28.2	41	28.1	30	20.5	113 (77.4)	
Source of capital for UA								
Own savings	50	21.1	82	34.6	61	25.7	193 (81.4)	0.004
Relatives	24	10.1	8	3.4	12	5.1	44 (18.6)	
Municipalities use vacant plots								
Yes	25	9.3	26	9.6	1	0.4	52 (19.3)	0.0013
No	65	24.1	64	23.7	89	33.0	218 (80.7)	
Access to vacant plots allowed								
Yes	13	4.8	17	6.3	7	2.6	37 (13.7)	0.003
No	77	28.5	73	27.0	83	30.7	233 (86.3)	
Municipalities treat wastes								
Yes	11	4.1	17	6.3	19	7.0	47 (17.4)	0.32
No	79	29.3	73	27.0	71	26.3	223 (82.6)	
UA plots per master plans								
Yes	14	5.2	7	2.6	21	7.8	42 (15.6)	0.024
No	76	28.1	83	30.7	69	25.6	228 (84.4)	
Why ignoring master plans?								
Marketability	29	13.6	24	11.3	31	14.6	84 (39.4)	
Profitability	24	11.3	25	11.7	19	8.9	68 (31.9)	
Consumer preference	2	0.9	12	5.6	39	18.3	53 (24.9)	0.0135
Environmental safety	2	0.9	2	0.9	-	-	4 (1.9)	
Neighbourhood	1	0.5	3	1.4	-	-	4 (1.9)	

NB: Numbers in parentheses are total percentages of the attributes

4.9 Provision of Extension Services for UA

Table 8 shows the status of provision of extension services to UA farmers in KMC, DMC and AMC. Of the 270 respondents, over two thirds, 192 (71.1%) showed that they had got extension services about UA from Urban Agriculture and Livestock Extension Agents (UALEAs). Of the 192 respondents, 115 (59.6%) indicated that they had obtained extension services (information, services) from the government employed UALEAs

while 34 (17.6%), and 43 (22.4%) showed that they got extension services from private UALEAs and from both the private and government employed UALEAs, respectively. This shows that there is an increasing trend of the private sector in proving extension services in UA activities, which has complementary effect. Similar findings were reported by Mlozi *et al.* (2003) in Mbeya and Morogoro municipalities who found that the Ministry of Agriculture and Food Security used its UALEAs to promote UA. The differences in getting extension services in the three study municipalities were found to be statistically significant $p \leq 0.05$. Of the 192 respondents who had received extension services, 97 (40.8%) indicated that they got all the information and services they needed for UA activities. And, of the remaining 95 respondents, 41 (43.2%) indicated that they lacked extension information on marketing, while, 28 (29.5%) and 13 (13.7%), said that they lacked in product promotion and production, respectively.

Again, seven (7.4%) and six (6.3%) of the respondents showed that they lacked extension information on ecological friendly UA and product packaging. The differences between the three municipalities on provision of extension information and services were statistically significant at $p= 0.0025$ (Table 8). The results confirm those of Tesha (1996) and Mwakaje (2007) who found that urban farmers in Dar es Salaam and Dodoma municipalities did not get enough extension information and services. The differences in type of extension services offered signified the low attention that municipalities showed through their UALEAs in developing scientific-based UA activities and to incorporate issues of value chain. Of the 270 respondents, few, 64 (23.7%) indicated that they had received training on UA farming. Further, this study results implied that UALEAs concentrated only on few issues, like production practices, leaving out other areas like marketing, packaging, product promotion, value adding, and environmental issues.

Table 8: Provision of extension services to UA farmers (N=270)

	KMC		DMC		AMC			
Statement	**N**	**%**	**N**	**%**	**n**	**%**	**Total**	**p-value**
Getting extension services								
Yes	65	24.1	75	27.8	52	19.3	192 (71.1)	0.0025
No	25	9.3	15	5.6	38	41.1	78 (28.9)	
Providers of extension services								
Public extension agents	40	20.7	42	21.8	33	17.1	115 (59.6)	
Private extension agents	10	5.2	15	7.8	9	4.7	34 (17.6)	0.0135
Private and public agents	18	9.3	16	8.3	10	5.2	44 (22.8)	
Getting all advisory services								
Yes	49	25.5	22	11.5	26	13.5	97 (50.5)	0.042
No	16	8.3	53	27.6	26	13.5	95 (49.5)	
Services lacking advisory services								
Production advices	5	5.3	3	3.2	5	5.3	13 (13.7)	
Marketing advices	6	6.3	27	28.4	8	8.4	41 (43.2)	
Product promotion	2	2.1	17	17.9	9	9.5	28 (29.5)	0.011
Ecological friendly production	3	3.2	2	2.1	2	2.1	7 (7.4)	
Packaging of products	-	-	4	4.2	2	2.1	6 (6.3)	
Received training related to UA								
Yes	42	15.6	12	4.4	10	3.7	64 (23.7)	0.022
No	48	17.7	78	28.9	80	29.6	206 (76.3)	

NB: Numbers in parentheses are total percentages of the attributes

Of the 270 respondents, 137 (50.7%) indicated that they got all the necessary inputs for their UA activities. But of these, 133 (49.3) showed that they lacked some of the important inputs for effective undertaking of UA activities, and of these, 73 (54.9%) showed that it was because of high prices of the inputs. Other respondents, 29 (21.8%), 22 (16.5%), and nine (6.8%) showed that they did not get all the necessary inputs for their UA activities because of their unavailability; were obtained far from homes and lacked capital. Claims by Mlozi *et al.* (2003) in Mbeya and Morogoro municipalities revealed that inputs required for UA depended on the type of UA system employed and the price involved. The differences of respondents' opinions between municipalities on getting the necessary inputs and reasons for not getting them were found to be statistically significant at p= 0.0421.

Of the 218 respondents, most, 175 (80.3%) indicated that they relied on private shops for the supply of inputs for UA activities, and 195 (72.2%) indicated to using commercial

inputs in their UA activities. Of the 270 respondents, 205 (75.9%) indicated to using home made inputs (animal feed rations, compost) in their UA activities. These findings support those of Jacobi *et al.* ((2000) and Mwakaje (2007) who found that most UA farmers in Dar es Salaam and Dodoma municipalities utilized inputs sourced within urban limits. Of the 205 respondents who used home made inputs, 113 (57.9%) showed that they got information on their use from UALEAs, while, 18 (9.2%) got it from fellow UA farmers, and the remaining 42 (21.5%), 19 (9.7%), and three (1.5%) relied on their personal initiatives, from NGOs, and training institutions, respectively. The differences on opinions of UA farmers between cities on using inputs and sources for information for inputs were found to be statistically significant at $p< 0.05$ (Table 9).

Table 9: Responses on input use for UA enterprises (N=270)

	KMC		DMC		AMC			
Statement	**n**	**%**	**N**	**%**	**n**	**%**	**Total**	**p-value**
Getting all necessary inputs								
Yes	54	20.0	50	18.1	33	12.2	137 (50.7)	0.0421
No	36	13.3	40	14.8	57	21.1	133 (49.3)	
Problems on getting inputs								
Unavailability	18	13.5	4	3.0	7	5.3	29 (21.8)	
Distant source	8	6.0	1	0.8	13	9.8	22 (16.5)	0.0005
Higher prices (costly)	7	5.3	34	25.6	32	24.1	73 (54.9)	
Low capital	3	2.3	1	0.8	5	3.8	9 (6.8)	
Institutions supplying inputs								
Private	52	23.9	67	30.7	56	25.7	70 (32.1)	
Governmental	12	5.5	11	5.0	-	-	90 (41.3)	0.0395
NGO	6	2.8	12	5.5	2	0.9	58 (26.6)	
Use commercial inputs								
Yes	66	24.4	76	28.1	53	19.6	195 (72.2)	0.0255
No	24	8.9	14	5.2	37	13.7	75 (27.8)	
Use home made inputs								
Yes	62	23.0	61	22.6	82	30.4	205 (75.9)	0.0125
No	28	10.4	29	10.7	8	3.0	65 (24.1)	
Source of information on using home made inputs								
Extension agent	20	10.3	52	26.7	41	21.0	113 (57.9)	
Fellow farmers	11	5.6	2	1.0	5	2.6	18 (9.2)	
Personal initiatives	10	5.1	3	1.5	29	14.9	42 (21.5)	0.0335
NGO	8	4.1	4	2.1	7	3.6	19 (9.7)	
Training Institution	3	1.5	-	-	-	-	3 (1.5)	

NB: Numbers in parentheses are total percentages of the attributes

Water supply for UA activities in KMC, DMC and AMC is as shown in Table 10. Of the 270 respondents, over two thirds, 183 (67.8%) agreed to had reliable sources of water for their UA activities. Of these, 155 (57.8%) indicated that they relied on tap water indicating that there was a competition between other household water needs and UA activities. In most cities, Dar es Salaam, Dodoma and Arusha inclusive, tap water has always not been enough in most areas, as of the 270 respondents, 73 (27.0%) indicated that they had problems in accessing water for UA activities, forcing them to use waste water. These findings confirms those of URT (2003) and Mwakaje (2007) both in Dodoma municipality who found that water was the most limiting factor in UA vegetable production. Observation revealed that some UA farmers used rainfall to water livestock and sometimes used untreated waste water for irrigation purposes. Differences between municipalities on issues related to water availability for UA were found to be statistically significant at $p< 0.05$.

Table 10: Water supply for UA in the three municipalities (N=270)

	KMC		DMC		AMC			
Statement	**n**	**%**	**n**	**%**	**n**	**%**	**Total**	**p-value**
Have a reliable source of water								
Yes	75	27.8	69	25.6	39	14.4	183 (67.8)	0.031
No	15	5.6	21	7.8	51	18.9	87 (32.2)	
Have constraints in accessing water								
Yes	35	12.9	35	12.9	3	1.1	73 (27.0)	0.0221
No	55	20.4	55	20.4	87	32.2	197 (73.0)	
Source of water for UA activities								
Tap water	65	24.3	58	21.6	32	11.9	155 (57.8)	
Stream	19	7.1	16	6.0	26	9.7	61 (22.8)	
Wastewater from household	3	1.1	1	0.4	1	0.4	5 (1.9)	0.0115
Wastewater from industries	1	0.4	-	-	19	7.1	20 (7.5)	
Furrow	-	-	15	5.6	12	4.5	27 (10.1)	
Use wastewater for UA activities								
Yes	22	8.1	6	2.2	29	10.7	57 (21.1)	0.0134
No	68	25.2	84	31.1	61	22.6	213 (78.9)	

NB: Numbers in parentheses are total percentages of the attributes

Table 11 shows respondents' opinions on the environmental social concerns that UA activities brought about in KMC, DMC and AMC. Of the 270 respondents, most, 221 (81.9%) indicated that they had no training on environmentally friendly UA undertaking.

However, over a third, 104 (38.5%) of the respondents agreed that there were promotional campaigns aimed at sensitizing UA farmers to practise environmentally safe food production within urban areas like proper disposal of UA wastes. Other areas of concern included recycling UA organic wastes, promoting use of bio-pesticides, waste water treatment before reusing it in UA activities, and environmentally friendly farming as indicated by 14 (13.5%), 12 (11.5%), and one (0.9%) of the respondents, respectively.

Table 11: Responses on environmental social concerns of UA (N=270)

	KMC		DMC		AMC			
Statement	**n**	**%**	**N**	**%**	**n**	**%**	**Total**	**p-value**
Trained on friendly UA production								
Yes	25	9.3	11	4.1	13	4.8	49 (18.1)	0.005
No	65	24.1	79	29.3	77	28.5	221 (81.9)	
Sensitized on safe production								
Yes	55	20.4	24	8.8	25	9.3	104 (38.5)	0.0311
No	35	12.9	66	24.4	65	24.1	166 (61.5)	
Areas on campaigns for UA								
Disposal of UA wastes	34	32.7	8	7.7	20	19.2	62 (59.6)	
Recycling organic wastes	10	9.6	4	3.8	-	-	14 (13.5)	
Use of bio-pesticides	5	4.8	6	5.8	3	2.8	14 (13.5)	0.003
Wastewater treatment	4	3.8	6	5.8	2	1.9	12 (11.5)	
Environmentally friendly	1	0.9	-	-	-	-	1 (0.9)	
Resistance from neighbours								
Yes	31	11.5	47	17.4	3	1.1	81 (30.0)	0.0122
No	59	21.9	43	15.9	87	32.2	189 (70.0)	
Why neighbours resist								
Pollution	14	17.3	13	16.0	2	2.5	29 (35.8)	
Poor UA waste disposal	7	8.6	10	12.3	-	-	17 (20.9)	0.31
Foul smell	5	6.2	13	16.0	-	-	18 (22.2)	
Noise	5	6.2	11	13.6	1	1.2	17 (20.9)	
Problems on safe production								
Manure disposal	47	17.9	3	1.1	55	20.9	105 (39.9)	
Use of bio-pesticides	20	7.6	16	6.1	3	1.1	39 (14.8)	0.13
Waste water handling	9	3.4	30	11.4	27	10.3	66 (25.1)	
Use of organic fertilizers	7	2.7	41	15.6	5	1.9	53 (20.2)	

NB: Numbers in parentheses are total percentages of the attributes

Only few, 81 (30.0%) of the respondents indicated that they got complaints from neighbours about their UA activities, which indicated pollution, foul smell, poor UA waste disposal and noises indicated by 29 (35.8%), 18 (22.2%), and 17 (20.9%) of the

respondents, respectively. Although most of the respondents wanted to produce their UA products on an ecologically friendly manner, 105 (39.9%), 66 (25.1%), 53 (20.2%), and 39 (14.8%) indicated that it was impossible to achieve it because they faced problems with proper manure disposal (Plate 6), had poor UA waste water handling and treatment, and lack of bio-pesticides, respectively. Differences on opinions given by UA farmers between municipalities on attributes related to environmental social concerns (though related) with exception of reasons for neighbours on resisting UA and problems associated with safe production of UA products, were found to be statistically significant at $p < 0.05$. The study found that problems that hindered ecological UA farming were somehow an indication of lack knowledge and skills of UALEAs to address these issues with UA farmers. Foeken, *et al.* (2004) in Mbeya and Morogoro municipalities reported similar findings of low awareness of UALEAs on potential damaging implications of UA activities.

Plate 5: A barn of cattle with problems on manure disposal in urban setting

4.10 Efficiency of UA Enterprises

Efficiency is an important economic concept used in assessing producer's performance to ensure that products are produced in the best and most profitable way (Park *et al.* 2010). Agricultural eco-efficiency is promoted as resources of increasing main production and recuperating food security (Jansen, 2000). Analysis of UA production efficiency is an important aspect to prevent waste of resources as its activities are carried out under constrained resource base and space within municipalities. This study examined the technical efficiency (TE) of UA activities in three municipalities. TE here refers to the ability of the UA farmer to produce maximum output using a given level of inputs. Data used for this study are mainly primary and were obtained from UA farmers using a questionnaire. The study utilised stochastic production frontier, which builds hypothesized efficiency determinants into inefficiency error components (Coelli and Battesse, 1996). The measure of the output is the total monetary value of UA products obtained during the last season (in Tanzanian shillings). And the inputs include size of land in square metres, family labour (in man days per day), hired labour (in man days per day), total variable cost for last season excluding charges for services offered by UALEAs (in Tanzanian shillings), and charges paid to UALEAs for extension services received (in Tanzanian shillings).

4.10.1 Estimates of stochastic frontier production function in UA

To estimate TE in UA, the Maximum Likelihood (ML) method using FRONTIER 4.1 software developed by Coelli (1996) was adopted for UA activities as presented in Table 12. From the results all except the family labour variable had positive signs suggesting that more output would be obtained from the use of additional quantities of these variables, *ceteris paribus*. The coefficient of land size for UA was positive and statistically significant at p= 0.005. The statistical significance of the variable explains

the importance of land in UA activities, meaning that its shortage would not only pose a negative effect on UA production, but an indirect negative effect on output through reducing the marginal productivity of non-land inputs. Similar results were reported by Okike (2000) in the savannah areas of Nigeria, Umoh (2006) and Shehu *et al.* (2007) in Adamawa state, Nigeria who found that small land size had a significant effect on agriculture production. This indicates that smaller land sizes for UA highly influenced production efficiency especially for UA practices requiring larger areas like dairy farming. However, UA activities like poultry keeping could be accommodated on smaller plot sizes.

The production elasticity of output with respect to family labour (β_2) (man days per day) had a negative sign of – 0.36 and was not statistically significant at $p< 0.05$. The negative sign however, could explain the reliance on more family labour for reducing production costs. However, dependency on hired labour would improve efficiency in UA production as shown by the positive sign of hired labour (β_3) coefficient of 0.17 indicating its positive relationship with UA efficiency, and the hired labour variable was found not to be statistically significant at $p< 0.05$. However, increasing hired labour by 10 percent would only result into increase in UA output by approximately two percent only (Table 12). The coefficient for total variable costs incurred (β_4) in UA activities was positive but and was statistically significantly different at $p= 0.015$.

However, the positive sign of total variable cost is an indication of association to increasing production levels in UA and is derived from the fact that, it is the determinant of how much is incurred to run UA activities on daily basis, and the rate at which the daily UA enterprise requirements are met the higher the efficiency in undertaking it. Similarly, UALEAs charges variable (β_5) had a positive sign, however, was not

statistically significant at $p < 0.05$. The positive sign of the variable however, signified that the more an UA farmer received extension information and services the more efficient he/she became in running UA activities. Additionally, efficient UA farmers attracted UALEAs to visit those more frequently, which increased the efficiency in running their UA activities. The positive relationship of the signs on the input coefficients agrees with the findings by Amaza and Olayemi (2000) in Gombe state, Nigeria, Amaza *et al.* (2005) in the Chad basin development area, Nigeria, Ebong (2005) in Akwa Ibom state, Nigeria and Onyenweaku *et al.* (2005) in Nasarawa state, Nigeria who reported positive relationship between input variables and technical efficiency in agricultural activities. The positive relationship between input variables and TE of UA shows their importance in enhancing the level of UA production in Tanzanian municipalities.

The yield function was expressed as a Cobb-Douglas function; hence, the coefficients of variables were the direct elasticity's. The elasticity's included land for UA, hired labour, total variable costs and charges for extension services were positive. Total variable costs component appeared as the most important factor affecting UA production with an elasticity of 0.509 (Table 12). It implied that increasing expenses in total variable costs by 10 percent will lead to increasing UA output by 5 percent. Further, the results also show that more inputs are required in UA activities like feed and agro-chemicals, which would greatly improve its TE.

However, this indicated that input allocation and use in UA activities was still in the rational stage of production, and increasing their use would increase UA output. These results confirm findings of Umoh (2006) in Uyo Metropolis, South-eastern Nigeria who found that positive relationship of variable costs (fertilizers, planting materials) increased TE UA vegetable output. However, the estimated return-to-scale computed as the sum of

the estimated output elasticity's was 0.697, suggesting that UA farmers were operating in the decreasing returns to scale region (efficient stage). The result of this study implied that a unit increase to the quantities of the production resources (inputs) would lead to less than proportionate increase to the output of UA, *ceteris paribus*. That is, a unit increase in inputs will lead to increase in UA production, however, not at an equal rate as the input increase. The results are contrary to the results by Idiong (2007) in Cross River State of Nigeria who found farmers operating under the increasing return to scale, which is a unit increase in inputs, could lead to more than proportionate increase to the output (Table 12). The variance parameter δ^2 (which is the model variance) was 0.94, which shows the goodness of fit and correctness of the distributional form assumed for the composite error term. The gamma γ indicating the systematic influences that are unexplained by production was 0.82, however, was found not statistically significant at $p< 0.05$. But, it is an indication that 82 percent variation in UA output was attributed to technical inefficiency in the resource use, meaning that the inefficiency effects had a significant contribution to the technical inefficiencies of UA farmers observed.

Table 12: Maximum Likelihood estimates of the stochastic frontier function and TE

Variable	Parameter	Coefficients	Standard error	t-statistics	p-value
Constant	β_0	0.118	0.22	1.199	0.10^{ns}
Land size	β_1	0.152	0.89	2.312	0.005^{**}
Family labour	β_2	-0.356	0.97	-0.464	$0,10^{ns}$
Hired labour	β_3	0.173	0.11	1.426	0.10^{ns}
Variable cost (Tshs)	β_4	0.509	0.13	2.117	0.015^{**}
UALEAs charges (Tshs)	β_5	0.101	0.11	1.194	0.10^{ns}
Sum of elasticity's		0.697			
Sigma squared (δ^2)		0.823	0.35	1.649	
Gamma (γ)		0.942	0.43	1.113	
Log likelihood		-0.269			
LR test		0.113			

NOTE: **= Statistically significantly different at $p< 0.05$

4.10.2 Technical Efficiency Indices (TEI) of selected UA enterprises

4.10.2.1 Overview

TEI differences were used to depict area densities and UA units at which highest efficiency levels were reached in the three municipalities (Arusha, Kinondoni and Dodoma). Density area types were used as predetermined in different municipalities, and UA units were calculated for different UA enterprises e.g. number of dairy cows, square metres for growing vegetables and batches of poultry (broilers, layers each of 100 birds to keep as explained below:

Keeping dairy cattle:- 1 UA unit = Keeping 1 dairy cow; 2 UA units= Keeping 2 dairy cows; 3 UA units = Keeping 3 to 4 dairy cows; 4 UA units = keeping 5 and more dairy cows

Growing vegetables:- 1 UA unit= Growing on an area not exceeding 20 square metres; 2 UA units= Growing on area larger than 20 Square metres but not exceeding 50 square metres; 3 UA units = Growing on area larger than 50 Square metres but not exceeding 100 square metres; 4 UA units = Growing on area larger than 100 square metres

Keeping poultry: - 1 UA unit = Keeping up to 3 batches at a time (300 broilers or layers); 2 UA units = Keeping between 4 to 6 batches at a time (400 to 600 broilers or layers); 3 UA units = Keeping between 7 to 10 batches at a time (700 to 1,000 broilers or layers); 4 UA units = Keeping more than 10 batches at a time (more than 1,000 broilers or layers).

DMU: - Decision Making Unit (an individual UA farmer)

4.10.2.2 TEI of UA enterprises in KMC

TEI for UA enterprises in KMC are shown in Table 13, which indicate that the highest mean TEI of 0.84 was observed for UA respondents keeping layers, and individual DMU ranged from 0.62 to 0.96. Keeping broilers ranked second in KMC with a mean TEI of 0.83 ranging from 0.44 to 1.00 for an individual DMU. Keeping dairy cattle ranked third in KMC with a mean TEI of 0.75 and an individual DMU ranged from 0.5 to 0.92. The lowest mean TEI of 0.67 was found in growing vegetables, which ranged from 0.43 to 1.00 (Table 13, Fig. 6).

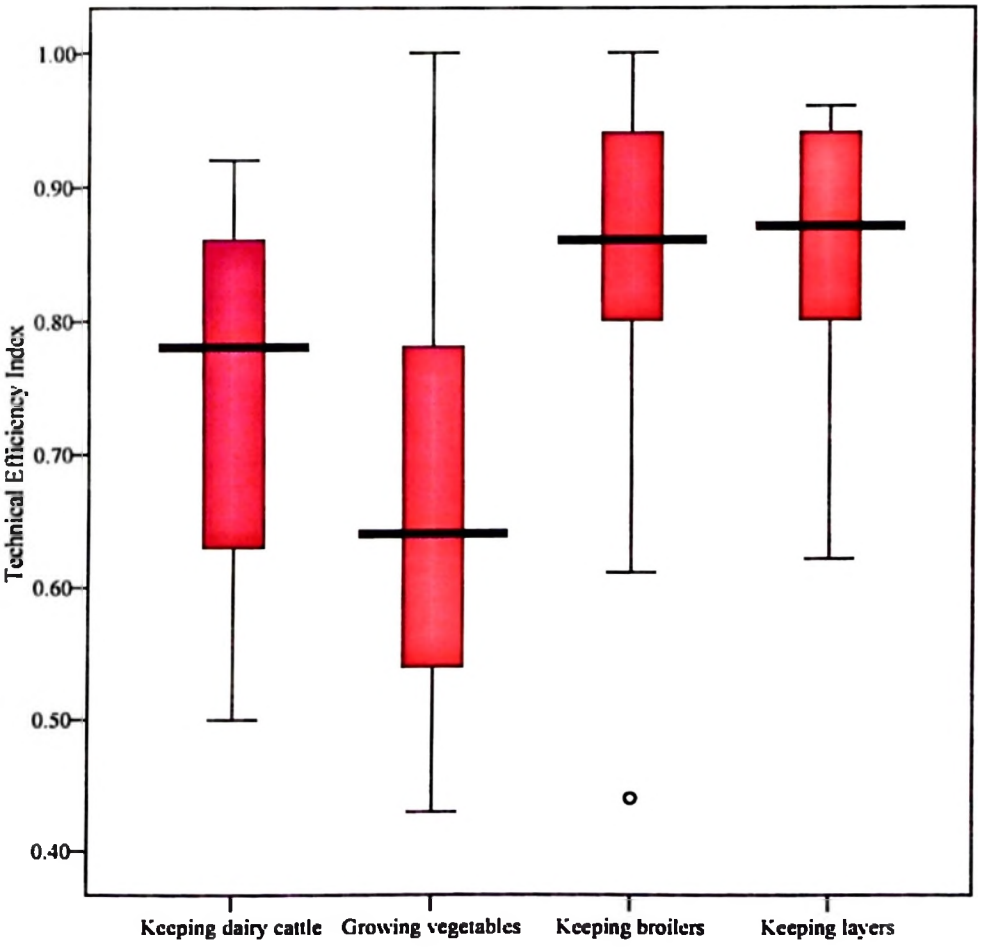


Figure 6: Mean TEI of UA in KMC by UA enterprises

Examining data of keeping dairy cattle in the three density areas of KMC showed that a TEI of 0.76 was attained by respondents who kept two to four dairy cows in medium-density areas. Minimum TEI of 0.50 was found in high-density areas for UA respondents who kept more than five dairy cows, while a maximum TEI of 0.92 was observed in medium-density areas for respondents keeping five dairy cows. This implied that UA respondents in medium-density areas had relatively more resources to care for dairy cattle than those in high-density areas (Table 13, Fig. 7). Vegetables performed optimally in medium-density areas with a TEI of 0.69 and reached up to 0.86 on plots ranging from 21 to 50 square metres (Fig. 7, 8).

Table 13: Technical Efficiency Indices (TEI) of UA enterprises in KMC

UA enterprise	TEI	Area density	UA units
Keeping dairy cattle			
Maximum	0.92	Medium	5 dairy cows
Mean	0.75	Medium	2 – 4 dairy cows
Minimum	0.50	High	5 dairy cows
Keeping broilers			
Maximum	1.00	Low/High	400-600 broilers
Mean	0.83	Low/High	400-600 broilers
Minimum	0.44	Medium	1000 broilers
Keeping layers			
Maximum	0.96	Medium/High	1000 layers
Mean	0.84	Low	400-600 layers
Minimum	0.62	Medium	700-1000 layers
Growing vegetable			
Maximum	1.00	Low	21-50 square meters
Mean	0.67	Medium	21-50 square meters
Minimum	0.43	Low	100 square meters

The minimum TEI of 0.43 for growing vegetables was found in low-density areas for UA respondents with plots of 100 square metres, while the maximum TEI of 1.00 was found in low-density areas on UA plots measuring 21 to 50 square metres (Table 13). One plausible reason could be due to shortages of water for irrigating relatively bigger vegetable plots. TEI of 0.86 for keeping broilers in KMC was attained both in low-and high-density areas for respondents keeping 400 to 1000 broilers at a time, while the

minimum TEI of 0.44 was found in medium-density areas for UA respondents keeping more than 1000 broilers at a time. Maximum TEI of 0.89 was attained in low-and high-density areas for UA farmers who kept from 400 to 600 broilers at a time (Fig. 8).

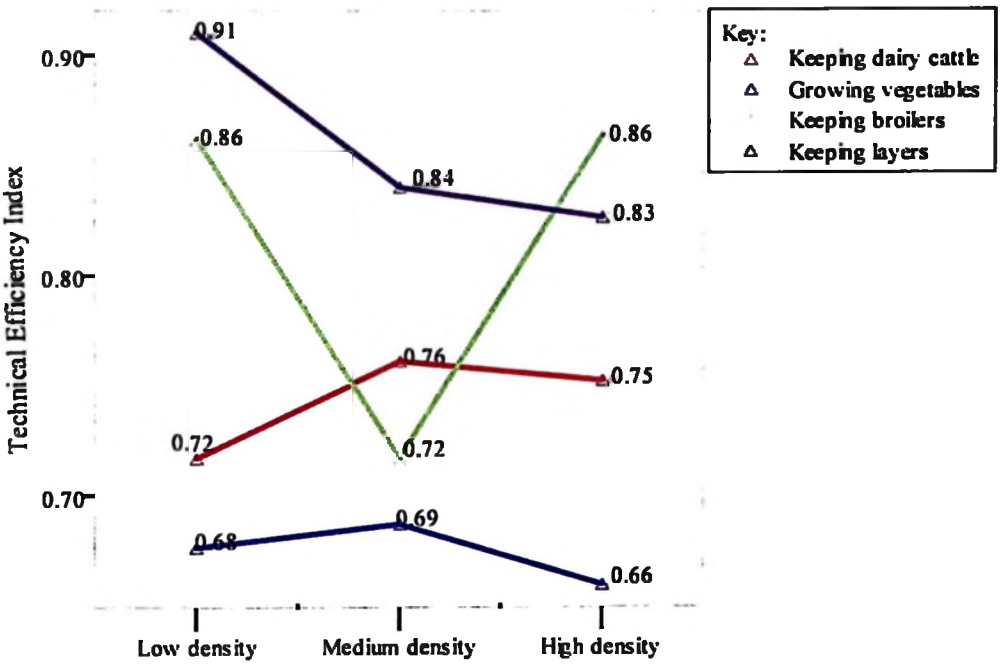


Figure 7: TEI by area of density and UA enterprises in KMC

In KMC, the mean TEI for keeping layers was 0.84 and minimum TEI of 0.62 was found in medium-density areas for UA respondents keeping 700 to 1000 layers, while the maximum TEI of 0.96 was found in medium-and high-density areas for those keeping 1000 layers at a time (Fig. 8). A TEI of 0.91 per UA unit was attained for UA respondents keeping 400 to 600 layers at a time. In KMC, keeping less numbers of layers reduced TEI to 0.75, and keeping layers beyond 600 reduced TEI to 0.62 (Fig. 8). TEI was found to be maximum in low-density areas and decreased with UA respondents keeping layers in medium-density and high-density areas. Therefore, a TEI of 0.91 for keeping layers in KMC could be attained if carried out in low-density areas by UA

respondents keeping 400 to 600 layers at a time, and a TEI of 0.85 could be attained by keeping 1000 layers at a time.

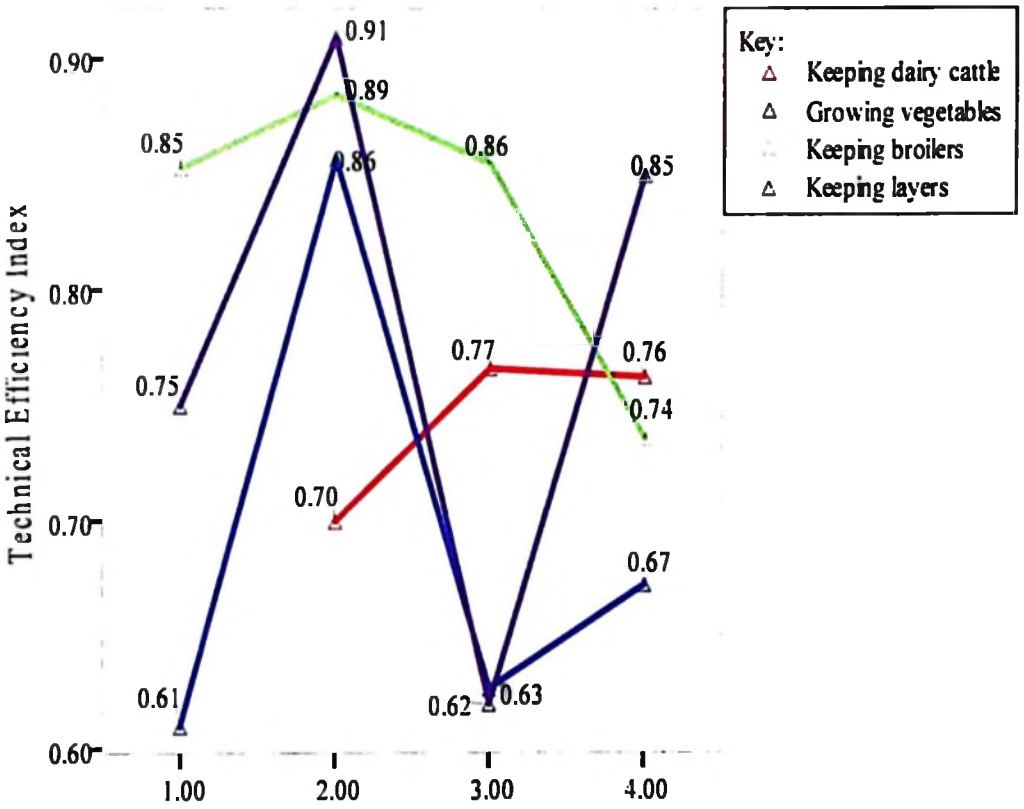


Figure 8: UA TEI by UA enterprises and UA units in KMC

The rational combinations of different UA enterprises in KMC is shown by the intersections of lines in Fig. 7 and 8 in which a TEI of 0.85 is found in both keeping 500 broilers and 500 layers at a time. If a respondent kept both 1000 broilers and 1000 layers at a time, TEI was reduced to 0.78 (Fig. 8). Sound combinations of UA enterprises are achievable with a maximum TEI of 0.88 in medium-density areas for UA respondents keeping a combination of 500 layers and 500 broilers or three dairy cows and 700 broilers. Respondents in low-density areas obtained maximum TEI by keeping 500 layers or 500 broilers alone. This study found that respondents in low-density areas who kept

layers attained maximum TEI of 0.91, while those in high-density areas experienced relatively lower TEI of 0.83, and UA enterprises in high-density areas could not be combined (Fig. 7, 8).

However, the study also found that UA respondents who kept broilers attained the same TEI of 0.86 both in low-density and high-density areas. Generally, TEI of all UA enterprises were high in low-density areas with the exception of respondents who kept broilers in low and in-high-density areas. Keeping a combination of 500 layers and 500 broilers and growing vegetables on an area ranging from 21 to 50 square metres attained a maximum TEI of 0.85. Keeping three to four dairy cows in medium-density areas attained a TEI of 0.77 and decreased to 0.76 for UA respondents keeping five dairy cows in high-density areas (Fig. 8). This was probably due to lack of labour for cutting forage and cleaning barns. TEI for growing vegetables increased from 0.63 to 0.67 in medium-density areas on areas exceeding 50 square metres. The observed low mean TEI of 0.67 in growing vegetables was probably due to shortages of labour and water and the competition of the latter with other household chores.

4.10.2.3 TEI of UA enterprises in DMC

TEI for UA enterprises in DMC are shown in Table 14 which indicate that a mean TEI of 0.82 was found in low-density areas for UA respondents keeping dairy cows in which TEI ranged from 0.50 to 0.98 (Fig. 9). A minimum TEI of 0.50 was found for respondents keeping two to four dairy cows in medium-density areas, while maximum TEI of 0.98 was found in low-density areas for respondents keeping two to four dairy cows. This could be due to low-density areas having large plots, wealthier owners, and relatively enough provisioning of forage to feed cattle, a reason for the noted differences in TEI.

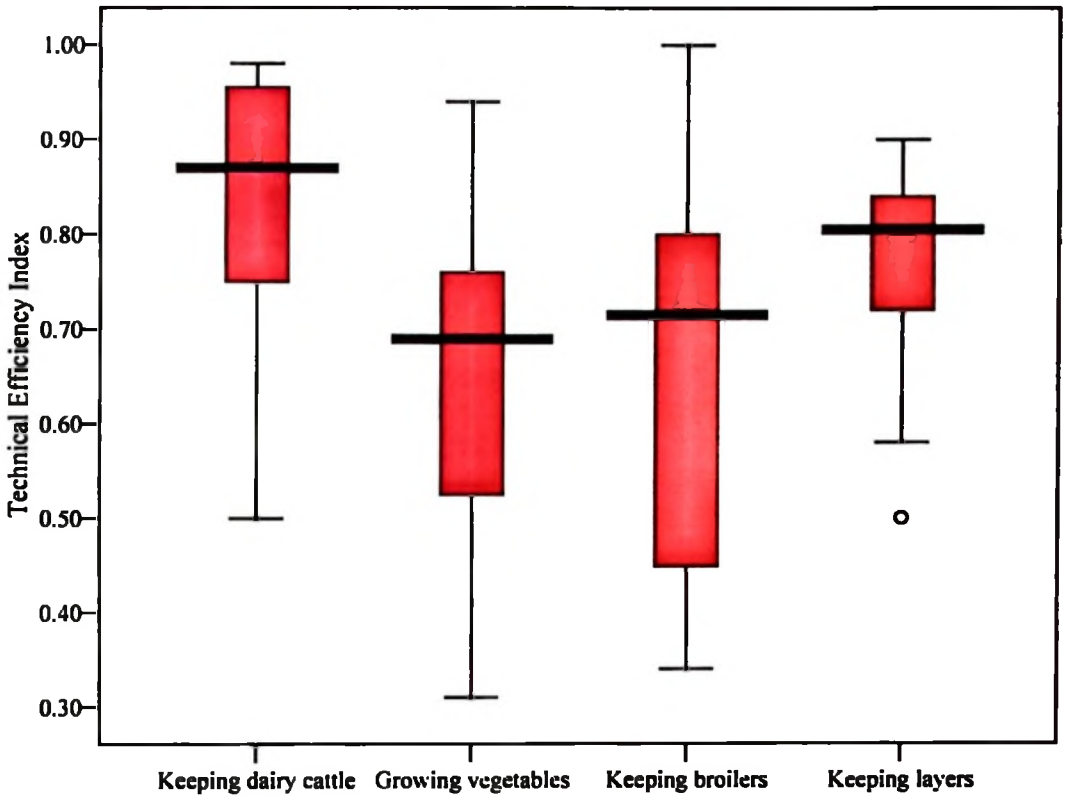


Figure 9: Mean TEI of UA in DMC by UA enterprises

Further, data of UA enterprises' TEI in DMC show that a TEI of 0.87 was found in medium-density areas for respondents keeping two to four dairy cows, which increased from three to four reaching a maximum TEI of 0.96 (Fig. 10, 11). TEI for UA respondents in DMC who kept layers ranked second with a mean TEI of 0.77. TEI ranged from a minimum of 0.50 for UA respondents keeping 300 layers in high-density areas to a maximum TEI of 0.90 for those keeping 400 to 600 layers in low-density areas. Further, data shows that a TEI of 0.85 was attained for respondents keeping 400 to 600 layers in medium-density areas (Table 14, Fig. 10).

A minimum TEI of 0.31 for growing vegetables was found in high-density areas for UA respondents with plots of 100 square metres, while a maximum TEI of 0.94 was found in

medium-density areas on UA plots measuring 100 square metres (Table 14). One plausible reason could be due to shortages of water to irrigate relatively bigger vegetable plots. TEI of 1.00 for keeping broilers in DMC was attained in medium-density areas for UA respondents keeping 400 to 600 broilers at a time, while the minimum TEI of 0.34 was in medium-density areas for UA respondents keeping 400 to 600 broilers at a time (Table 14).

Table 14: Technical Efficiency Indices (TEI) for UA enterprises in DMC

UA enterprise	TEI	Area density	UA units
Keeping dairy cattle			
Maximum	0.98	Low	2-4 dairy cows
Mean	0.82	Medium	2-4 dairy cows
Minimum	0.50	Medium	2-4 dairy cows
Keeping broilers			
Maximum	1.00	Medium	400-600 broilers
Mean	0.65	Medium	400-600 broilers
Minimum	0.34	Medium	400-600 broilers
Keeping layers			
Maximum	0.90	Low	400-600 layers
Mean	0.77	Medium	400-600 layers
Minimum	0.50	High	300 layers
Growing vegetable			
Maximum	0.94	Medium	100 square meters
Mean	0.65	Medium	21-50 square meters
Minimum	0.31	High	100 square meters

A mean TEI for respondents growing vegetables in DMC was 0.65 and a minimum TEI of 0.31 was found in high-density areas for respondents growing vegetables on plot sizes of 100 square metres (Table 14). A maximum TEI of 0.94 was found for respondents growing vegetables in medium-density areas on similar vegetable plot sizes that exceeded 100 square metres. The observed differences in density areas could be due to lack of water to irrigate vegetables in high-density areas compared to those in medium-density areas. In DMC, a TEI of 0.72 for respondents growing vegetables was attained in medium-density areas on plot sizes ranging from 21 to 50 square metres (Fig. 10).

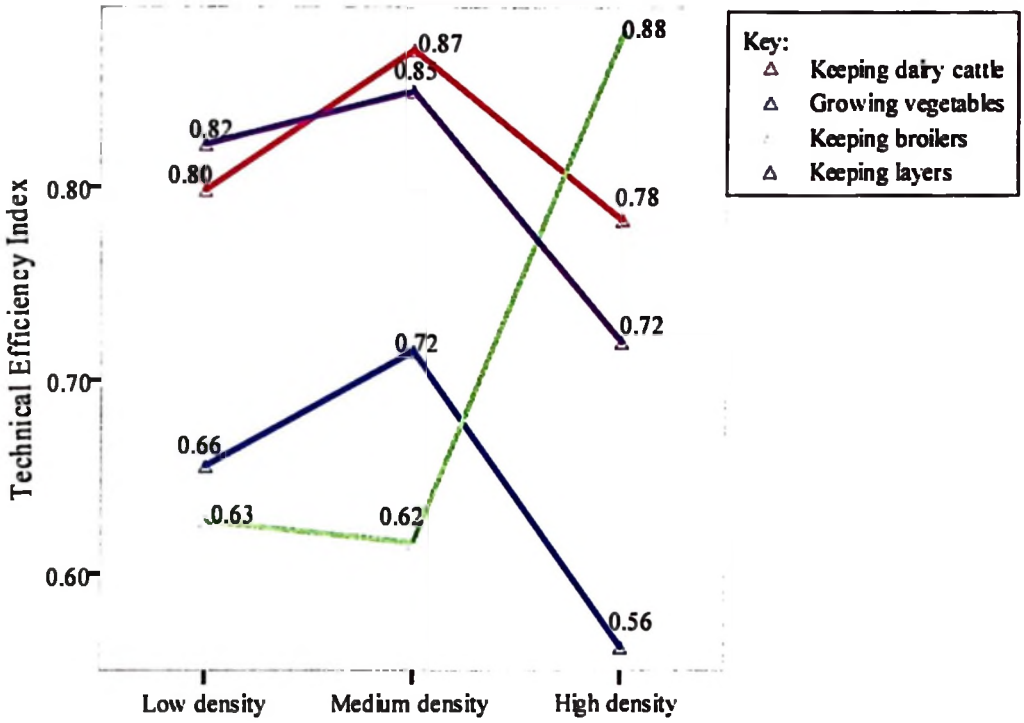


Figure 10: UA TEI by area density and UA enterprises in DMC

Fig. 9 show that keeping broilers in DMC had a mean TEI of 0.65. A minimum TEI of 0.34 was found in medium-density areas for respondents keeping 400 to 600 broilers, while a maximum TEI of 1.00 was also found in medium-density areas for those keeping 400 to 600 broilers. The observed differences in TEI of respondents keeping broilers in DMC could be due to farmers' failure to get all the required resources and problems associated with accessibility to markets (Table 14, Fig. 9). A TEI of 0.80 was found in high-density areas for respondents keeping 700 to 1000 broilers at a time.

Fig. 10 show that, a rational combination of UA enterprises in DMC was only possible in medium-density areas for which a respondent could keep two to four dairy cows and 400 to 600 layers and attain a TEI of 0.84. Similarly, a combination of keeping broilers and layers, keeping dairy cows and broilers in medium-density areas was possible to attain TEI of 0.81 and 0.76, respectively. TEI above 0.80 was found for respondents keeping a

combination of two to four dairy cows and 400 to 600 layers in medium-density areas (Fig. 10).

In DMC, a maximum TEI of 0.79 was reached at 2 UA units for respondents keeping 400 to 600 layers and keeping above 600 layers tended to lower the TEI. A rational combination of keeping broilers and layers at a time was only achieved if respondents did not exceed 3 UA units (700 to 1000) layers at a time (Fig. 11). Undertaking UA enterprises in DMC with the exception of keeping broilers and growing vegetables shows that a maximum TEI above 0.85 were obtained in medium-density areas and decreased in high-density areas to 0.72.

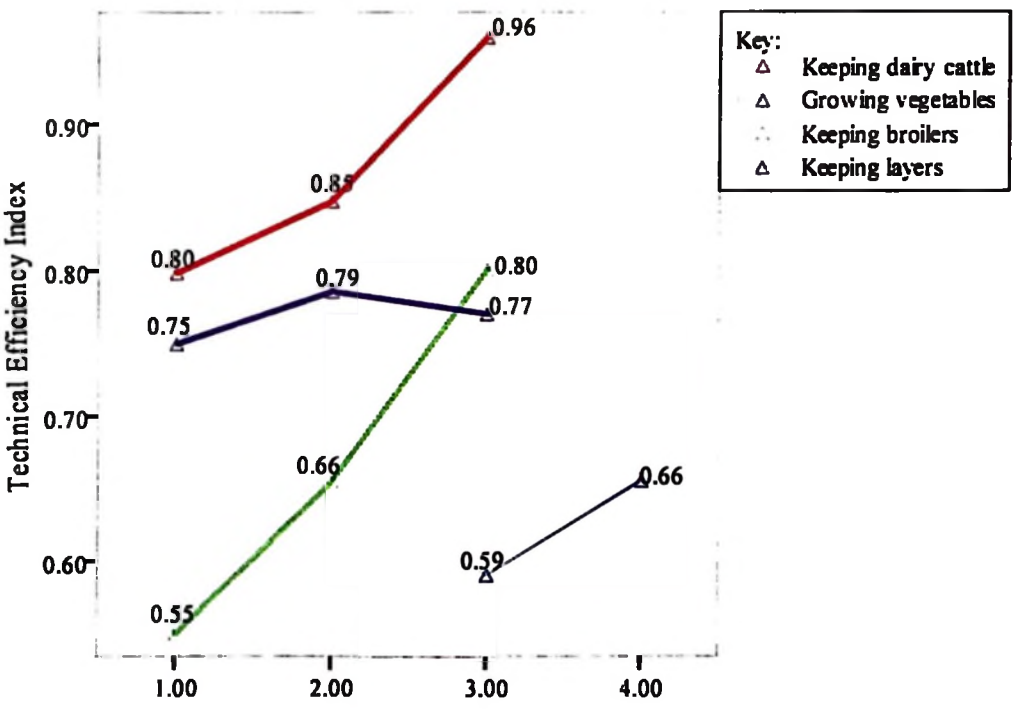


Figure 11: UA TEI by UA enterprises and UA units in DMC

This could be due to decreasing plot sizes from low-to high-density areas. Again, other external factors such as social, physical, cadastral and environmental issues seem to limit

UA TEI in high-density areas. Factors such as noise from animals, stench, sludge, dust and flies limited the undertaking of UA in high-density areas. In DMC, TEI for keeping layers, broilers and dairy cattle showed an increasing trend from 1 to 3 UA units (700 to 1000 layers, broilers) and keeping 3 to 4 dairy cattle. However, the study found that lack of forage, concentrates and day-old chicks limited UA respondents to keep these livestock beyond 3 UA units (Fig. 11). In DMC, vegetable growing showed a maximum TEI of 0.66 in medium-density areas on plot sizes of 100 square metres.

4.10.2.4 TEI of UA enterprises in AMC

TEI for UA enterprises in AMC are shown in Table 15 and Fig. 12, which show that a mean TEI of 0.74 was found for respondents keeping dairy cattle with TEI ranging from 0.41 in high-density areas to a maximum TEI of 0.92 in low-density areas of keeping five dairy cows.

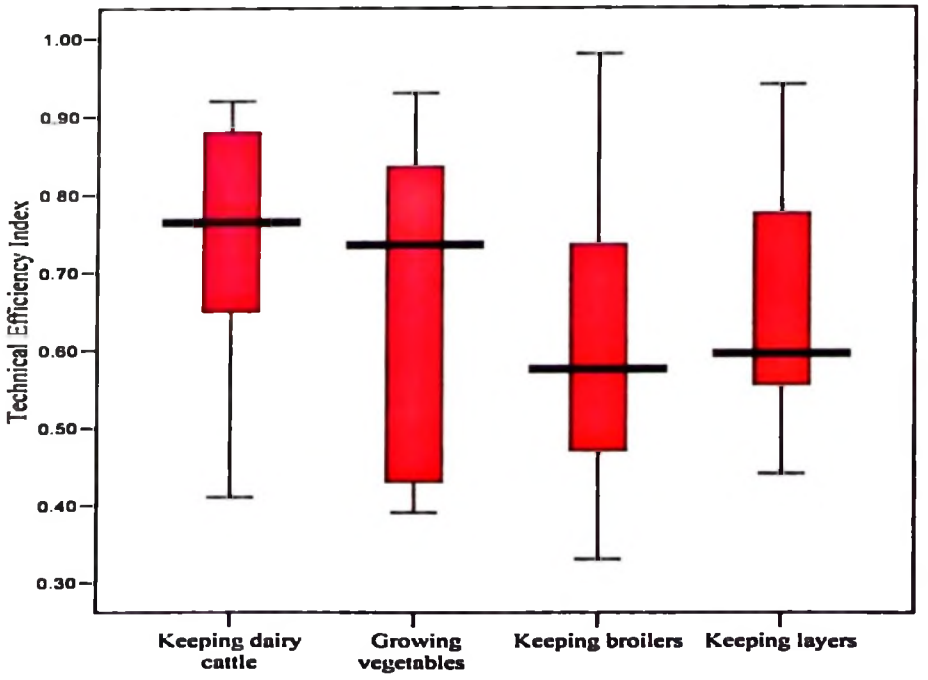


Figure 12: Mean TEI of UA in AMC by UA enterprises

In AMC, a maximum TEI of 0.92 was found for respondents keeping dairy cattle in low-density areas, while a TEI of 0.78 was found in low-density areas for those keeping three to six dairy cows (Table 15, Fig. 12). In AMC, keeping layers ranked second with a mean TEI of 0.66 and TEI ranged from a minimum of 0.44 in medium-density areas for respondents keeping 300 layers to a maximum of 0.94 in low-density areas for those keeping 400 to 600 layers (Table 15, Fig. 12).

Table 15: TEI of UA enterprises by area density and UA units in AMC

UA enterprise	TEI	Area density	UA units
Keeping dairy cattle			
Maximum	0.92	Low	5 dairy cows
Mean	0.74	Low	5 dairy cows
Minimum	0.41	High	1 dairy cow
Keeping broilers			
Maximum	0.98	Medium	300 broilers
Mean	0.62	Medium	400-600 broilers
Minimum	0.33	Low	400-600 broilers
Keeping layers			
Maximum	0.94	Low	400-600 layers
Mean	0.66	Low	400-600 layers
Minimum	0.44	Medium	300 layers
Growing vegetable			
Maximum	0.93	High	100 square meters
Mean	0.64	High	21-50 square meters
Minimum	0.39	Low	100 square meters

Growing vegetables in AMC ranked third with mean TEI of 0.64. The individual DMU ranged from a minimum TEI of 0.39 in low-density areas for respondents growing vegetables on plot size of 100 square meters to a maximum of 0.93 in high-density areas on vegetable plots of 100 square meters. The observed difference in TEI was probably due to the fact that respondents in low-density areas in AMC had other crops like banana that competed for water and space with vegetables. Similarly, high integration of UA enterprises in low-density areas in AMC created more competition for water use, hence lowering the TEI for growing vegetable (Fig. 13).

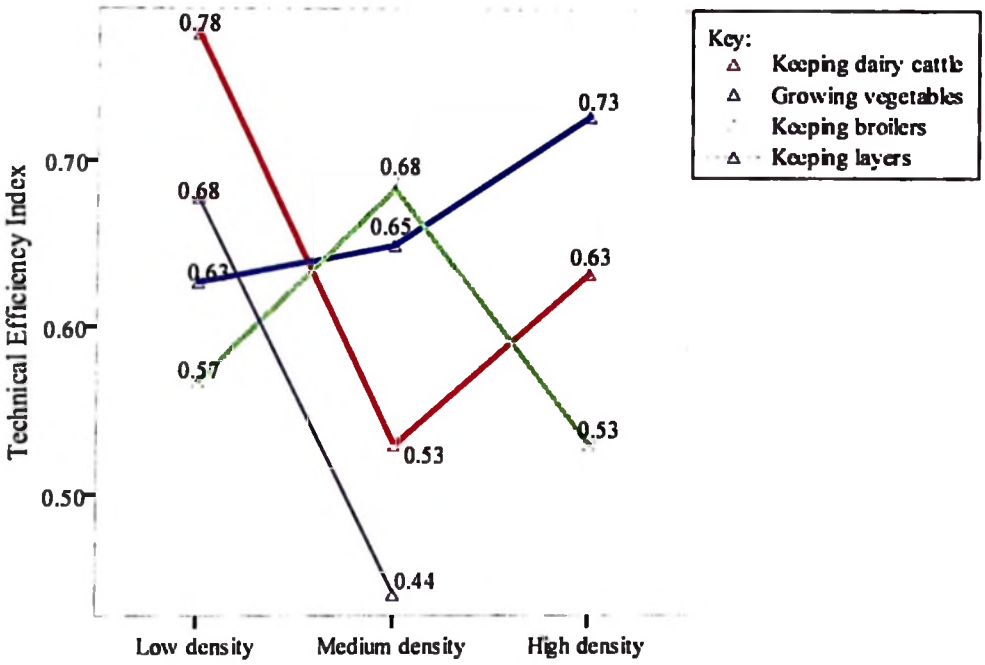


Figure 13: UA TEI by area density and UA enterprises in AMC

In AMC, respondents keeping broilers recorded the lowest mean TEI of 0.62 with a minimum TEI of 0.33 in low-density areas for those keeping 400 to 600 broilers. A maximum TEI of 0.98 was found in medium-density areas for respondents keeping 300 broilers at a time. In AMC, a combination of UA enterprises was found to be intensive in low-density areas and none in high-density areas (Fig. 13). Further, data revealed that a TEI of 0.66 was obtained by UA respondents who combined the keeping broilers and growing vegetables in medium-density areas. This was followed by TEI of 0.64 for those who combined the keeping dairy cows and growing vegetables or dairy cows and broilers at a time in low-density areas. In AMC, lower TEI of 0.61 and 0.58 were found for respondents keeping a combination of 300 layers and 300 broilers in low-density areas, and for those keeping dairy cows and broilers in high-density areas (Fig. 13). Further examination of data revealed that optimal TEI per UA unit in AMC was found to be 0.68 in low-density areas for respondents keeping 400 to 600 broilers at a time (Fig. 14).

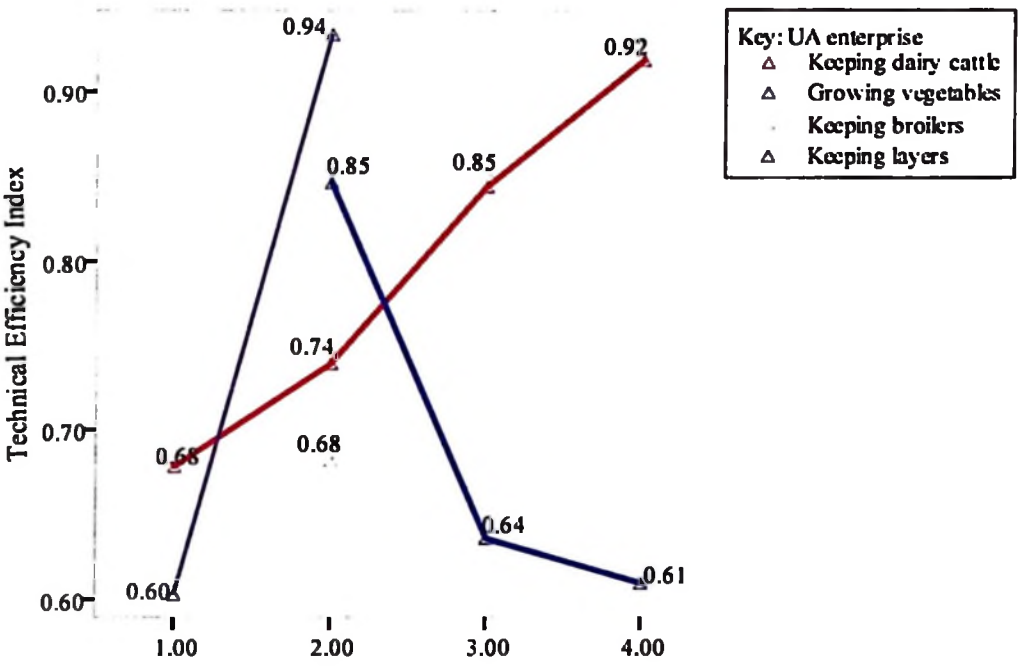


Figure 14: UA TEI by UA enterprises and UA units in AMC

In AMC, a maximum TEI of 0.94 was found for UA respondents keeping 400 to 600 layers at a time in low-density areas, while a TEI of 0.92 of was obtained by respondents keeping five dairy cows in low-density areas. In AMC, TEI for UA respondents keeping layers, broilers and dairy cows decreased drastically in medium-density areas with decreasing UA units, while TEI for growing vegetables decreased with increasing plot density. The observed lower TEI for respondents keeping layers and broilers could probably be due to poor markets for eggs and broiler meat. Also, in AMC, consumers seemed to prefer local chicken meat and eggs than of improved ones. Smaller plot sizes found in high and medium-density areas of AMC seemed to limit UA units. AMC has a developed tourist industry which offers good markets for products such as milk, broiler meat and eggs.

4.10.2.5 Overall TEI of UA enterprises

The overall TEI of UA enterprises for the three municipalities are presented in Fig. 15, which show that the overall mean TEI of 0.77 was found for respondents keeping dairy cattle and ranked first. For this enterprise TEI ranged from 0.41 to a maximum of 0.98. Keeping layers in the three municipalities ranked second with an overall mean TEI of 0.78, which ranged from a minimum TEI of 0.44 to a maximum TEI of 0.96. Overall mean TEI for UA respondents keeping broilers was 0.73 and ranked third with individual DMU ranging from a minimum of 0.33 to a maximum TEI of 1.00. Growing vegetables had an overall mean TEI of 0.66 and individual DMU ranged from a minimum TEI of 0.31 to a maximum TEI of 1.00 (Fig. 15).

TEI for different UA enterprises by area densities and UA units presented in Table 16 and Fig. 16 shows that overall mean TEI of 0.77 was found for respondents keeping dairy cattle for UA respondents keeping two UA units in medium-density areas with a maximum TEI of 0.85 for those who kept three UA units in high-density areas.

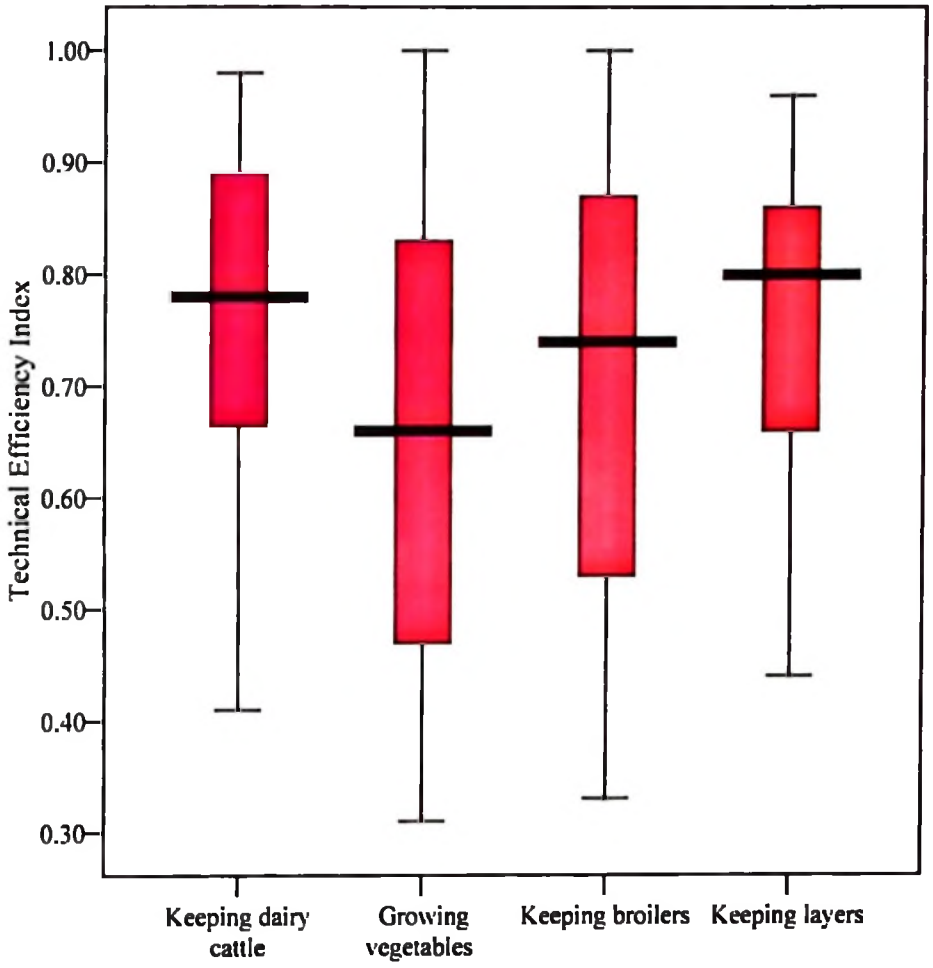


Figure 15: Overall mean TEI in three municipalities by UA enterprises

However, in DMC the mean TEI of 0.82 for respondents keeping two to three UA units of dairy cattle in medium-density and a maximum TEI of 0.98 for those keeping three UA units in low-density areas were found to be above the other two municipalities of KMC with a mean TEI of 0.75 for those keeping two to three UA units and a maximum TEI of 0.92 for those who kept three UA units in medium-density area and AMC with a mean TEI of 0.74 for those keeping four UA units in low-density areas and a maximum TEI of 0.92 for those keeping two to three UA units in low-and-medium-density areas (Table 16). The probable reasons for this could be due to lack of forage, which seemed to be scarce in KMC and AMC. Observations showed that there were few UA respondents

in DMC keeping dairy cows compared to those in KMC and AMC. Also, high costs of feeds like concentrates and transportation costs of forages from the outskirts of KMC and AMC was a problem that impacted on the overall TEI of keeping dairy cattle.

The overall mean TEI for UA respondents keeping broilers was found to be 0.69 by keeping two broiler UA units and reached a maximum TEI of 0.9 for those who raised two UA units of broilers in low-density and high-density areas, respectively. The mean TEI of 0.83 by keeping two broiler UA units in KMC was found to be above the other two municipalities of DMC and AMC with mean TEI of 0.65 and 0.62 for UA respondents who kept two broiler UA units, respectively (Table 16). The probable reasons on lower TEI for UA respondents keeping broilers in AMC could be due to high preferences placed on local chicken consumption that lowered the market for broilers.

Overall mean TEI for UA respondents keeping layers was found to be 0.76 by keeping two UA layer units in low density-area while the maximum TEI for UA respondents keeping layers was found to be 0.90 by keeping two UA layer units in either medium-and-high-density areas. UA respondents keeping layers in KMC experienced a mean TEI of 0.84, and those in DMC a mean TEI of 0.77, and all the two municipalities were above the overall mean TEI of 0.76, however, that for AMC was 0.66 and was found to be below the overall mean TEI for keeping layers (Table 16).

In KMC, a mean TEI of 0.84 for UA respondents is keeping two UA layer units in low-density area and again a mean of 0.83 for UA respondents keeping two UA broiler units in low-and-high-density areas were far above the overall mean TEI and mean TEI obtained in DMC and AMC for the two UA enterprises. That is, in DMC, a mean TEI of 0.77 for respondents keeping layers and 0.65 for those keeping broilers ranked second,

while in AMC it was lower, 0.66 and 0.62 for respondents keeping layers and broilers, respectively. These high TEI in KMC could probably be attributed to readily available markets for eggs and chicken meat at Dar es Salaam city. Urban dwellers in KMC and other dwellers in the Dar es Salaam city ate fried chicken and/or eggs with fried chips.

Growing of vegetables had an overall mean TEI of 0.66 for UA respondents growing two UA vegetable units in medium density area to a maximum TEI of 0.90 for UA respondents growing two UA vegetable units in low-density areas. In KMC respondents growing vegetables had a mean TEI of 0.67 by growing two UA vegetable units in medium-density area and a maximum TEI of 1.00 for UA respondents growing two UA vegetable units in low-density area were found to be above the other two municipalities - DMC was 0.65 to a maximum TEI of 0.94 for UA respondents growing two and three UA vegetable units in medium-density areas, respectively and AMC was 0.64 to a maximum TEI of 0.93 for UA respondents growing two and three UA vegetable units in high-density areas, respectively (Table 16, Fig, 16).

Table 16: Overall TEI of UA enterprises in the three municipalities

UA enterprise and municipality	TEI by UA units and area density					
	Mean TEI	UA units	Plot density	Max. TEI	UA units	Plot density
Keeping dairy cattle						
KMC	0.75	Two to three	Medium	0.92	Four	Medium
AMC	0.74	Four	Low	0.92	Two to three	Low/medium
DMC	0.82	Two to three	Medium	0.98	Three	Low
Overall mean	0.77	Two	medium	0.85	Three	High
Keeping broilers						
KMC	0.83	Two	Low/High	1.00	Two	Low/high
AMC	0.62	Two	Medium	0.98	One	Medium
DMC	0.65	Two	Medium	1.00	Two	Medium
Overall mean	0.69	Two	Low	0.90	Two	High
Keeping layers						
KMC	0.84	Two	Low	0.96	Four	Medium/high
AMC	0.66	Two	Low	0.94	Two	Low
DMC	0.77	Two	Medium	0.90	Two	Low
Overall mean	0.76	Three	High	0.96	Four	Medium
Growing vegetables						
KMC	0.67	Two	Medium	1.00	Two	Low
AMC	0.64	Two	High	0.93	Three	High
DMC	0.65	Two	Medium	0.94	Three	Medium
Overall mean	0.66	Two	Medium	0.90	Two	Low

NB: For UA units refer to descriptions on page 108.

Generally, growing vegetables in an urban setting showed the lowest TEI in all the three municipalities and this could probably be due to small plot sizes that respondents used that did not warrant high investments. Also, small plot sizes seemed to limit respondents from growing combinations of vegetables that could fetch higher prices. Still, growing vegetables in urban areas competed with cheaper vegetables brought in from urban peripheries or up country destinations. Results of TEI have shown in Table 16 and Fig. 16 that most UA respondents could obtain mean and maximum TEI for the various UA enterprises by not exceeding three UA units. Respondents in high-density areas could be more efficient if they make rational decisions of either reducing the number of UA units or selecting UA enterprises that have high TEI. For example, they keep 700 to 1000 or 400 to 600 broilers with a TEI of 0.88 to 0.90, respectively, or keep 1000 layers to attain TEI of 0.78 to 0.79, or grow vegetables on a plot not exceeding 50 square meters to attain a TEI of 0.86. Also, they could keep two to three dairy cows to attain a TEI of 0.85.

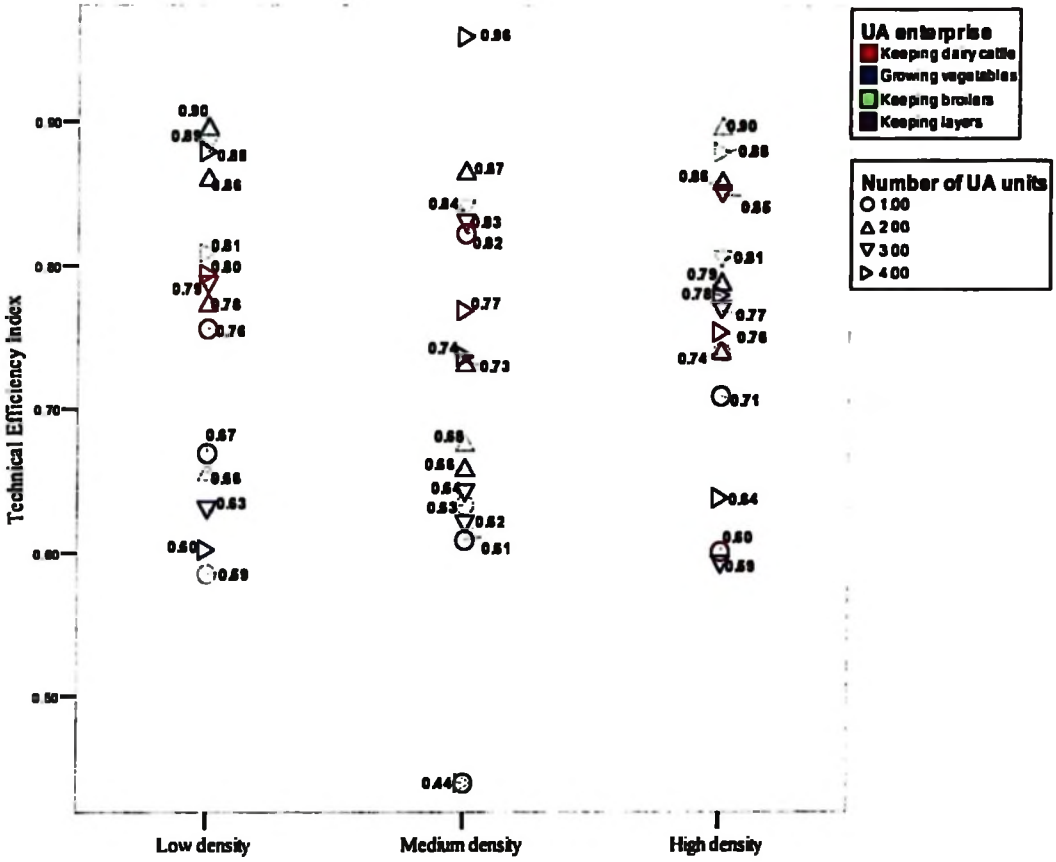


Figure 16: Overall TEI by area density and UA units

The overall mean TEI of 0.72 of the studied UA enterprises indicated that a chance for improving UA technical efficiencies was only 28% to reach a maximum TEI of 1.00. Respondents who kept layers and dairy cattle showed minimum TEI inefficiency indices of 0.24 and 0.23, respectively. A mean TEI of 0.69 was found for respondents keeping broilers. This finding is similar to that of Udoh and Etim (2009) in Uyo, Akwa, Ibom State, Nigeria who found that a mean TEI of 0.62 was attained in broiler production.

This study, therefore, shows that UA enterprises are viable and can be accommodated in all municipalities and across the three plot densities. The study found that growing vegetables registered a low TEI probably due to it being done on small plots, most of

which were not owned by the respondents. Here, respondents did minimal investments, especially use of organic manure. Animal-based UA enterprises showed high TEIs probably due to being adequately supplied with inputs (medications, concentrate feed) available in the city stores. For example, enterprises like keeping of layers and broilers required little space, and with minimal improvement on environmental issues, could be found in low-and medium-density areas. This study showed that UA enterprises can be undertaken within cities either individually or in a combination if they were well regulated and controlled.

4.10.2.6 Respondents overall distribution of TEI

TEI classes for respondents are shown in Table 17, and 16.3 percent of the respondents had their TEI less than 0.5, while 24.4 percent registered TEI that ranged from 0.5 to 0.7. The remaining 59.3 percent of the respondents operated their UA practices that had TEI above 0.70. Idiong (2007) reported similar results in River State, Nigeria and Ebong *et al.* (2009) in Uyo metropolis, Nigeria who found a mean TEI of 0.77 and 0.81 in small-scale farm and UA, respectively. Generally, UA TEI observed in the three municipalities were high as most (83.7%) of the respondents operated above a TEI of 0.5. Based on the overall mean TEI of 0.72 for UA, it is plausible that UA farmers in the studied municipality to increase production by 28 percent if they adopted improved production technologies, such as composting to improve manure disposal, waste water treatment, planting high yielding varieties of vegetables, and use of UALEAs.

production. A negative sign of a regression coefficient implied that the variable reduced the technical inefficiency of UA enterprise (increased TEI); while a positive sign implied that the variable increased the technical inefficiency of UA enterprise (reduced TEI). Regression results in Table 18 show that most of the coefficients included in the model with the exception of the number of years an UA respondent had practiced UA had the expected negative signs.

The regression coefficient for the number of years that a respondent undertook UA was found to be positive, which suggested that, the more the years one undertook UA enterprises the higher was the inefficiency, that is, reduced TEI. A plausible explanation to this could be that once one adopted UA technologies and used them for a prolonged period of time, she/he felt an expert and did not want to seek for new developed technologies. Observations showed that respondents who had undertaken UA enterprises for many years did not consult UALEAs for advice. For example, they made own feed, treated livestock, applied fertilizers, etc. Generally, one would expect that, respondents who had undertaken UA for many years would have gained experience through learning by doing and seek for advice from UALEAs. But instead, these individuals avoided UALEAs because of the charges to advice. In many cases this has a negative effect on their TEI. However, these results disagrees with those of Amos *et al.* (2004) in Savannah zone of Nigeria and Ogunyinka and Ajibefun (2004) in Ondo State, Nigeria, who found that long experience in farming led to improvement in TEI of the small scale rain-fed rice farmers.

The predicted coefficient of respondents' education background was negative and not statistically significant at $p \leq 0.05$. This indicated that respondents with more years of formal schooling tended to undertake more technically efficient UA. These results are

comparable to those of Amaza and Maurice (2005) in Adamawa State, Nigeria and Ajibefun and Aderinola (2003) in South-Western Nigeria, who found that the number of years of formal schooling of a farmer had a positive influence on increasing TEI. Similarly, respondents who had access to knowledge and skills either from government-employed UALEAs or private ones increased their TEI as shown by the negative sign of the variable and was statistically significantly different at p= 0.05 (Table 18).

Table 18: Tobit regression estimates for inefficiency UA

Variable	Parameters	Coefficient	Std error	t-value
Constant	δ_0	0.458	0.535	0.856
Sex	δ_1	-0.522	0.335	-0.156ns
Education	δ_2	-0.272	0.282	-1.965ns
Farming experience	δ_3	0.163	0.161	0.101ns
Extension service	δ_4	-0.517	0.383	-2.135**
Access to credit	δ_5	0.661	0.429	0.154ns
Area density	δ_6	-0.691	0.261	-0.264ns

Note: **= Statistically significant at p=0.05

The coefficient of sex of the respondent was negative and this implied that women enterprise managers were found to be more effective in managing UA enterprises, which partly explained their dominance in UA enterprises in the study municipalities. The coefficient of area of density was negative, implying that UA enterprises conducted in low-density areas were likely to achieve higher TEI than those in medium-and high-density areas. In this case in our study, for example, the maximum TEI of 0.98 in keeping dairy cattle that was found in DMC, and a TEI of 1.00 for keeping broilers and growing vegetables found in KMC were obtained in low-density areas. That is, availability of more space in low-density areas give room for increased expansion and more efficient resource allocation and use for UA enterprises, and hence improved TEI. However, the coefficient for area density was not statistically significant at $p \leq 0.05$ (Table 18). Data in Table 18 also show that the predicted coefficient on credit provision or its access had a

Table 19: T-test results on influence of municipal by-laws on number of UA units and TEI levels

Variable	Mean TEI	df	F-value	Significance level
Recognizing UA as legal				
Low UA units	0.49	268	6.718	0.035
High UA units	0.61			
Presence of defined norms on UA				
Low UA units	1.33	268	52.24	0.015
High UA units	0.92			
Municipal authorities support of UA				
Low UA units	0.04	268	7.46	0.011
High UA units	0.02			
Allowance on accessing productive vacant plots for UA				
Low UA units	0.09	268	107.28	0.02
High UA units	0.32			
Types of by-laws set for UA				
Low UA units	2.85	74	3.04	0.127
High UA units	2.62			

Ho_2:There is no statistically significant difference of the influence of the respondent's socio-economic status on UA technical efficiency levels of UA enterprises and decision making on the number of UA units to undertake in the three plot density areas (low, medium, high) in the three municipalities.

To establish whether there was any significant difference in TEI levels as influenced by socio-economic status of respondents, one-way ANOVA was employed to answer questions if the observed TEI levels were a result of the differences in socio-economic status of individuals residing in the three density areas (see Table 20). The sum of squares was computed by considering interaction with the number of UA units one undertook and the area density. The socio-economic factors considered were sex, ethnicity, age, marital status, years of experience in UA and education level of the respondent. Age was categorized as old (above 40 years) and young age (below 40 years); marital status as whether married or not; ethnicity if ethnic or not; Education if one had attained at most a primary education or had post primary education, and years of

experience in UA were grouped into three as those with low experience (less than 5 years), medium experienced (5 to 10 years) and long experienced (more than 10 years).

However, the Null hypothesis was rejected as age of the respondents, years of experience on had in UA and education backgrounds of respondents highly influenced the TEI levels and decision on number of UA units in the three density areas and were statistically significant at P= 0.005, 0.025 and 0.035, respectively.

Table 20: ANOVA results on differences in TEI by respondents social characteristics

Variable	Sum of Squares	df	Mean square	F-value	Significance level
Sex of the respondent					
Between groups	0.03	1	0.031	0.99	0.32ns
Within groups	8.46	268	0.032		
Total	8.49	269			
Ethnicity of the respondent					
Between groups	0.02	1	0.02	0.57	0.45ns
Within groups	8.47	268	0.032		
Total	8.49	269			
Age of the respondent					
Between groups	0.17	1	0.17	5.57	0.005
Within groups	8.32	268			
Total	8.49	269			
Years of experience in UA					
Between groups	0.61	2	0.30	10.28	0.025
Within groups	7.88	267	0.30		
Total	8.49	269			
Marital status of the respondent					
Between groups	0.01	1	0.01	0.12	0.73ns
Within groups	8.48	268			
Total	8.49	269			
Education level of the respondent					
Between groups	0.15	1	0.15	4.64	0.035
Within groups	8.34	268			
Total	8.49	269			

Ho_3: There is no statistically significant difference of the influence of agriculture extension provision on UA technical efficiency levels of UA enterprises and decision making on the number of UA unit to undertake in the three plot density areas (low, medium, and high) in the three municipalities.

Again ANOVA was used to determine if there were statistically significant differences in TEI levels of UA enterprises as influenced by extension services provision and the number of UA units one undertook in the three density areas. Extension services under consideration included if one got UA extension services; if one received training in ecologically friendly production techniques, training in accessing markets and if one got all the necessary advisory services required in UA production and marketing chain and if one got all the necessary required inputs in UA production. The results in Table 21 reject the Null hypothesis as some of the elements considered under extension service provision in UA highly influence the TEI level and the number of UA units in the three density areas. That is, lack of extension services in UA, lack of training in ecologically friendly techniques and lack of necessary inputs required in UA production highly impacted on TEI levels and on number of UA units one undertook and were found to be statistically significantly different at $p= 0.015$, 0.045 and 0.025, respectively. However, lack of training in accessing markets and lack of training in accessing credits had little influence on TEI levels and number of UA units one undertook and were not found to be statistically significantly different at $p< 0.05$ (see Table 21).

Table 21: ANOVA results on influence of extension services in UA on UA units and TEI levels

Variable	Sum of Squares	df	Mean square	F-value	Significance level
Availability of UA extension services					
Between groups	0.45	1	0.45	14.99	0.015
Within groups	8.04	268	0.03		
Total	8.49	269			
Training in ecologically friendly UA					
Between groups	0.09	1	0.09	3.09	0.045
Within groups	8.40	268	0.31		
Total	8.49	269			
Training in accessing markets for UA					
Between groups	0.004	1	0.004	0.117	0.73ns
Within groups	8.405	267	0.031		
Total	8.410	268			
Availability of inputs for UA					
Between groups	0.22	1	0.22	7.10	0.025
Within groups	8.27	268	0.03		
Total	8.49	269			
Training in accessing credits for UA					
Between groups	0.001	1	0.001	0.025	0.875ns
Within groups	8.409	268	0.031		
Total	8.410	269			

Ho_4: There is no statistically significant difference of UA technical efficiency levels of UA enterprises undertaken in the three plot density areas (low, medium, high) in the three municipalities.

A T-test was used to verify if the TEI levels of UA were significantly different for UA undertaken in different three density areas and with different UA units. However, results in Table 22 show that the differences observed in UA TEI levels were not due to undertaking UA in different density areas and the TEI levels were not statistically significantly different at $p<0.05$. Therefore, the Null hypothesis is accepted that UA could be undertaken equally efficient and bear good return in all density areas within city.

Table 22: T-test results on influence of density area and number of UA units and TEI levels

Variable	Mean TEI	df	F-value	Significance level
Low density area				
Low UA units	0.73			
High UA units	0.68			
Medium density area		268	0.01	0.92ns
Low UA units	0.71			
High UA units	0.73			
High density area				
Low UA units	0.75			
High UA units	0.69			

4.10.5 Implications for urban agriculture and livestock extension services

In Tanzania and many other developing countries, UA is becoming increasingly important, as urban demand for animal and crop products is continuously rising. The different statistics revealed in this study and information from various literatures documented on continued tendency of many urban dwellers practicing UA of different forms and expansion of UA with increasing urbanization demonstrates the increasing significance of this sub-sector, and it plays central function in the existence of a range of sectors of the urban inhabitants. Such functions as outlined earlier in literature review and revealed by information reported in this study embrace:

- Employment and income to unemployed or low income urban poor families
- Additional earnings to the employed, poorly paid, low and middle class urban dwellers
- Contributions to food security of urban households that cannot manage to pay for all of their food needs

- On a more global basis, UA narrows the gap between food command in the municipality and supply from rural areas where production is declining, and where marketing and distribution are inefficient because of inadequate infrastructure

- UA is a source of commercial and economic activity for those who can invest in intensive UA like poultry and milk production to accommodate to the particular demands of the city dwellers.

From the facts evidenced by this study it implies a great need to reshape the traditional extension service provision which looked into farming as a rural undertaking to a new and a more focused urban agriculture and livestock extension service provision system. The provision of agricultural extension services that we are used to, normally comes under one of three main categories: Services funded and provided by the private sector; Services funded by the public sector; and Information and advice - both formal and informal - operating on a farmer-to-farmer basis, sometimes with the support of NGOs. The extension services provided by private sector has predominantly been linked to commercial crops grown in well integrated areas and so is not likely to be of direct relevance to low-income producers (though it may benefit the poor as customers or labourers); the extension services funded by public has generally been characterized by top-down delivery modes of operation and focused to rural settings and hence contradicts with urban integrated system setting. In some cases it has been restrictive to UA as it has been advocating technologies which are generally applicable on large areas found mainly in rural setting ad hence making the technologies too high-risk to be taken up widely by the urban poor. Traditional agricultural extension services have been developed around large scale crop and livestock production, and remain tied largely to the seasonal nature.

Such a system is less useful for UA production, with a longer time-scale and ever changing challenges that are faced by UA farmers.

In spite of the mounting significance of UA, urban agriculture and livestock production extension is a field neglected both by policy-makers and by researchers. The importance of UA to household wellbeing and food supply to meet urban food needs is still under-recognized in many developing countries. But UA extension faces the additional institutional problem of being marginal to both agricultural extension and animal health services.

The final approach of information and advice usually adopted by most UA farmers, though often relevant to UA low-income producers, tends to be both limited in scope and difficult to expand in the absence of local support organizations such as NGOs, and municipalities and requires an integrated approach and set up to fit in different urban land use systems.

Therefore, for urban agriculture and livestock extension services to be relevant to the needs of UA farmers, it will have to address mainly the two broad objectives: pro-poor growth; and vulnerability reduction. The emphasis and blending of one or other of these broad objectives will have to vary mainly based on the opportunities and constraints facing the UA farmers in different areas. An emphasis on pro-poor growth will be most effective in the relatively well integrated, commercial areas for UA enterprises with higher TEI. On the other hand, vulnerability reduction though a priority objective for marginal areas, but there is likely to be some potential for pro-poor growth.

Since governments are unlikely to start creating new institutions, or funding new services, to deliver extension services to UA farmers, the growing need for urban

agriculture and livestock extension service provision must be met by reforms of existing institutions and services to incorporate changes that will address challenges faced by UA. In all settings, participatory assessment of producers' information needs is essential before institutional forms are decided upon. There is a continuing role for the government in providing urban agriculture and livestock extension services, especially to poorer UA producers, and in areas where there are significant positive externalities with environmental implications.

CHAPTER FIVE

5.0 CONCULUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The following conclusions were drawn from this study;

- UA is practiced across all density areas and different urban dwellers of varying socio-economic status are practicing it.
- UA is practiced under different systems and economics guided UA practices in terms of choice and expansion
- Generally, UA is a profitable undertaking although doers were confronted by marketing problems
- Municipalities recognized and legalized UA, however bylaws set were municipal specific
- Extension services provision for UA is inadequate and limited
- Overall mean TEI was 0.72 and an overall mean TEI of 0.77 was found in UA respondents keeping dairy cows, TEI of 0.76 (keeping layers), a TEI of 0.76 for(keeping broilers) and 0.66 for (growing vegetables)
- Combining different UA activities it was found to be relatively possible and profitable to undertake UA in low-medium density areas, and taken singly in high density areas

5.2 Recommendations

Based on the conclusions drawn from the findings, recommendations for enhancing UA should aim at investing in combinations of strategies to: (a) revisit the set municipal bylaws for regulating and controlling UA enterprises in Tanzania towns/cities; (b) revamp a sound agricultural extension delivery system for UA; (c) Improving UA support

services delivery for promoting uptake of innovations by UA farmers. To achieve these, the study recommends intervention in the following areas.

5.2.1 Recommendations on revisiting municipal bylaws set for regulating and controlling UA

In most cases UA has been doubtfully considered by municipal authorities as an active useful activity that can help ensure food security and decrease urban poverty. Master plans for Tanzanian cities have designated UA zones, recreational areas and green belts but municipal authorities seem not to abide to the set plans and reducing capability to execute them like failure to enforce zoning regulations, prohibit areas not designated for UA, as a result areas such as open spaces that were designated for playgrounds have been encroached upon.

Bylaws set for regulating and controlling UA enterprises are different between municipalities and have been developed without scientific or analytical backing. A number of problems have resulted from uncontrolled grazing of animals in open spaces and unguided crop farming. Another part of concern is that while the Harare Declaration on UA requires municipalities to promote UA enterprises, section 80 of the Local Government (Urban authorities) Act No. 8 of 1982 of Tanzania empowers towns and municipal authorities to destroy crops grown which are a metre or more in height. Therefore, this study recommends the following:

1. Municipal authorities should revisit HD-UA and develop policy guidelines on UA with positive attitude on UA to avoid bylaws on UA being improperly enforced and worsening the economic status of urban dwellers who undertake UA.

2. All UA enterprises TEI should be determined and be used as base for setting sizes and scales of UA enterprises in different density areas.
3. Now empirically evident that UA TEI is relatively high in low to medium density and declines as one move in high density area- it is high time areas within cities/towns are zoned and protected to accommodate UA practices and avoid further reduction on plot sizes. This study shows TEI decreases with decreasing plot sizes.
4. Municipal authorities should make sure the bylaws developed for regulating and controlling UA enterprises are documented, made public and enforced to the book.
5. Municipal authorities should enforce bylaws on proper handling, use and disposal of organic wastes to avoid environmental pollution.
6. Municipal authorities should promote recycling urban wastes into productive UA products.
7. Municipal authorities should educate urban policy makers through seminars to change their negative mindset toward UA and include it in urban land use systems.
8. Urban authorities should set UA demonstration plots placed near locations where UA is undertaken for introducing and promoting UA innovations
9. Municipal authorities should promote urban farmer groups , networks and UA associations at city level as target groups in UA education activities and as an essential step to promote sustainable UA

5.2.2 Recommendations on revamping extension delivery system for UA

Urban farmers rarely benefit from urban agricultural extension services due to their availability and accessibility as sometimes extension service provision is biased making

poorer UA farmers unable to afford some of the recommended technologies. Although the UALEAs and their offices are situated in cities/towns, they are hardly accessible for offering advisory services to UA farmers. Again, advisory services offered are inadequate due to the nature of training they went through which may leave important elements in the whole UA production chain. It is therefore recommended that:

(a) The ministries concerned (Ministry of Livestock Development and Fisheries and Ministry of Agriculture and Food Security) should retool UALEAs through short courses and seminars.

(b) UALEAs should organize UA in every area/neighbourhood and offer specific training. For example, it is imperative for the UALEAs in KMC to educate UA farmers on number of UA units they should abide to for improving their TEI in the different UA enterprises and imparting skills and knowledge that will allow intensive production. Given the small plot sizes found in cities one should undertake UA with minimal number of UA units to match with the resources found in cities.

(c) UALEAs should develop extension packages based on empirical evidence on TEI for the different UA enterprises. For example, with lower TEI in keeping layers and broilers in AMC, UALEAs can train UA farmers to keep local chicken or cross-bred chicken so that they can capture the market of local chicken meat and eggs. In AMC, UALEAs should advise UA farmers to keep dairy cows in low-density areas were there are more resources like forage and can obtain maximum TEI.

(d) For the purpose of changing mind sets of different stakeholders and graduates, aspects related to UA should be introduced and taught in the curricula of agriculture, environment and urban land planning.

(e) Universities and research institutions should direct their teaching on applied research activities towards addressing the problems of UA. They should participate effectively in the formation of instructive materials that will be used in the training of UA farmers.

(f) UALEAs should turn their focus and train UA farmers on proper handling of manure by introducing composting systems to reduce foul smell and flies in the compound.

(g) UALEAs and land use planners should train UA farmers on preparing alternative water sources like ponds and wells to reduce water scarcity for UA enterprises.

5.2.3. Recommendations on improving support services for UA

Improving support services for UA enterprises requires a thorough understanding of a situation in which UA operates. There are factors that influence one engaging in UA enterprises and factors limiting undertaking UA. A balance sheet between driving forces and restraining forces will help determine ways of diminishing restraining forces for improving UA enterprises in a given locale by using Force Field Analysis tool. Force Field Analysis theory developed by Kurt Lewin (1951) provides a framework for looking at forces that influence a situation. The approach allows breaking down common misconceptions and determining their basic elemental construct. Improvements in support services geared towards reducing opposing forces to UA will help eliminate misconceptions that are held against UA and hence improve UA TEIs. Services for supporting the development of UA are so minimal and sometimes are expensive. A number of constraints for the promotion of UA are described in Fig. 17. Such limiting factors include lack of credits for UA for the poor UA farmers, inability to prevent post-production losses, lack of know-how on UA like composting, container farming, and few agents who supply the necessary UA inputs.

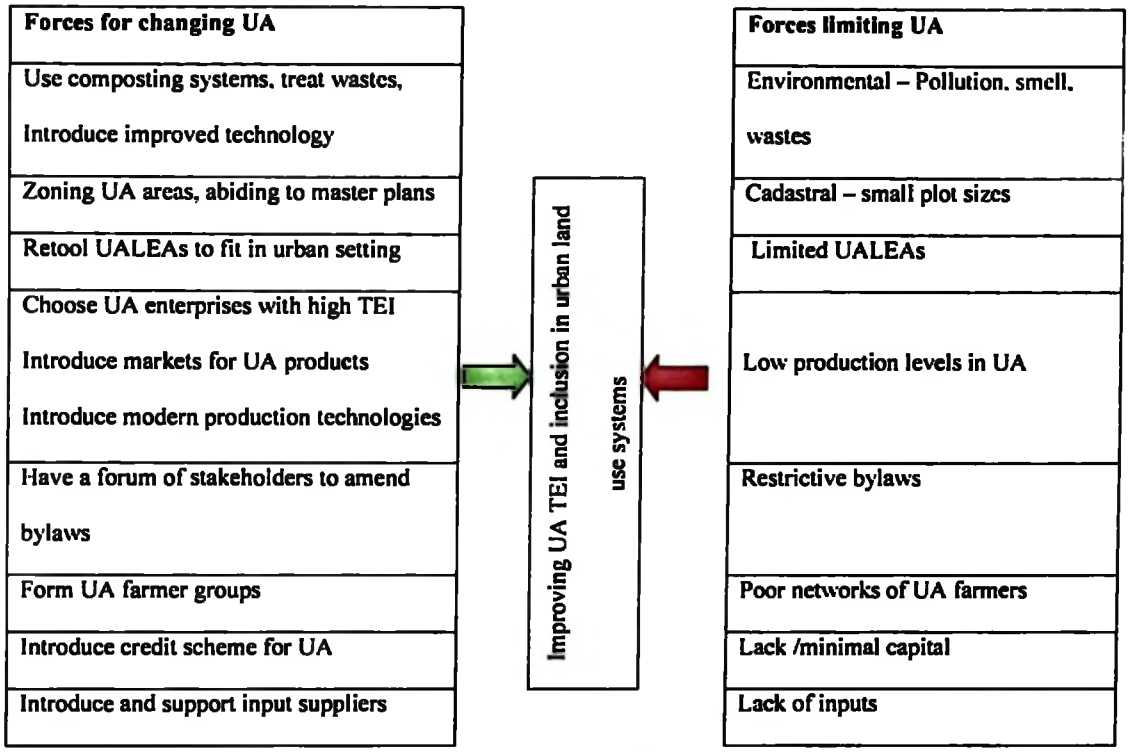


Figure 17: A Force Field Analysis on promoting UA in Tanzanian municipalities

The following are recommended for improvement of support services in UA:

(a) Carryout a thorough market chain analysis of UA products.

(b) Credits for UA should be availed to support UA farmers to conduct UA activities.

(c) UA should be integrated into urban land use planning and linked to solid waste and water waste management.

5.2.4 Recommendations for further Research

The following areas are recommended for further studies to enhance UA in Tanzanian cities.

- Explore profitable innovations for promoting UA in urban setting
- Carryout technical efficiency analysis of all UA practices to ascertain TEI levels and UA units for profitable UA enterprises

- Carryout thorough market analysis of UA products to enhance marketability and explore ways of promoting markets for the same
- Undertake feasibility study on possibility and profitability of undertaking other types of UA enterprises like fish farming in tanks and or concrete ponds

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APPENDICES

Appendix 1: Relating Research objectives and Data sources

Research Questions	Data source
To assess municipal policies/by-laws regulating UA practices (Specific objective 1)	
What are the city/municipal by-laws regulating UA practices?	Literature review and consultation with municipal officials, Household interviews
How effectively are the by-laws enforced?	Consultation with municipal officials, Household interviews
Are there any conflicts in implementing by-laws regulating UA practices? - What are the conflicting by-laws? - How are the conflicts resolved during enforcement?	Consultation with municipal officials, Household interviews
What is the influence of the by-laws on efficiency of UA?	Focus group discussion (FGD)with UA practitioners, household interviews
What plans are set by municipalities in supporting UA? - How to enhance access of vacant land and land tenure security? - Formal acceptance of UA as a legitimate land use system? - Setting up institutional arrangements to foresee urban food production (Like special UA department)?	Consultation with municipal officials, Household interviews, municipal officials interview
To identify socio-economic factors affecting efficiency and choice decision of UA enterprise in the study areas (Specific objective 2)	
Including income, credit facilities, availability of extension services, e.t.c	Household interviews
What is the pattern of the extension service provision to Urban farmers? (Specific objective 3)	
Is there provision for extension services for UA farmers? - How Extension services are provided? - What are the training needs for UA farmers? - In which areas in UA are extension services available? - What are the knowledge gaps in UA production system?	Household interviews; Consultation with municipal officials
What are types of services offered by extension agents to Urban farmers? (In areas of production, processing and marketing)	Household interviews, FGD
How efficient is UA undertaken in the study areas? (Specific objective 4)	
What are the resources required in UA enterprises?	Household interviews
How are the resources obtained?	Household interviews
What is the input-output relationship in UA production?	Household interviews
What are the enabling environments for UA production?	Household interviews
What are the marketing channels for UA produce?	Household interviews
What are the marketing constraints for UA produce?	Household interviews

Appendix 2: The Harare-Declaration on Urban and Peri-Urban Agriculture

The Harare Declaration on Urban and Peri-Urban Agriculture in Eastern and Southern Africa

We, the Ministers responsible for Local Government from Kenya, Malawi, Swaziland, Tanzania and Zimbabwe, at our meeting in Harare on Urban and Peri-urban Agriculture (UPA) in Eastern and Southern Africa organized by the Ministry of Local Government, Public Works and National Housing of the Government of Zimbabwe and the Municipal Development Partnership for Eastern and Southern Africa, in collaboration with UNDP, UNICEF, FAO-SAFR, FANRPAN, RELMA and IDRC held on 28 and 29 August, 2003;

Acknowledging,

The presence of local government practitioners and representatives of non-governmental organizations and community based organizations;

Acknowledging further that:

- UPA is a widely practised activity in and around towns and cities within the region on parcels of land with alternative competing uses;
- UPA has generally been practised informally without appropriate policy, legislative and institutional framework in;
- UPA plays, and will continue to play, a significant role in promoting food security, employment creation and income generation, health and nutrition and improving the economies of urban areas;
- Some governments in the region have made significant progress in incorporating UPA in their urban development plans, and that others are now beginning to rise to the challenge.

Recognizing,

The existence and increasing practice of UPA and also noting the many challenges that it faces, including:

- Absence, inadequacy and/or inconsistency in the policies, legislation and institutional arrangements for regulating the sector
- Limited availability of and access to resources
- Limited research, documentation and information-sharing nationally and regionally
- The need for environmental sustainability

Accepting,

That the foregoing challenges require immediate and prudent reform of policies, legislative and institutional arrangements in order to effectively integrate UPA in our urban economies,

We therefore,

Call for the promotion of a shared vision of UPA that takes into account the specific needs and conditions in the region, and accordingly commit ourselves to developing policies and appropriate instruments that will create an enabling environment for integrating UPA into our urban economies.

Thus done at Harare on 29th Day of August, 2003

Signed: _____
Mlikeli W. Thuru
For the Government of Kenya

Signed: _____
Honourable Henry Mukaya
For the Government of Malawi

Signed: _____
Honourable Mabuza Phinda
For the Government of Swaziland

Signed: _____
Honourable Magesa Pinda
For the Government of Tanzania

Signed: _____
Honourable Ignatius Chombo
For the Government of Zimbabwe

Appendix 3: Questionnaire for researchers (Survey instrument)

TITLE: EFFICIENCY OF URBAN AGRICULTURE IN SELECTED MUNICIPAL CITIES IN TANZANIA: IMPLICATIONS FOR EXTENSION SERVICES

Questions should be addressed to the enterprise manager or owner who should preferably be the respondent

Name of enumerator _____ **Date of interview** _____

A. Household demographic and socio-economic characteristics

A1	Municipal name	1= Arusha, 2= Kinondoni, 3= Dodoma
A2	Area name (Mtaa)	
A3	Are you ethnic or a migrant?	1= Ethnic, 2= Migrant | Tribe:
A4	If a migrant, mention region of origin	
A5	If a migrant, when did you come to this place?	_____(Number of years)
A6	If a migrant, What was the reason for coming to this place?	1= Seeking employment, 2= On official transfer, 3= To attend school, 4= Followed a spouse, 5= Join parents, 6= Others, specify
A7	Area of residence	1= Low density, 2= Medium density, 3= High density 4= Squatter (Unclassified)
A8	Name of the enterprise manager	
A9	Sex of the enterprise manager	1= Male, 2= Female
A10	Age of the enterprise manager	_____(Years), 999 (Do not know/missing)
A11	Education level of the enterprise manager	1=No formal education, 2= Adult education, 3= Finished STD VII, 4= Finished Form II, 5= Finished Form IV, 6= Finished 1st University degree, 7= Finished 2nd University degree
A12	Marital status of the enterprise manager	1= Single, 2= Married, 3= Divorced, 4= Widowed
A13	What is your main UA activity?	1= Dairy farming, 2= Vegetable grower, 3= Keeping broiler chicken, 4= Keeping Layers 5= Keeping local chicken
A14	What other type(s) of urban agriculture enterprise(s) are you engaged in? (excluding the main UA enterprise)	1= Dairy farming, 2= Vegetable grower, 3= Keeping broiler chicken, 4= Keeping Layers, 5= raising local chicken, 6= Growing mushroom, 7= Others, specify
A15	Who in your household is primarily responsible for taking care of the UA enterprise?	1= Husband, 2= Wife, 3= Children, 4= employees, 5= Relatives staying with
A16	Apart from UA, what is your main alternative source of income?	1= Government employment, 2= Self employment, 3= Private company employment, 4= Others, specify
A17	If self employed, what are your current activities?	1= Food vendor, 2= Clothing trader, 3= Wood works, 4= Metal works, 5= Leather trading, 6= Others, specify
A18	What is your total monthly household income?	_____(TShs)
A19	How much of the monthly total household income comes from UA enterprise?	_____(TShs)

B. Urban Agriculture Production

B1	For how many years have you practiced UA activities?	_____ 999= missing/do not know
B2	Have you ever changed type of UA since you started?	1= YES, 2= NO
B3	If changed, what was your previous UA enterprise?	1= Dairy farming, 2= Vegetable grower, 3= Keeping broiler chicken, 4= Keeping Layers, 5= raising local chicken, 6= Growing mushroom, 7= Others, specify_____
B4	What were the reasons for changing your UA enterprise?	1= Lack of capital, 2= Lack of markets, 3= labour shortage, 4= Enterprise not profitable, 5= inputs not available, 6= by-laws restrictions
B5	State the main objectives of your current UA enterprise	1= Selling, 2= Home consumption, 3= Selling and home consumption, 4= Others, specify_____
B6	What is the main reason that prompted you to engage in UA enterprises?	1= Household food security, 2= Income generation, 3= Employment, 4= Utilize the available land, 5= Substitute meagre income from my employment, 6= Culture, 7= Poverty alleviation initiatives, 8= Demand for fresh foods, 9= Responding to market demands in the city, 10= Utilizing extra time available, 11= Others, specify_____
B7	What are the major problems encountered in running UA activities in your area? [*rank in order of priority of 1 to 5*]	1= Land scarcity, 2= Theft, 3= High/many taxes, 4= Restricting by-laws, 5= Higher production costs, 6= Poor market access, 7= Insufficient extension services, 8= Contaminations on production sites, 9= unavailability of required inputs, 10= Low market prices
B8	Did you get credit to start your UA activities?	1= YES, 2= NO
B9	If answered YES in Q. B8 above, where did you get your initial capital to start urban farming?	1=From a credit scheme (NGO/SACCOS?_____). 2= From relatives, 3=From Bank, 4= Others, specify_____
B10	If answered NO in Q. B8 above, how did you obtain capital to start your UA activities?	1= From relatives as an assistance, 2= From own savings, 3= Others, specify_____
B11	Do you own land within the urban area?	1= YES, 2= NO
B12	If answered YES in Q B11 above, how big is the land?	_____(Square metres)
B13	Do you own land outside the urban area?	1= YES, 2= NO
B14	If answered YES in Q B13 above, how big is the land?	_____(Square metres)
B15	Do you own land where you conduct your UA activities?	1= YES, 2= NO
B16	How far is the UA land plot from residential?	_____(Metres)
B17	What is the size of land plot for UA activities?	_____(Square metres)
B18	If answered NO in Q. B15 above, what is the status of land ownership, on which you undertake your UA activities?	1= Rented, 2= Government plot, 3= An open space, 4= Others, specify,_____
B19	What is the level of security on the piece of land where you undertake your urban agriculture activities?	1= High security, 2= Medium security, 3= Low security, 4= insecure
B20	Is there any possibility of accessing/ acquiring extra land within city for urban agriculture?	1= YES, 2= NO

B21	If answered NO in Q.B20above, list problems encountered in acquiring extra land within city for expanding UA activities [*Rank in order of priority 1 to 5*]	1= Land is expensive, 2= Land scarcity, 3= Municipal By-laws restrictions, 4= Environmental limitations, 5= Far from area of residence.
B22	If answered YES in Q.B 20 above, are you planning to expand land for your urban agriculture activities?	1= YES, 2= NO
B23	Is there any possibility of accessing/acquiring extra land outside the city for urban agriculture activities?	1= YES, 2= NO
B24	If answered NO in Q. B23 above, list the problems encountered in accessing/acquiring extra land outside the city for urban agriculture activities [*rank in order of priority 1 to 5*]	1= Land is expensive, 2= Land scarcity, 3= Municipal By-laws restrictions, 4= Environmental limitations, 5= Far from area of residence, 6= Additional expenses in running UA activities (like paying guards)
B25	If answered YES in Q.B20 above, how much land are you planning to acquire for expanding UA activities?	_____ (ha)
B26	Do you think that the current urban agriculture activities have equipped you with enough skills and knowledge to start a commercial operation of agriculture outside the city?	1= YES, 2= NO

C. Performance of Urban Agriculture enterprise

1. Performance of Broiler birds

Indicate performance for the two (2) latest/most recent batches (0= none, 999 = missing)

	Indicator	Batch 1	Batch 2	*Total*	*Average*
C1	No. of DOC bought				
C2	No. at market point				
C3	No. of actual birds marketed				
C4	No. consumed in household				
C5	No. given as gift				
C6	No. stolen/lost				
C7	Number of weeks before birds are sold				
C8	Number of weeks before all birds are sold				
C9	Number of batches per year				
C10	Selling price per bird				
C11	Total income from all sales (to be verified after interview)				

2. Performance of Layers birds

Indicate performance for the two (2) latest/most recent batches (0= none, 999 = missing)

	Indicator	Batch 1	Batch 2	*Total*	*Average*
C1	No. of DOC bought				
C2	No. of birds at laying point				
C3	No. of actual egg trays collected				
C4	No. of egg trays consumed in household				
C5	No. of egg trays given as gift				
C6	No. of egg trays stolen/lost				
C7	Number of weeks before starting egg sales				
C8	Number of weeks for collecting eggs				
C9	Number of batches per year				
C10	Selling price per egg tray				
C11	Total income from all sales (to be verified)				

3. Performance of Dairy cattle

Indicate performance for the two (2) latest/most recent production seasons (0= none, 999 = missing)

	Indicator	Season1	Season2	*Total*	*Average*
C1	No. of Dairy cows reared				
C2	No. of cows in lactation				
C3	No. of actual litres of milk marketed				
C4	No. of litres of milk consumed in household				
C5	No. of litres of milk given as gift				
C6	No. of litres of milk stolen/lost				
C7	Number of weeks before starting selling milk				
C8	Number of weeks before all milk is sold				
C9	Number of cows calving per year				
C10	Selling price per a litre of milk				
C11	Total income from all sales (to be verified)				

4. Performance of vegetable growing

Indicate performance for the two (2) latest/most recent production cycles (0= none, 999 = missing)

	Indicator	Cycle 1	Cycle 2	*Total*	*Average*
C1	No. of seedlings planted				
C2	No. of plants at harvest point				
C3	No. of actual vegetables marketed (kg/bundles)				
C4	No. of bundles consumed in household				
C5	No. of bundles given as gift				
C6	No. of bundles stolen/lost				
C7	No. of weeks before vegetables are sold				
C8	No. of weeks before all vegetables are sold				
C9	Number of production cycles per year				
C10	Selling price per bundle/kg of vegetables				
C11	Total income from all sales (to be verified)				

5. Performance of local/grade chickens/birds – [additional]

Indicate performance for the two (2) latest/most recent batches (0= none, 999 = missing)

	Indicator	Batch 1	Batch 2	*Total*	*Average*
C1	No. of DOC bought				
C2	No. at market point				
C3	No. of actual birds markcted				
C4	No. consumed in household				
C5	No. given as gift				
C6	No. stolen/lost				
C7	Number of weeks before birds are sold				
C8	Number of weeks before all birds are sold				
C9	Number of batches per year				
C10	Selling price per bird				
C11	Total income from all sales (to be verified)				

D. Price variability and marketing conditions

(0= none, 999 = missing)

This information is intended to capture market information of the main UA enterprise only

D1	For the latest/most recent production, what was/is the lowest price for UA unit product you received?	
D2	In which season was the lowest price received?	1= Rainy season, 2= Dry season 9= do not know
D3	In which period was the lowest price received?	1= During shortage 2= high supply 3= all year round
D4	For the latest/most recent production, what was/is the highest price for UA unit product you received?	
D5	In which season was the highest price received?	1= Rainy season, 2= Dry season 9= do not know
D6	In which period was the highest price received?	1= During shortage 2= high supply 3= all year round
D7	What is your main market outlet for your UA produce?	1= Retailers, 2= wholesalers, 3= Individual consumers, 4= vendors, 5= Others, specify

D8	Where do you market your UA product	1= Farm gate, 2= Local market, 3= Central market, 4= Super markets, 5= My own Kiosk, 6= Others, specify
D9	Do you market all the UA produce intended when due?	1= YES, 2= NO
D10	If answered NO in Q. D9 above, what do you do when with the remaining products?	1= Keep for selling next day, 2= Process to prolong shelf life, 3= Throw it away, 4= Give away as gift, 5= Consume at home, 6= Others, specify
D11	Do you face problems in marketing your UA products?	1= YES, 2= NO
D12	If answered YES in Q D11 above, what is the main problem for your UA product?	1= Quality of product, 2= High/many taxes, 3= Packaging, 4= Consumer preference, 5= marketing regulations/by-laws, 6= Others, specify
D13	What challenges do you face during marketing your produce?	1= Competitors in marketing a similar product, 2=High demand of produce than I can supply, 3=Low market prices, 4= High standards of produce required in good markets, 5= failure to meet consumers preferences, 6= Others, specify
D14	How do you determine the selling price of your product?	1= Market demand and supply pattern, 2= Cost of production, 3= Consumer's purchasing powers, 4= Sales history, 5= Seasonality, 6=Others, specify
D15	What is your main source of market information such as price, demand, etc?	1= Traders/buyers, 2= Visiting market centres, 3= Fellow farmers, 4= Extension officers,
D16	Do you produce your UA product on the basis of a pre-arranged contract with traders/buyers?	1= YES, 2= NO
D17	If you have ever sold your produce recently, did you take to the market on typical marketing days?	1= YES, 2= NO
D18	At present, what is the distance to the nearest market for your UA produce?	_____(Km)
D19	Approximately, how much do you pay to transport the UA produce to the market and to come back? (per trip)	_____(Tshs)
D20	How many days per week do you have to transport UA produce to the market?	_____(Days/week)
D21	Does your supply meet the market demands for your product?	1=YES, 2=NO

E. Production technology and input use

E1	What production system do you use?	1= Intensive, 2= Semi-intensive, 3= Free range, 9= Do not know
E2	What type of UA do you raise/grow?	1= Exotic, 2= Local, 9= Do not know
E3	Do you change breed/variety you use over time?	1= YES, 2= NO
E4	Do you keep records for your enterprise?	1= YES, 2= NO
E5	If answered NO in Q. E4 above, give reasons for not keeping records	1= Tedious, 2= I do not know how to do it, 3= It is not necessary, 4= It is costly, 5= Others, specify
E6	If answered YES in Q. E4 above, have you ever received formal training on how to keep record?	1= YES, 2= NO
E7	Apart from record keeping, have you ever received any formal training related to production of your main UA enterprise?	1= YES, 2= NO
E8	If you received training, for how long did it last?	_____(weeks)
E9	If you received training, who conducted the training?	1= NGO, 2= Extension agent, 3= Training Institute, 4= Others, specify

For the recent production of UA product explain the following:		
E10	Do you use commercial inputs for your enterprise? [Like fertilizers, commercial feeds, seeds e.t.c.?	1= YES, 2= NO
E11	Do you use home made inputs for your enterprise? [Like FYM, compost, reserved seeds, home made rations e.t.c.?	1= YES, 2= NO
E12	If you use home made inputs, indicate source of technical know how	1= NGO, 2= Extension agent, 3= Personal initiative, 4= Fellow farmers, 5= Training institution, 6= Others, specify
E13	Do you get all the inputs required in your production cycle?	1= YES, 2= NO
E14	If NO in Q. E 13 above, what is the problem for not getting all the required inputs?	1= Unavailable, 2= Higher prices, 3= Found from distant source, 4= Low capital, 5= Others, specify
E15	Estimate your production cost per season/batch/lactation?	(Tshs) [see attached costing list of each enterprise at the end]
E16	Estimate the total amount spent for seeking technical assistance	(Tshs)

Item	**Unit price (Tshs)**	**Distance from source (Km)**	**Transport cost (Tshs**
Quantity of day Old chicks			
Quantity of Seedlings			
Number of dairy cows			

For the most recent production cycle indicate quantities and prices

F1. Labour resources

Explain the labour resources in household as specified below (if none write "0")		
F1	Number of household members who regularly sleep here	
F2	Number of adults (above 18 years)	
F3	Number of children (< 18 years)	
F4	How many are involved in your main UA enterprise?	
F5	What is the main occupation of head of household?	

Explain current use of labour in most recent production of UA enterprise by major operation for the most recent days

	Activity	**Family labour (Hrs)**	**Gender**	**Hired labour (Hours)**	**(Wage)**
F6	Cleaning of utensils/water troughs/ barn				
F7	Feeding + watering (Morning)				
F8	Feeding + watering(Afternoon)				
F9	Feeding + watering(Evening)				

F10	Milking				
F11	Egg collection				
F12	Slaughtering and dressing birds				
F13	Marketing				
F14	Land preparation				
F15	Sowing				
F16	Weeding				
F17	Application of pesticides				
F18	Harvesting + processing				
F19	Marketing activities				

Labour hours should be expressed as No. of persons X No. of hours per day

For wages in kind estimate the wages in monetary value (if the manager was to use an employee)

Gender indicate who does the task within a family (Father-F; Mother-M; Female child-FC; Male child-MC)

G. Institutional conditions

G1	Do you get extension services?	1= YES, 2=NO
G2	If answered YES in QG1 above, what is the average distance to the extension agent (km)	---------- (km)
G3	Do you get all advisory services required in your production and marketing chain of your UA enterprise?	1= YES. 2= NO
G4	If answered NO in Q G3 above, what services do you lack?	1= production, 2= marketing, 3= promotion. 4=environmental, 5= packaging, 6= others. specify, ----------
G5	If answered YES in Q. G1, what are the supplier of the extension services for UA in your area?	1= public, 2= private, 3= Both 1&2, 4= NGO
G6	Is the UA activity you are undertaking recognized and legal in your area?	1= YES, 2= NO
G7	If answered YES in Q. G6 above, do you get facilitation in accessing credits	1= YES, 2= NO
G8	Are there farmers' markets created for your UA products?	1= YES, 2= NO
G9	Do you have access to existing city markets?	1= YES, 2= NO
G10	Are you linked in anyway to consumer organisations? (like supermarkets, hotels, restaurants)	1= YES, 2= NO
G11	Are you supported in food distribution programmes and value adding techniques? (Like canning, bottling, pickling)	1= YES, 2= NO
G12	Are you facilitated for direct marketing of your products?	1= YES, 2= NO
G13	Do you get training on ecologically friendly UA production?	1= YES, 2= NO
G14	What problems do you face UA enterprise ecologically-friendly?	1= Use of bio-pesticides, 2= use of natural fertilisers, 3= manure disposal, 4= wastewater handling and treatment, 5= Compost production, 6= Others, specify, ...
G15	Do you face competition on resources for UA production like water, land and labour?	1= YES, 2= NO
G16	Do you face resistance from neighbours in	1= YES, 2= NO

	running your UA enterprise?	
G17	What are the reasons for that kind of resistance from your neighbours?	1= Smell, 2= Noises, 3= pollution, 4= Waste disposal, 5= Others, specify
G18	Does the municipal authorities make productive use of vacant land areas by allocating them to UA producers?	1= YES, 2= NO
G19	Does the municipal authorities carryout treatment of wastewater and recycled wastes for supporting UA?	1= YES, 2= NO

H. Environmental and social concerns of UA

H1	Is your UA plot located in an area designated for that purpose by the municipal authorities? (zonification)	1= YES, 2= NO
H2	If answered YES in Q. H1 above, what type of UA production was designed for this zone?	1 dairying, 2= poultry farming, 3= vegetable production, 4= I don't know, 5=.Any UA enterprise
H3	Are you producing according to what was planned for the zone in which you are undertaking your UA enterprise?	1= YES, 2= NO
H4	If answered NO in Q. H3 above, why did you decide to change to another enterprise?	1= Profitability, 2= Marketability, 3= Consumer preference, 4= Neighbourhoods, 5= Environmental safety, 6= Others, specify
H5	Are there defined norms and regulations concerning UA in your area?	1= YES, 2= NO, 3= I don't know
H6	If answered YES in Q. H5 above, which regulations or norms are set to control UA?	1= Type of product to produce, 2= Type of inputs to use, 3= Environmental precautions, 4= Size of enterprise, 5= Neighbourhoods, 6=
H7	Are there promotional campaigns to sensitize UA producers on safe product production?	1= YES, 2= NO
H8	If answered YES in Q. H7 above, which areas are given consideration in promoting safe production in UA?[circle all appropriate)	1= Wastewater treatment, 2= Use of Bio-pesticides, 3= Recycling urban organic waste, 4= Proper disposal of UA production wastes, 5= Ecological farming, 6= Consumer education, 7=Use of wastewater in UA production,
H9	Are there institutions supplying necessary inputs for UA production in your area? (Urban organic wastes, irrigation water, feeds)	1= YES, 2= NO
H10	Which institutions are the main source(s) of your UA inputs?	1=Private, 2= Governmental, 3=NGO, 4=Others, specify----------
H11	Do you have a reliable source of water for your enterprise?	1=YES, 2= NO
H12	What is your main source of water?	1= Tap water, 2=Stream, 3= Furrow, 4= River, 5=wastewater from Household, 6= Wastewater from industries, 7=Others, specify
H13	Do you sometimes use wastewater for your UA activities during shortages?	1=YES, 2= NO
H14	Do you use ecologically-friendly inputs in your UA production? [use of natural fertilizers, bio-pesticides]	1=YES, 2= NO

I. Constraints to UA enterprise production and marketing

I1	Do you have constraints on accessing water for your UA enterprise?	1=YES, 2=NO
I2	Do you have constraints on accessing land for your UA enterprise?	1=YES, 2=NO
I3	Did you get initial capital for your UA enterprise?	1=YES, 2=NO
I4	Do you have access to open space/vacant land plots for your UA enterprise?	1=YES, 2=NO
I5	Do you get trainings on production techniques for your UA enterprise?	1=YES, 2=NO
I6	Do you get trainings on accessing markets for your UA enterprise?	1=YES, 2=NO
I7	Do you get trainings on accessing credits for your UA enterprise?	1=YES, 2=NO
I8	Do you have access to extension service for your UA enterprise?	1=YES, 2=NO
I9	Are you linked to other farmers producing a similar product in UA?	1=YES, 2=NO
I10	Are you linked to other urban farmers producing different UA products?	1=YES, 2=NO
I11	Are you linked to consumer organizations in city markets? [Like supermarkets, hotels, e.t.c.]	1=YES, 2=NO
I12	Are you linked to other consumer organizations [like supplying food to schools, and other food distribution programmes]?	1=YES, 2=NO
I13	Are there farmer markets created for UA products?	1=YES, 2=NO
I14	Do you have constraints on accessing markets for your enterprise?	1=YES, 2=NO
I15	Do you have constraints on accessing credits for your enterprise?	1=YES, 2=NO
I16	Do you have constraints on accessing extension service for your UA enterprise?	1=YES, 2=NO

J. Enterprise assets [value of equipments and initial enterprise costs]

	ITEM	VALUE (Tanzanian Shillings)
J1	Building [barn]	
J2	Construction costs [barn and /or irrigation channels]	
J3	Hand hoe	
J4	Panga	
J5	Knife	
J6	Feeding equipments [troughs/feeders/drinkers e.t.c.]	
J7	Land cost – [value of buying]	
J8	Sickle	
J9	Buckets	
J10	Milking machine	
J11	Cost of initial stock [heifer cost]	

Costing list per batch/lactation/production season

Costing list 1	Costing list2	Costing list3	Costing list4
Dairy cattle farming	Broilers/local chicken	Layers	Leafy vegetables
Feeds	Feeds	Feeds	Fertilizer
Labour	Labour	Labour	Labour
AI services	Chicks	Chicks	Seeds
Bull services	Veterinary services	Veterinary services	Pesticides
Veterinary services	Construction	Construction	Land preparation
Construction	Repairs	Repairs	Weeding
Repairs	Solid waste disposal	Solid waste disposal	Harvesting
Solid waste disposal	Training	Training	Training
Training	Transport	Transport	Transport
Transport	Marketing costs	Marketing costs	Marketing costs
Marketing costs	Others,	Others,	Others,
Others,