Urban Agriculture in Dar es Salaam

by

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Abstract: The UA Project in Dar es Salaam grew from the IDRC 1993 Workshop on Urban Environmental Management, Developing a Global Research Agenda. The Project's objective was to build-up a baseline data on UA in Dar es Salaam as information input into the Urban Environmental Management process through the Sustainable Dar es Salaam Project. The subordination of the project into a policy formulation process in SDP, which faced some political problems and management changes, somehow delayed project completion. However, by tapping existing and information the project contributed to insitutional capacity building at UCLAS and UDSM. Some human resources were trained indirectly. Local partnerships were utilized and some gender analysis of data occurred. Again interdisciplinary research design and use of different methodological approaches added important empirical components to the research process. Finally, leverage of additional funds from STOAS and NIGP facilitated rehabilitation of urban horticultural gardens, which are future vehicles of UA development in Dar es Salaam.

1.0 Introduction

The Project: **Urban Agriculture, Environmental Planning and Management Process in Dar es Salaam (IDRC Project 93-0037)** started in April 1994. This occurred following a fruitful discussion in 1993 between the International Development Research Centre (IDRC), represented by the Program Specialist Expert, Professor Luc Mougeot, and the United Nations Centre for Human Settlements (UNCHS - Habitat), represented by Dr. Eugen Eigen, Director of the Sustainable Cities Program (SCP).

The discussions recognized and underscored the importance and significance of the Urban Agriculture (UA) industry. It was noted that by the 1980s, and increasingly in the 1990s, urban agriculture, especially in the developing countries, was gaining currency in research among social scientists. UA was increasingly seen as contributing significantly to the economies of cities in many developing countries. Numerous actors were involved in the practice of UA including: men, women, children, the elderly, professionals, educators, administrators, and the majority of the unemployed

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[1] *Paper prepared for the Workshop on Cities Feeding People: Lessons Learned from Projects in African Cities, Nairobi, June 21-25, 1998. The longer version of the Project is: Urban Agriculture, Environmental Planning and Management Process in Dar es Salaam.*

and the urban poor. In addition, it was recognized that UA was contributing in significant ways to the survival strategies of the urban poor. Quite surprisingly, UA is enhancing urban food security. Moreover, it was convincing that if UA is well practiced and managed, it is a potential management tool in dealing with solid and liquid wastes and other related environmental problems in cities of the developing world. The same is true for cities in the developed world.

1.1 The Genesis of the Project

The Project grew directly from the International Workshop hosted by the International Development Research Centre (IDRC) in Ottawa in 1993 (see, Mougeot, L.J.A. and Masse, D. ed. 1993, **Urban Environmental Management, Developing a Global Research Agenda:** Proceedings of an IDRC Workshop, 4-6 May, 1993, Ottawa, Canada). The workshop provided the seed for the Dar es Salaam Urban Agriculture Project. This workshop unfolded several areas of research which had not yet been addressed given the newness of the research agenda and the growing need to build more sustainable cities of the future. The workshop did a wonderful job. It must be underscored that the workshop contributed much in globalizing the concept of Urban Agriculture (UA), which was, until then, least known or publicized in the academic literature. This is not to forget the fact that IDRC pioneered research in UA in the early 1980s especially in Asian countries.

It was after the Ottawa workshop in May 1993, that the United Nations Centre for Human Settlements (UNCHS (Habitat) found UA to be of considerable interest. It was clear that any attempts to the idea of sustainable cities understood some global initiative in educating people and balancing environment and development efforts was needed. Urban agriculture was a fitting topic within this context. During that time, Dar es Salaam City had just been chosen as one of the ten world cities to have the opportunity of benefiting from the Sustainable Cities Program (SCP) by initiating several development options/strategies meant to exploit more efficiently the resources available within the Dar es Salaam city region. Besides, several studies on urban agriculture had already been carried out in Tanzania, and Dar es Salaam City featured out quite prominently. Any further research on UA would be a sequel to already conducted research and on-going ones. It was seen as reasonable, therefore, to carry out more research on UA in Dar es Salaam given that: -

- *The practice of UA in Dar es Salaam was quite prevalent and some documentation of the activities had already been done to some extent.*

- *Realistically, UA was taking place in an environment that could pose several problems:*

    (i) There is air and water pollution in Dar es Salaam, though not that serious as in developed countries. Undeniably, crops irrigated with polluted water or exposed to polluted air is a potential health hazard.

(ii) Health problems are increased if animals eat grass that has been contaminated in some way.

(iii) UA being beneficial or not to urban dwellers, the major threats or constraints to UA in the city of Dar es Salaam include:-

* *Water shortage.*
* *Poor land tenure.*
* *Pollution from industrial wastes emanating from food processing industrial wastes, petroleum wastes, pesticide wastes, insecticides and fungicides.*
* *Numerous problems of collecting and disposing solid and liquid wastes from households (Kishimba, 1993; Mashauri, 1989).*

More research on UA was needed to identify suitable areas and/or justify greater private investments and environmental pollution controls. Wastes are being dumped haphazardly, marring the city's aesthetics and increasing health dangers to urban dwellers, especially the poor living in unplanned areas.

(iv) In a City Consultative Workshop in 1992, under the auspices of the Sustainable Dar es Salaam Project (SDP), on Urban Environmental issues[2], it was established that less than 5% of city's solid wastes were being collected daily and dumped crudely. The consequences have been:

* *Drains and sewers are blocked and flooding escalates during the rainy season.*
* *Improper solid waste incineration causes air pollution from toxic gases*
* *Uncollected garbage in residential areas as well as business areas cause irritating odors and reduces city beauty.*
* *People pile wastes, especially from livestock reared in residential areas on streets. This creates breeding areas for diseases, insects and rodents. At the same times opportunities for small scale and even large scale composting and waste recycling remain untapped.*

o *Dar es Salaam was growing at 4.7 % p.a. (Baruti et al., 1992:4), a fast growth rate like other cities in the developing world. This meant that there is obvious increase in urban demand for land, water, fuel, food and other rural-based resources. This is a challenge.*

o *The growing demand for rural-based resources, in Dar es Salaam, as would be the case*

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[2] *Note the relationships as shown in Figure 1.0.*

elsewhere in the world has been:-

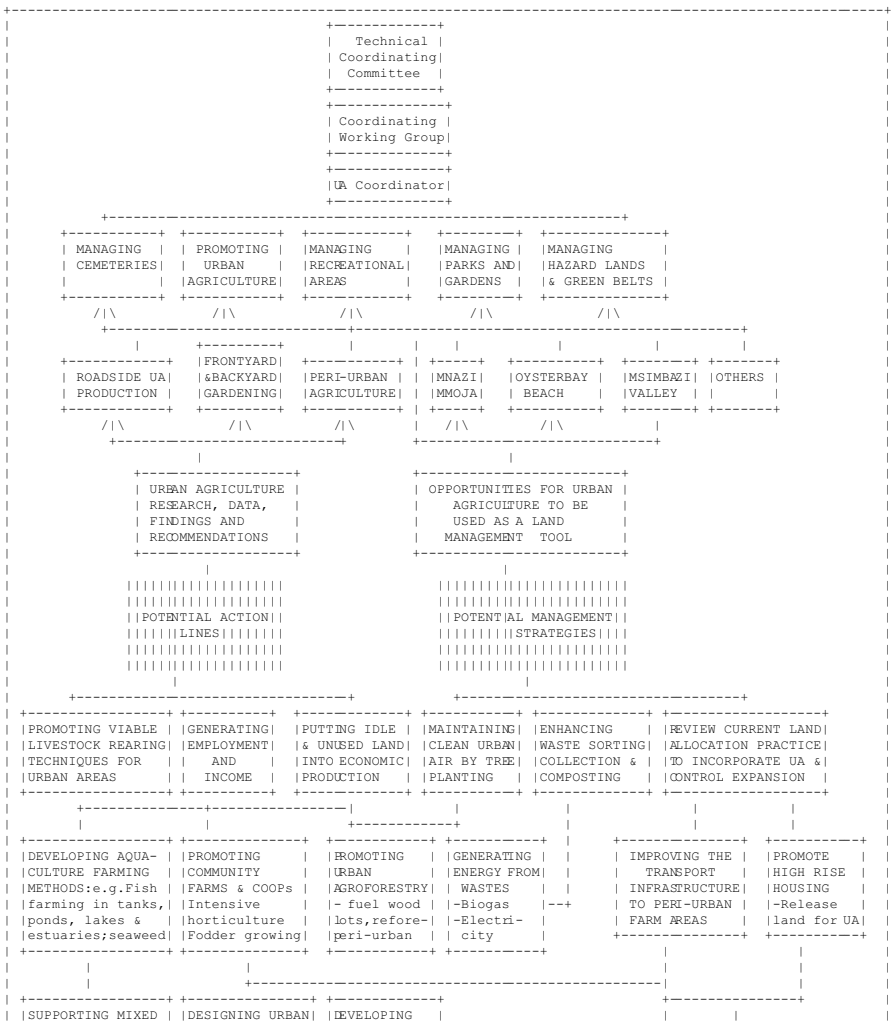
* *Aggravating environmental tress.*
* *Undermining the productivity of man-made capital.*
* *Intensifying social conflicts within the city and immediate hinterland and even beyond.*

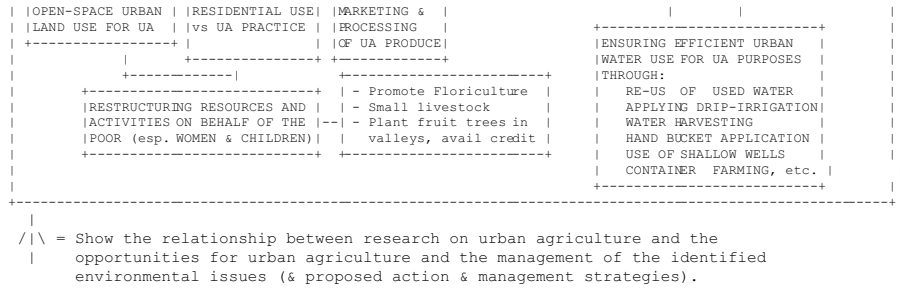
o *As cities grow, the food supply systems become stressed. The urban food supply systems in Dar es Salaam have been constrained on account of: -*

(a) Increase in population over the years.

(b) Stagnation of rural agriculture in both cash and food crops production.

Figure 1.0 Relationship Between Urban Agriculture and Management Strategies of Open Spaces, Recreational Areas, Green Belts and Hazardous Lands in Dar es Salaam and SDP]





(c) Poor and inefficient transportation systems that have constrained transfer of foods from rural areas to urban centres in time and in affordable terms.

(d) Constrained food importation for lack of enough foreign reserves and purchasing power locally.

(e) Poor performance of the national economy characterized by declining household incomes, worsened by delayed payments of salaries, negative impacts of structural adjustment programs, urban food shortages, malnutrition, illness, unemployment and poor urban governance.

- *In a Sustainable Dar es Salaam Project (SDP) consultative workshop (1992), it was established that the city council lacked the capacity to collect the wastes. Indeed, there had been failure to improve the capacity in creating an integrated approach in collecting, treating, transporting and disposing the city wastes in an environmentally sound manner.*

- *Again, in a city consultation workshop in 1992 with SDP, the issue of managing open spaces, recreational areas, hazard lands as well as green belts for the promotion of urban agriculture was unfolded. Strategies were to be drawn up to redress the dwindling of open spaces because people simply built on earmarked open spaces and recreational areas. The promotion of urban agriculture as a land management tool would go a long way to integrate hazard land management and hence maximize the development of urban agriculture potential (see summary in Figure 1.0).*

It for this reason that the research project was carried out in focus with this objective in mind. That is an action oriented project research aimed at ensuring that there is generation of information that will input or show the existing relationship between UA, Management Strategies for Open Spaces, Recreational Areas, Green Belts and Hazard Land in the city of Dar es Salaam. This idea is reflected in Figure 1.0.

o *The above issues were also emphasized in a One Day Mini-Workshop on Urban Agriculture in Dar es Salaam, sponsored by SDP in November 1993, involving a wide array of experts and UA practitioners. This particular workshop was a great input into writing the proposal which culminated into the Project (IDRC 93-0037), after obtaining support and guidance from Mr. Cris Radford, the then Technical Advisor to the Sustainable Dar es Salaam Project (SDP).*

1.2 General Objectives of the Project/Research

From the foregoing, there was thus a growing interest to build on existing research findings and generate more information with the view to integrate urban agriculture (UA) activities and the city's growing problem of managing solid and liquid wastes. Also central to the project was the need to establish the socio-economic significance of supporting UA in Dar es Salaam or elsewhere in the country.

Overall, the objective of the Urban Agriculture Project in Dar es Salaam was *to build-up a baseline data on Urban Agriculture in Dar es Salaam in order to supply substantial information into the Urban Environmental Planning and Management (EPM) Process taking place in Dar es Salaam under the auspices of the Sustainable Dar es Salaam Project (SDP).* SDP has been funded by the United Nations Development Programme (UNDP) and executed by the UNCHS (Habitat) operating, as earlier mentioned, under the Sustainable Cities Program (SCP). It was expected that such information would provide foundation for action oriented research that contributed directly to policy formulation and integrated urban agriculture activities into managing the city environment both at the city and central government.

1.2.1 Specific Objectives of the Project

Five specific objective areas were central to the research project:

-i- Documenting the scale and extent of UA and its role in the urban economy and food security, and its importance vis-a-vis subsistence consumption, health, incomes and employment.

-ii- Detailing in some way, the interaction between urban agriculture and the environment to establish negative and positive impacts of UA activities on food production.

-iii- Identifying and describing the main actors involved in UA as producers and managers of environmental resources and the constraints they face.

-iv- Identifying and documenting instruments of intervention available.

-v- Identifying, documenting and describing the opportunities available for UA through appropriate land and waste management.

1.2.2 Project Duration and Constraints

The Project was scheduled to last two years (1994-1996). However, due to a number of problems, including partly some delays in funds availability at some points during the project execution; delays and worries caused by the closure of the then Meridian Biao Bank, where the project had its account. Because of the Meridian Biao Bank closure, funds were withheld for a while until a new bank arrangement was in place. Other problems include frequent changes within the municipal government (The Dar es Salaam City Council) with whom SDP was working. In fact, the City Council was the owner of the project. It was responsible for executing it in collaboration with Sustainable Dar es Salaam Project (SDP). The frequent changes of officers in the city council during that period affected, in varying degrees, the functions of SDP and consequently the Urban Agriculture project execution. Since the project was action oriented and information was needed to feed into the SDP for planning process, close links with the City Council was necessary. But the city council was experiencing management problems. Changes in personnel had to take place. Thus, the frequent new faces in office in the city government meant starting almost anew in certain areas of the project, especially in relation to SDP information requirements. Problems within the city council continued until there was a need to disband the entire City Council management team.

The total disbanding of the City Council in 1995, and institution of Dar es Salaam City Commission (DCC) instead, meant that certain things had to be started anew. For instance: (a) SDP had to brief the new officials what SDP stood for and what processes were involved, (b) explaining and convincing the new commissioners the relevance and role of the working groups within SDP, (c) the relevance of the information gathered by the working groups including the UA working group, and the place of UA in city planning and so on. Generally, there was added delay in carrying out fieldwork in connection to our project since we needed blessings of the New City Commission. There were also delays in arranging and conducting seminars and workshops between SDP, the City authorities and the public through which findings of the UA research might be discussed, even if the project was not ended yet. Several political and bureaucratic arrangements were needed to smoothen matters and create a more enabling environment to sensitize people on the involvement of stakeholders, and this could not be done as quickly as one desired.

Again, the rapidity with which the city environment was changing in terms of population increase, housing and road construction, as well as the impact of migration, evidenced by increase in petty trading and erection of kiosks in the city centre, invasion of open spaces, and road reserves;

expansion of roads and demolition of built-up structures (e.g. along Morogoro road and the New Bagamoyo Road), and the need to document more up-todate information for the planning purposes of SDP, all this necessitated dropping some earlier gathered information. This, in some ways, contributed to some further delays in bringing the project into completion. Request for extension has been done twice, and the project will soon wind-up once the final technical report is submitted, reviewed and the very final report submitted.

2.0 Areas of Impact Relevant to the Project

The Urban Agriculture, Environmental Planning and Management Process in Dar es Salaam Project has had the following impacts:

(A) Institutional Capacity Strengthening

The project contributed significantly to institutional capacity strengthening in both the University College of Lands and Architectural Sciences (UCLAS), former Ardhi Institute and the University of Dar es Salaam (UDSM). From UCLAS, three researchers were drawn. The coordinator of the SDP Urban Agriculture Working Group, Ms. A. Mtani graduated from the former Ardhi Institute, just like Mr. Kyessi, Mr. Majani and Ms. Mwaiselage. The University of Dar es Salaam drew researchers from the Department of Chemistry, Faculty of Science, and Department of Geography, Faculty of Arts and Social Sciences. These benefitted in capacity building from the project. Institutional capacity building at UCLAS and UDSM was in the form of: -
Office equipment and materials. These included: -

(1) One desktop computer and an HP Laser 4 Plus printer. These were allocated to the Geography Department, University of Dar es Salaam.

(2) Four laptop Compaq computers. Two were allocated to UCLAS researchers, and two to University of Dar es Salaam researchers.

(3) Two spray-jet printers to support the laptops. One was allocated to UCLAS and the other the University of Dar es Salaam.

(4) A potable water analysis kit and chemicals. All these were allocated to the Chemistry Department for use under the care of Dr. M. Kishimba, one of the research team members.

(B) Human Resources Development

The Research Team comprised 5 principal researchers; Dr. C.J. Sawio (Coordinator, Geography Department, University of Dar es Salaam, - Geographer, Urban and Regional Planner); Dr.M. A. Kishimba, Chemistry Department, University of Dar es Salaam, (Chemistry Specialist), Mr. A. Kyessi (Urban Planner, Settlement Analyst, knowledgeable in Geographic Information Systems (GIS) and aerial photo interpretation), Mr. B.B. Majani (Urban Planner), and Ms. A. Mwaiselage (Architect and Urban Planer) all from UCLAS, former Ardhi Institute). In addition to the 5 principal researchers, the representative of the Urban Agriculture Working Group in SDP, Ms A. Mtani was closely linked with the research team. Each of the principal researchers made use of the services of a research assistant at different times depending on the research activities at hand. These were supposed to be trained people, we did not need to train them, and they assisted in gathering all kinds of information pertinent to the project.

Of the principal researchers, Dr. Sawio coordinated the team and concentrated, among other things, on issues of extent of UA, role in urban economy, food security, health issues, incomes from UA, employment as well as on some planning aspects. Dr. Kishimba addressed UA environmental issues, water, soil and crops analysis and impacts of UA on the urban environment in general. Mr. A. Kyessi dwelt on issues of opportunities and potential for UA support and management. Mr. B. B. Majani documented instruments of support for UA that are available in Dar es Salaam, and Ms. A. Mwaiselage focused on the analysis and description of UA actors as managers of environmental resources and producers.

Prior to conducting the socio-economic surveys in the selected study areas, the research team, having prepared the questionnaire, conducted a four-day training of 25 interviewers, selected from within the University, UCLAS, District Agricultural offices and from among UA farmers. There were 9 women and 16 men. These were trained on how to carry out interviews, how to approach farmers, administer different kinds of questions on a person-to-person interview format, and appropriate ways of recording information.

In addition, it should be noted that the project did not conduct training as such to undergraduates and graduates in terms of funding them. That would not have been feasible. Rather there was indirect training. Thus, the project contributed in a modest way to human resources development in the sense that some training did take place as follows:

(i) One undergraduate student in Geography, Anna Kashaija, impressed by the UA project did an independent study on solid waste management at household and city level. The coordinator, Dr. Sawio, supervised her. She performed very well. The focus of her work was on solid waste collection, sorting, composting and recycling for use in urban agriculture at the household and city level.

(ii) Four graduate students, one from Japan, one from the United Kingdom and two from

Tanzania (Ms. Joyce Tesha, from Sokoine University of Agriculture, and Ms. Ludovicka Tarimo (Agricultural University of Norway) did their MScs in Urban Agriculture. They made use of the literature assembled by the project and supervision from the coordinator of the project.

(iii) Since the 1994/95 academic year, the Geography Department at the University of Dar es Salaam, has been offering ingredients of Urban Agriculture oriented tasks and lectures (By Dr. Mwamfupe and Dr. Sawio) to Second Year students in their compulsory Field Course. In the 1994/95 academic year, 66 students participated. In the following 1995/96 academic year, 80 students participated in the field course. In the 1996/97 academic year, another 80 students undertook the field course. In the 1997/98 academic year, again 80 students participated.

One of the written projects these students have to submit has been featuring on the role, importance and significance of urban agriculture as one of the features of the informal sector, so common in cities of developing countries. During the 1996/97-field course, UA practices were studied in Kibaha town, regional capital of Coast Region. In the 1997/98-year field course, the students had the opportunity of studying elements of UA in Mbagala area in Dar es Salaam.

(C) Effectiveness of Local Partnerships (Academic and Non-Academic)

Some effective local partnerships have been established:

- The Project team has worked closely with the Sustainable Dar es Salaam Project (SDP) Urban Agriculture Working Group under the coordination of Ms. A. Mtani. The research team, through the coordinator and the SDP Urban Agriculture working group also worked with the Regional Agricultural Development Office (RALDO) to study UA and to suggest possible viable action plans for the promotion of UA.

- The Dar es Salaam City Commission (DCC) has been a partner in that we consulted with officials, and we had a number of meetings with commissioners regarding the way UA should or could be practiced more sustainably.

- Again with SDP and in collaboration with the City Council/City Commission, and also with Agriprojects Foundation Department of Sub-Sahara Africa-STOAS[3] International, and the National Income Generating Program (NIGP). Out of this was produced a proposal that was

[3] STOAS, Agriprojects Foundation Department of Sub- Sahara Africa. A Foundation for the Development of Agriculture, Education and Training. P.O. Box 33536 Dar es Salaam. Tel. 255-51-151608 Fax: 255-51-46775.

funded by STOAS and NIGP, with a proposed budget at the start of about Tsh. 294,500,200/= (roughly US $ 500,000) for the rehabilitation of the Dar es Salaam Horticultural gardens.

Collaborated with Natural Resource Institute (NRI) during their establishment of Pilot Projects in Mbutu and Buguruni in exchanging ideas and participating in workshops, and visited farmers in their farms

- Exchanged views/literature where possible with the Urban Vegetable Promotion Project (UVPP)[4] on subjects of UA, extension services, and integrated pest management strategies. Field visits have been to conduct between research team and the UVPP group.

- The coordinator has linked with Sokoine University of Agriculture (SUA) Department of Continuing Education with Dr. Mlozi R. S. Malongo and currently are together developing a Proposal for the development of UA Model Projects for replication as well as teaching purposes. This initiative is in its infant stage.

- Links with on-going researches or projects within the University and with some Non-Governmental Organizations (NGOs), e.g. Coastal Dairy Farmers' Association (CODAFA) and a gas energy production project TAKAGAS[5], that will be using urban solid wastes.

(D) Gender Analysis

The project results show that men and women, boys and girls, the poor and the rich are involved in UA in Dar es Salaam. Although the project did not carry out strong gender analysis, using for example gender-oriented methodology, other studies conducted in Dar es Salaam suggest that female vegetable growers benefitted less from their activities than the male growers.

A further look at the project findings, however, reveals that a number of gender issues and some gender analysis in fact took place. Gender analysis is indicated by: (a) some evidence from the literature review which show that men and women engage in UA; (b) specific questions in the socio-economic surveys, especially on farming activities (farm preparation, sowing, weeding, harvesting, applying fertilizers, etc.) alluded to gender relations. Analysis of information of this indicates that this was done. (c) The research team included two women and four men. (d) Distribution of UA actors in the study areas has been depicted on gender lines. (e) Similarly, demographic characteristics

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4 Funded and supported by the German Agency for Technical Cooperation (GTZ).

5 TAKAGAS is a Project for the production of GAS from solid wastes. The word "TAKA" is the Swahili version for "wastes". TAKAGAS means gas produced from solid wastes.

of UA actors including heads of households, and household sizes have been done on gender basis. (f) Last, not least, interviewers included men and women, and efforts were made during the administration of questionnaires to interview both male and female UA practitioners.

(E) Added Value of Multidisciplinary Approach

The projects research team was composed of different disciplines (see section 2.0 (B). From the University of Dar es Salaam came a Geographer, urban and regional planner (a social scientist); and a scientist per se, specializing on Chemistry and Environmental Issues. From UCLAS, the project benefited from the experiences of four urban planners, most of them combining skills in other social science areas, especially geography, human settlement planning, aerial photo interpretation and GIS (remote sensing in general), policy analysis and architecture.

There was use, therefore, of different research methods, aerial photograph interpretation, digital data analysis for mapping purposes and understanding of process on the land; social economic data analysis from the numerous questionnaires that were administered in order to document characteristics of the UA actors and economic aspects. The empirical analysis, from the utilization of chemistry knowledge and tools, for heavy metals in water, soils and crop samples in laboratories, added an important focus to the project. Equally important is the documentation of the legal instruments of intervention (by-laws) for regulating UA. All these contributed to a comprehensive treatment of the issues that were to be addressed by the project research.

This interdisciplinary approach facilitated (a) the designing of a broad-based questionnaire meant to gather as sufficient information as possible. (b) Use of a broad spectrum of interviewers with different skills and experiences to collect survey data. (c) Documentation of impacts and suggestions of potentials and opportunities of UA in Dar es Salaam from the project was made easier because of the multi-disciplinary approach used.

(F) Methodological and Scientific Advances

The methodological and scientific advances are reflected in the way data was gathered. Both secondary and primary data collection methods were employed. The extensive literature review added more historical perspectives to the practice of UA. The combined social-economic survey methods which made use of random and stratified sampling of respondents to include representative UA actors and several aspects of UA; group discussions; participant observation and field reconnaissance, and sharing of experiences and information among the working groups in SDP enabled the research team to have a broader understanding of UA issues and relationships with other environmental issues (see Figure 1.0).

It is worth noting that Map and Aerial photo interpretation including use of GIS for mapping

and data presentation. Selection of Sampling Sites for Water, soils and sediments and crops for in-depth analysis to decipher environmental problems: that is, pollution and food contamination added an important empirical component to the research process.

(G) Results Utilization by Non-Research Entities

The project has generated information that has been used by the Sustainable Dar es Salaam Project (SDP) to input into the Strategic Urban Development Plan for Dar es Salaam. A Proposition Paper on *"Managing Urban Agriculture in Dar es Salaam"* has been produced. That paper incorporated part of the research findings. The paper was discussed in a workshop designed by SDP to general views on the Preparation of "The Strategic Urban Development Plan" (SUDP) for Dar es Salaam city. This is meant to replace the 1979 Master Plan. Many of the views and/or workshop propositions, and suggestions emanating from the UA project have been adopted. The Strategic Urban Development Plan for Dar es Salaam, will indicate clearly, hopefully, that UA has been recognized as a legitimate urban land use, and that there are areas that have been earmarked for the development of both urban and peri-urban agriculture.

A Mixed-Land Use strategy for UA has been proposed in that regard in the proposition paper. This includes both food crops and livestock keeping. Livestock keeping has been recommended to be kept in the peri-urban zones where it is thriving well. It is hoped that more results from the project will be utilized by urban decision-makers (planners, urban economists, law enforcers, extension officers and others) to support and enhance urban agriculture in urban centres in Tanzania. This is feasible because nine other municipalities in Tanzania, including Arusha, Moshi, Dodoma. Morogoro, Tanga, Tabora, Mbeya, Mwanza and Iringa have geared themselves to replicate the SDP process.

(H) Leverage of Additional of Non-Centre Funds

It is to be underscored that the Project benefitted from the UNCHS support through the SDP to estimated tune of CAD $ 171,600, as part of the budget from the very beginning. Not all this money accrued to the project as such, as much of it was used to support the working group.

During the project execution, as pointed out in section 2.0 (C), in the efforts to rehabilitate the Horticultural Gardens of Dar es Salaam, through the STOAS/NIGP Project, about US $ 500,000 was earmarked for use to accomplish this task in two phases. This started in 1994 and the project has now come to end, after some successes and failures here and there. It is most likely that the urban horticultural gardens will, in future, be managed commercially by interested individuals and groups on cooperative basis.

3.0 Discussion of Specific Impacts of Areas Selected.

(a) Institutional Capacity Building

The office equipment and materials have enhanced research capacity of the researchers in the project. The institutions they come from and have acquired the computers which will be used by other people in the respective institutions.

In a very special way, the desktop computer and the laser printer was a major acquisition by the Department of Geography at the University of Dar es salaam. It was the first and only IBM desktop PC to be acquired through the project. Prior to that, the Department only enjoyed use of a donated Macintosh and a LaserWriter, from the Department of Geography, University of Glasgow. The software provided is supporting data processing in the department. Again, for the Geography Department, and also UCLAS, the computers have facilitated installation of e-mail software. This is capacity building in modern communication.

The Chemistry Department at UDSM acquired a Potable water analysis kit and chemicals. The Water analysis Kit can be used again and again. It has been an invaluable addition to the Departments' stock of such equipment.

Apart from the acquisition of equipment and materials, institutional strengthening, it so happened that the coordinator managed to create a mini-collection on UA materials in his office. Several shelves have been made to accommodate them. Later, if a small building could be acquired to accommodate the materials, it will provide space for reading. This could well be the beginning of a small research library on UA.

(b) Human Resources Development

As said earlier, a few people were indirectly trained because of the project. Because there are two members of academic staff in the Geography Department at the University of Dar es Salaam who have done research on UA, there has been a spontaneous interest in developing some teaching materials. This has been done through incorporating UA knowledge in the teaching programs. As mentioned earlier (section 2.0 (B), since the 1994/95 academic year, apart from a third year finalist doing a dissertation of Solid Waste Management at the Household Level focusing on UA, all Second Year Geography students have been directed to work on UA-related issues in their compulsory fieldwork. The numbers of students that have been exposed to this each year have been indicated (section 2.0 (B).

Just to reiterate on a few cases on graduate work, one Japanese graduate student consulted with the UA project coordinator and researched and wrote a term paper on Solid Waste Management

in Dar es Salaam and UA practice. A Graduate student (M. Sc.) from SUA, Joyce Tesha benefitted from the project through consultation and guidance on literature gathering and completed a study on *Extension Services and Urban Agriculture Development in Dar es Salaam.* Another graduate students Gisa Muster, attached to Urban Vegetable Promotion Project (UVPP-GTZ), completed MA in Development and Environment at the School of Oriental and African Studies, University of London UK. She also benefitted from consulting with the project coordinator and accessed some of the literature in our collection. Again, one graduate student, Ludovika Tarimo, was supervised partly by the coordinator and completed an M Sc. Dissertation on *Urban Farming in Dar es Salaam: Some Socio-economic Aspects,* at the Agricultural University of Norway. It should also be noted that field survey and interview administration skills were imparted through a four-day training session prior to the administration of questionnaires by interviewers.

(c) Effectiveness of Local Partnerships (Academic/Non-academic)

The Project effectively collaborated with SDP for which data was been directed. The research team worked with the SDP Urban Agriculture Working Group and put together information that was used in informing SDP and the city council on the significance and importance of UA in the city economy. Local workshops were held with SDP in 1993, 1995, and later in 1997 in order to disseminated relevant information on UA and environmental planning process.

A very significant achievement in this area was the collaboration between the project, SDP, RALDO and the City Council in obtaining support from STOAS and NIGP (about US $ 500,000) to rehabilitate the urban horticultural gardens. Significant achievements have been made in reviving the horticultural gardens. Although there are problems of drought, water shortage, theft and the like, these gardens are now becoming vehicles for disseminating knowledge, seeds, fruits and techniques and/or strategies for developing UA in Dar es Salaam.

The project has made efforts to link with other academic institutions, e.g. Sokoinne University of Agriculture, Department of Continuing Education through Dr. Mlozi to explore further on how we can develop UA in our cities. One of the efforts under way for the moment is to develop Model UA Projects that can be replicated elsewhere.

(d) Added Value of Multi-disciplinary Approach and Methodological And Scientific Advances

There was a combination of urban planners, geographers and scientists in the research team. Urban planners were more in number than the others. Nonetheless, we benefitted tremendously from the multi-disciplinary approach especially in the socio-economic surveys, and analysis of water samples, soils and crops. The empirical approach adopted especially in the analysis of water and soil samples added a different dimension to studies on UA. The methods described below demonstrate

the rigor and the results are quite informative:

To understand the impact of pollution in irrigation waters in Dar es Salaam as well as effects of pollution on some crops, in the research conducted in Dar es Salaam, samples were collected at selected sites along Msimbazi valley and treated with care as described below. In this methodological procedure, the following parameters were analyzed:

(i) In Water

The following 16 parameters were analyzed for:

(a) Heavy Metals:

(1) Copper (Cu); (2) Chromium (Cr); (3) Lead (Pb); (4) Cadmium (Cd); (5) Zinc (Zn).

(b) Other parameters:

(1) Temperature; (2) pH; (3) Conductivity; (4) Total dissolved solids (TDS); (5) Dissolved Oxygen (DO); (6) Total Nitrate (T_{NO3}-); (7) Phosphate (PO_4^{3-});

(ii) Sediments

In the sediments, only heavy metals were analyzed for the obvious reason that these are the only serious pollutants.

(1) Copper (Cu); (2) Chromium (Cr); (3) Lead (Pb); (4) Cadmium (Cd);
(5) Zinc (Zn).

(iii) Soils

As was the case with sediment, only heavy metals were analyzed for the same reason.

(1) Copper (Cu); (2) Chromium (Cr); (3) Lead (Pb); (4) Cadmium (Cd) and Zinc (Zn).

Methodology for Water Sampling:

(i) **Sample Collection**

Water samples were collected in new polyethylene one-litre bottles. The bottles were cleaned with detergent and rinsed several times with distilled water. Then the bottles were soaked in a 1.5M solution of nitric acid to remove any trace metals on the walls of the container. Finally the bottles were again rinsed with distilled water before being used for the actual sampling. During the sampling, a can which was used for drawing water was immersed deep enough to avoid collecting

the surface water which may not be representative of the water by being enriched in heavy metals. The can and bottles were rinsed a few times before collecting the samples for analyses. Three samples were taken from different points at a sampling site.

For the sediment and soil sampling, new stoppered polyethylene jars were also rinsed several times before the samples were collected.

Analytical Procedure Followed

Temperature was measured on site so as to get the real temperature of the water; pH and conductance. This was done as soon as the samples were in the laboratory (less than three hours after sampling). Concentrations of metals were determined using both a Hach DR 2000 Spectrophotometer and a Perkin Elmer 2380 Atomic Absorption Spectrophotometer. For samples to be analyzed for heavy metals using the latter pre-treatment to avoid changes due to physical, chemical or biological factor which usually occur within several hours. After filtration on an acid washed filter paper, they were acidified with Pro-Analysis nitric acid to a pH of 1.5. Conductivity, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Nitrate (NO_3^-) and Phosphate (PO_4^{2-}) were determined using Hach DR 2000 Spectrophotometer equipment. As said, it was necessary to analyze foods produced for safely purposes. The central issue is health on consuming UA grown foods. Selected vegetables were analyzed.

Analysis of Vegetables

Plants as a whole, and in this case crops, take up heavy metals and if not carefully monitored, they end up in the human food chain. For example, vegetation at the side of the road may have Pb levels of up to 50 ppm. But only 150 metres from the road, the level is normally 2 - 3 ppm. Contamination by inorganic lead usually occurs only on the outer surface of the plant and the contaminant can mostly be removed by washing. But the case is very much different with organic lead such as the alkyl lead derivatives like tetraethyl lead which is the compound used in leaded petrol. Triethyl and diethyl lead also have the same properties. These are taken up into the plant tissue and end up accumulating to dangerous levels with respect to human health. Another heavy metal, cadmium is also taken up by plants and the rate of uptake is dependent on the concentration of the pollutant in the plant's vicinity.

After examining the irrigation waters, sediments and the soils in Msimbazi Valley, one of the areas selected for the study, efforts have been directed towards determining the levels of heavy metals in the urban grown vegetables to find out whether their levels are within the tolerable/recommended limits.

Methodology For Crops Analysis:

Samples of Cowpea (*Vigna unguliculata*) leaves, pumpkin (*Curcubita moschata*) leaves and African spinach (*Amaranths sp.*) were collected from Kijitonyama, Mwenge and Keko Bondeni. The collected samples were washed with distilled water to remove air borne pollutants. The unedible parts were removed and the specimen and were sliced and oven dried to constant weight at 60°C. The samples were then ground to a below 60 mesh and subsequently dry ashed and the following heavy metals concentration was determined on a Perkin Elmer 2380 Atomic Absorption Spectrophotometer:

(1) Copper (Cu)
(2) Lead (Pb)
(3) Cadmium (Cd)
(4) Zinc (Zn).

The use of this method as well as other social science methods, remote sensing and GAS and mapping, reflect the interdisciplinary approach. As said, the multi-disciplinary composition of the research team and the use of the different methods contributed to a comprehensive treatment of UA issues in Dar es Salaam.

4.0 Overall Evaluation of Impacts

The UA project in Dar es Salaam created institutional strengthening at the UDSM and UCLAS. The equipment, materials, and enhancement of research capacity among the researchers is an impact to reckon with. The project has sensitized people around Dar es Salaam to realize that UA is no longer an issue to ignore. Urban plans have to include it. This sensitization occurred through seminar and workshops and meetings with UA operators and other stakeholders. More seminars and workshops are needed to impact more knowledge on UA issues.

Results indicate that UA is contributing significantly to the household economy. Ua is generating jobs, and incomes of over 50 million Tanzanian Shillings (Tsh.) per year from UA produce. More income is realized through sell of dairy products and high valued horticultural products. UA makes use of local technology to produce food. The local government is interested in developing UA and nine municipalities are currently emulating SDP. There is a strong legal framework, in the form of by-laws to regulate the practice of UA. However, there is little attention paid to the by-laws by the majority of UA actors. In Dar es Salaam keeping of only four heads of cows on zero grazing is mandatory. Yet, there is weakness in enforcing this by-law. The city governments should be more forceful and realistic in enforcing regulations to support UA.

Results of the study indicate that solid waste composting and recycling for UA use is possible. It can be developed in peri-urban areas and in such places as Vingunguti, Mtongani Kunduchi, and mining sites when mining is exhausted.

Human resources development has taken place to some extent, however, it can be enhanced in future if an UA-oriented curriculum is developed sooner and more rigorously among participating institutions. Notably, the multi-disciplinary approach helped to unearth more on the environmental impacts on UA and of UA on the environment through livestock keeping and pesticides use. Also better highlighted is the existence of instruments of intervention in the form of regulations and by-laws that are least observed.

The potential to form partnerships exists, but on the whole, there is lack of commitment on the part of politicians and decision-makers as demonstrated by big and influential persons who simply disobey laws and nothing is done. Again, gender issues are important in UA research, however, the project design from the start did not adopt a strong gendered approach; this will be take care of in future.

Overall, the results are quality results, documenting to a satisfactory level the dominant issues on UA in Dar es Salaam. This is result of broad data collection, in depth analysis and presentation of the results in maps, diagrams, tables and figures that are not complicated.

4.1 Some Difficulties due to Sub-ordination of the Project to SDP A Policy Formulating Process.

The aim of the project was to feed data into SDP while it continues to carry out its programs. From the start, there was a heavy hand on the research team, for there was that assumption that every bit of data must be submitted to the SDP. There was a general feeling that one might be commanded to move towards a certain direction that was not fully within the objectives of the research.

There was constant demand that the project should expand its area of study, as the interests and view of SDP expanded. This demand was there, notwithstanding the budget and time constraints. Once we had to change design of the areas to include in the project in order to accommodate some demands. This added some stress and potential for delay on the research team. Because SDP had to bee keen on the direction of political happenings in the city administration, and government policy as a whole, the project execution had to follow suit in some way too, since this information was be used by SDP. In one way or another this necessitated some waiting for certain political problems to settle (see section 1.2.2).

Again, because the research was action-oriented, at times data or information was demanded before proper analysis was carried out, causing some pressure and making it difficult to check certain bits of information that was given out and seemed to come from contradicting sources. All, however, went well, and SDP assisted in getting the project through in funding and dissemination of initial results through seminars/workshops.

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