type and land use. Additional ArcInfo coverages of Dar es Salaam were obtained from the Tanzania Natural Resources Information Centre (TANRIC). For Mwanza District ward boundaries were taken from a map prepared for the Mwanza Master Plan. The 1994 series of 1:50,000 topological maps covering Mwanza Region provided valuable information on village and road locations. ArcInfo (v7.0), MapInfo Professional and SPSS were used to analyse spatial information and prepare maps. Distances between outlying villages and urban areas were calculated to the city centre via a straight line route.

FINDINGS

This section of the report presents the major findings of the research. The first part presents an analysis of the relationship between population density, ward type, land area and distance from the urban centre. In the subsequent parts, the Dar es Salaam milk system, the Mwanza and Shinyanga milk systems (summary only), and poultry production in and around Dar es Salaam and Mwanza are described. The section ends with a summary of a review of the implications for agricultural policy of food production in and around urban areas in Africa. Detailed papers describing the Mwanza and Shinyanga milk study and the agricultural policy review appear as Appendix 1 and 2 respectively.

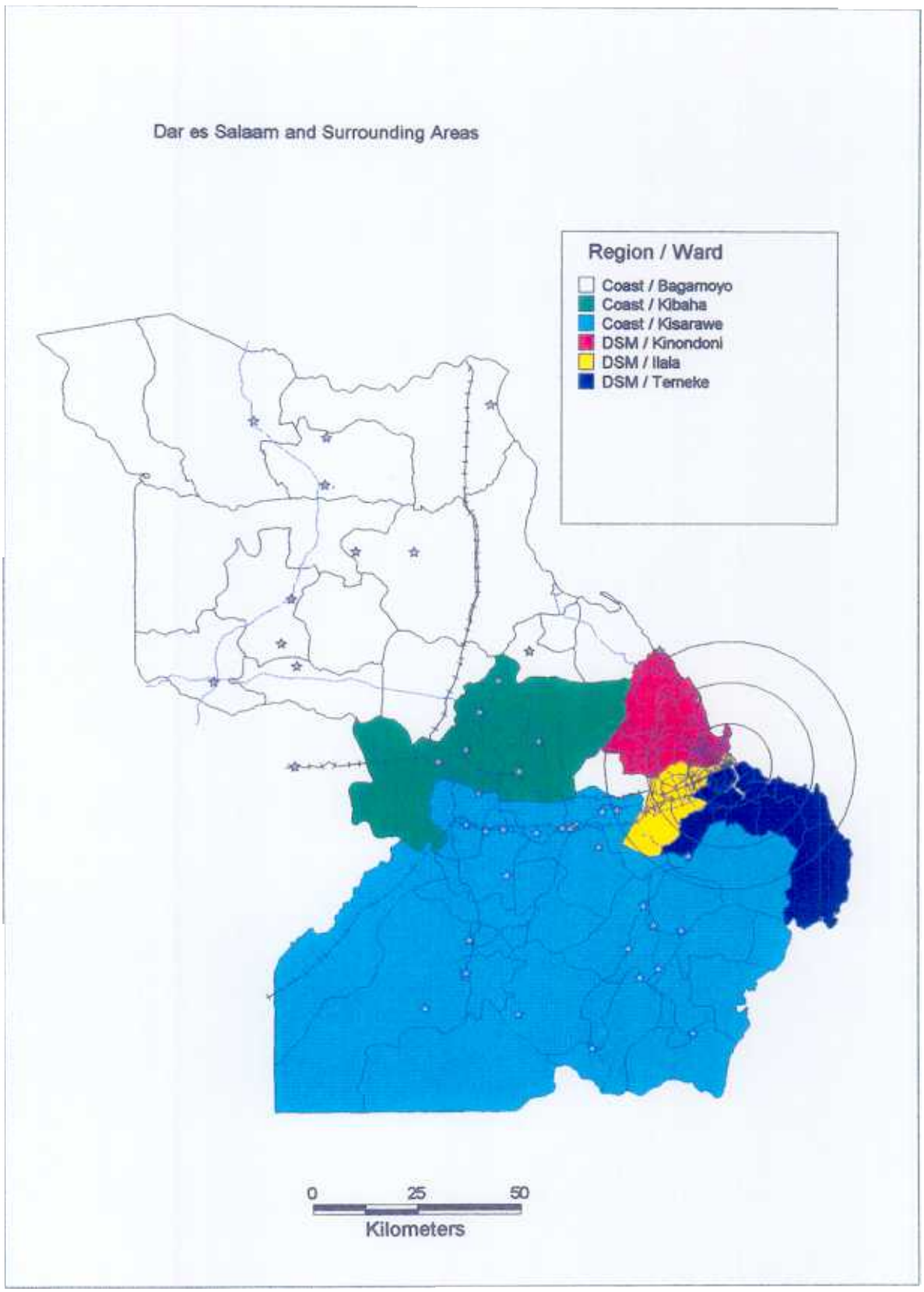
Identification of zones

The districts comprising Dar es Salaam Region and Coast Region (excluding Rufiji and Mafia) and shown in Map 1. Most of Dar es Salaam Region lies within 30 km of the city centre, while the furthest borders of Coast Region are over 125 km from the city centre. For the purposes of the national census every ward is coded as either rural, urban or mixed (i.e., containing both urban and rural areas). These codes are meant to reflect a number of characteristics including population density, type of housing and level of infrastructure development. However, there are no hard and fast rules for classifying wards, and as many individuals are involved in the classification exercise, it is reasonable to expect considerable variation. Nevertheless, the ward codes provide one easily accessible means of separating wards in a way that may be relevant to the discussion of food production in and around urban areas.

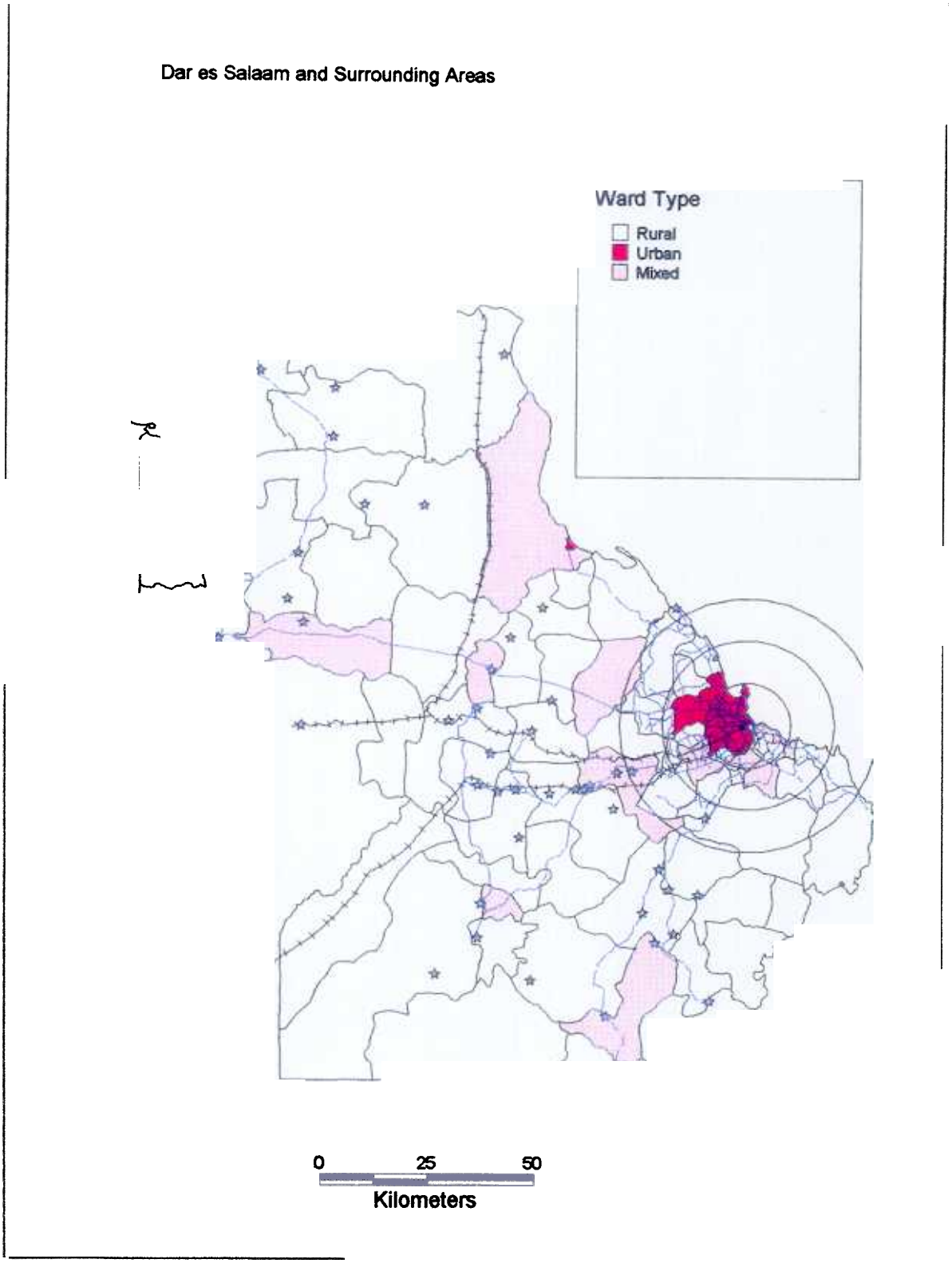
The distribution of ward types for Dar es Salaam and Coast Regions is shown in Map 2.[2] Two points are immediately obvious: urban wards are concentrated around the centre of Dar es Salaam, and a relatively large proportion of Dar es Salaam region was not classified as urban. Other recent studies of land use around Dar es Salaam also indicate that urban development tends spread along the major roads leading from the city, and that relatively large areas within the municipal boundary have few urban characteristics (Mwanfupe 1994; Briggs 1991).

[2] This map may be somewhat misleading in that only a very small proportion of the area of wards coded as 'mixed' may have urban characteristics.

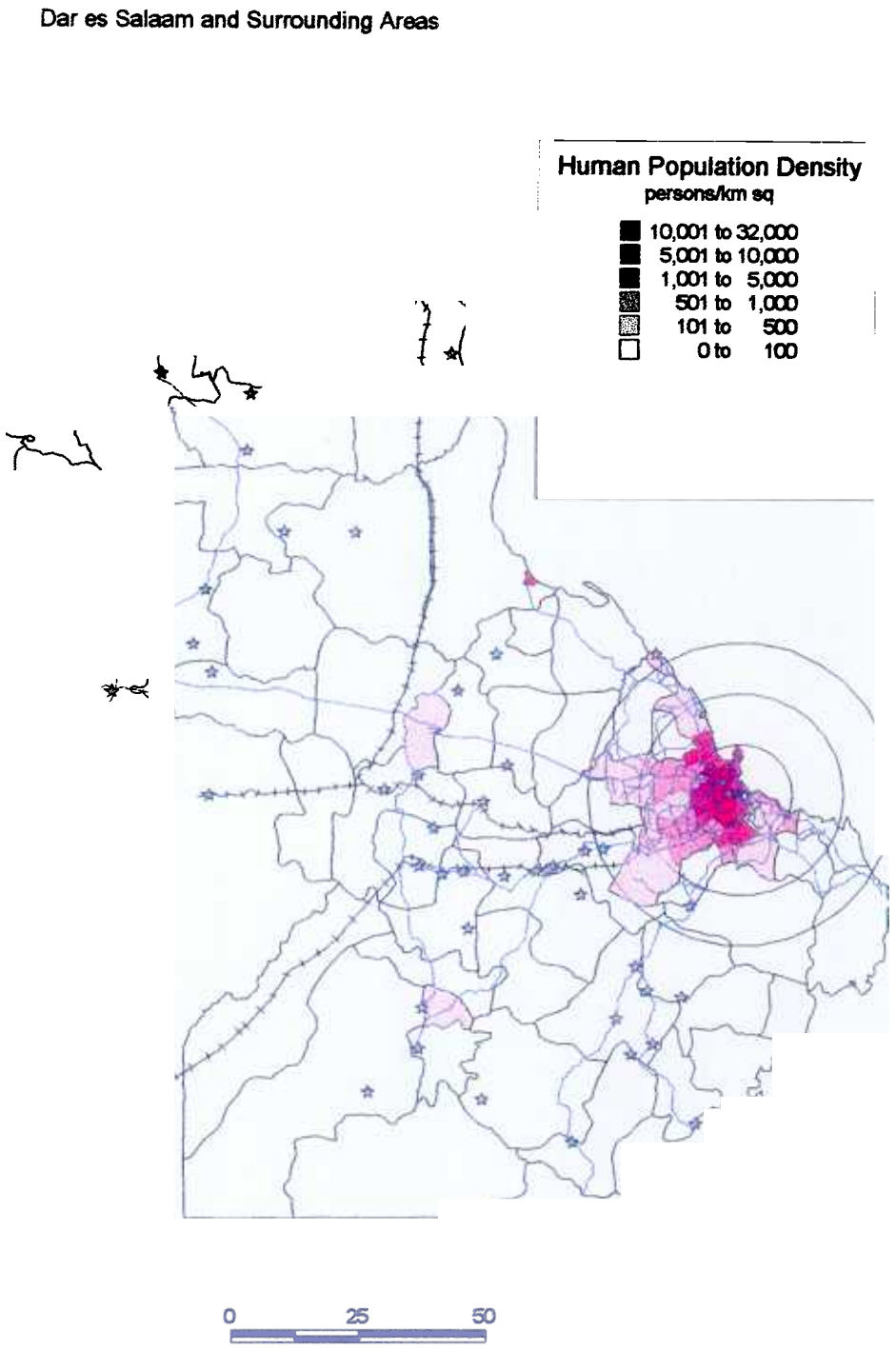
Map 1. Districts of Dar es Salaam and Coast Regions.



Map 2. Distribution of wards by type, Dar es Salaam and Coast Regions.



Map 3. Population density of wards, Dar es Salaam and Coast Regions.



These visual impressions are re-enforced by the data presented in Table 5, which indicate that something in the order of 10% of the land area of Dar es Salaam was classified as urban while over 60% was classified as rural. In contrast, over 80% of the population of Dar es Salaam lives in urban wards with only 10% in wards classified as rural. For the three districts of Coast Region, nearly 90% of the area is located in wards classified as rural, where 75% of the human population is located.

Table 5. Distribution of land area and human population by ward type.

	Land area (%)			Human population (%)		
Area	**Rural**	**Mixed**	**Urban**	**Rural**	**Mixed**	**Urban**
Kinondoni District	73	0	27	9	0	91
Ilala District	34	12	55	7	14	80
Temeke District	83	13	4	12	21	67
Dar es Salaam Region	**66**	**25**	**9**	**9**	**10**	**81**
Bagamoyo District	88	12	<1	74	21	5
Kibaha District	79	21	0	55	45	0
Kisarawe District	92	8	0	81	19	0
Coast Region	**89**	**11**	**<1**	**74**	**24**	**2**

The average population density of individual wards is shown in Map 3. As expected population density declines with increasing distance from the city centre, such that further than 20 km, all wards have densities of less than 501 persons/km^2 (from a maximum of 32,000 persons/km^2 in the city centre) and most are less that 101 persons/km^2. The relationship between distance from the city centre and human population density appears to have two forms. Within about 4km of the city centre population density is relatively constant, but beyond 4 km population density declines linearly with increasing distance (Figure 1). Beyond 4 km the relationship between distance and population density is expressed by the equation:

$$\log \text{population density} = 7.751 - 1.775 (\log \text{distance}); (R^2 = 0.82, \text{d.f.} = 96).$$

The classification of ward types also reflects significant and consistent differences in population density, with averages of 11,738, 947 and 221 persons/km^2 in Dar es Salaam's urban, mixed and rural wards respectively (Table 6). The differences between the average population density of the three ward types in Coast Region are less dramatic and less consistent, and illustrate some of the limitations of the use of the ward classification to compare different regions.

Figure 1. Relationship between distance from city centre and human population density.

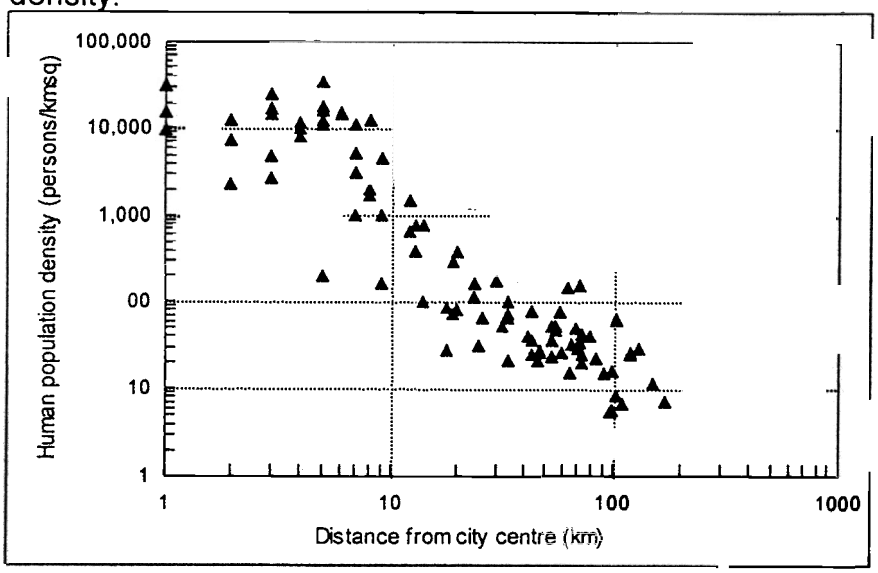


Table 6. Average population density by ward type (persons/km^2)

	Ward type		
Area	**Rural**	**Mixed**	**Urban**
Kinondoni District	172	-	13,090
Ilala District	166	754	10,881
Temeke District	274	1,011	10,622
Dar es Salaam Region	**221**	**947**	**11,738**
Bagamoyo District	23	40	2,357
Kibaha District	40	123	-
Kisarawe District	32	86	-
Coast Region	**30**	**84**	**2,357**

The relationship between population and land area in and around Dar es Salaam is explored further in Table 7 and Table 8, which highlight the fact that the human population of Dar es Salaam Region is very unevenly distributed over the available land area and that there remains a large land area within the municipal area with a relatively low population density.

Table 7. Distribution of land area by population density class (%)

	Population density (persons/km^2, class midpoint)						
Area	50	300	750	3,000	7,500	18,500	Total
Kinondoni District	40	33	12	9	1.6	5	100
Ilala District	47	34	12	4	1.7	1.6	100
Temeke District	75	11	7	4.6	0.7	2	100
Dar es Salaam Region	**57**	**24**	**10**	**6**	**1**	**3**	**100**
Bagamoyo District	100	0	0	0	0	0	100
Kibaha District	94	6	0	0	0	0	100
Kisarawe District	99.2	0.8	1	0	0	0	100
Coast Region	**99**	**1**	**0**	**0**	**0**	**0**	**100**

Classes: 100; 101-500; 501-1000; 1,001-5,000; 5,001-10,000; 10,001-27,000

Table 8. Distribution of population by population density class (%)

	Population density (persons/km^2, class midpoint)						
Area	**50**	**300**	**750**	**3,000**	**7,500**	**18,500**	**Total**
Kinondoni District	2.5	7	8	16	8	58	100
Ilala District	5	7	14	23	16	34	100
Temeke District	5	6	11	17	11	50	100
Dar es Salaam Region	**4**	**7**	**11**	**18**	**11**	**50**	**100**
Bagamoyo District	95	0	0	5	0	0	100
Kibaha District	83	17	0	0	0	0	100
Kisarawe District	96	5	0	0	0	0	100
Coast Region	**93**	**5**	**2**	**0**	**0**	**0**	**100**

Classes: 1-100; 101-500; 501-1000; 1,001-5,000; 5,001-10,000; 10,001-27,000

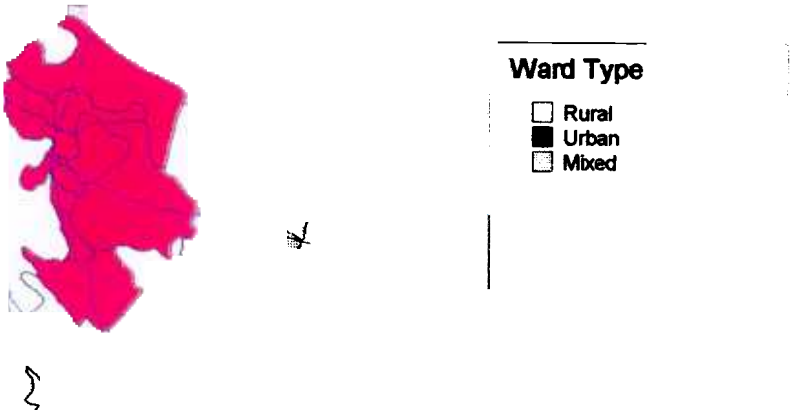
Similar analyses for Mwanza and Shinyanga Regions were not possible because of the lack of maps which would enable the estimation of the area of individual wards. Nevertheless Map 4 and Table 9 illustrate similar patterns in Mwanza District to those observed for Dar es Salaam, in that a large proportion of the district area is classified as rural, and the human population is concentrated in the urban wards which are clustered tightly around the city centre. Casual observation of settlement and land use patterns within Shinyanga District point to similar patterns.

Table 9. Distribution of land and population by ward type, Mwanza District.

	Ward type			
Area	**Rural**	**Mixed**	**Urban**	**Total**
Area (km^2)	167.7	31.3	58.9	258
Area (%)	65	12	23	100
Population (persons)	67,169	19,994	135,851	223,014
Population (%)	24	5	71	100

These simple, preliminary analyses again highlight the fact that urban areas are not uniform in terms of population density or land use, and that within the municipal boundaries of the three urban areas under consideration there exist relatively large areas with the 'rural' characteristics of low population density and a preponderance of agricultural land use. This potential availability of nearby land for food production is clearly of great importance to the discussion of peri-urban and urban food production and food systems.

Map 4. Distribution of wards by type, Mwanza District.



Does this kind of analysis help to locate, even if only in a most approximate way, something that can legitimately be considered as the peri-urban zone? If the essence of peri-urban is that it is transitional, exhibiting both urban and rural characteristics, then both the spatial distribution of ward types and average population density in Dar es Salaam indicate a zone of transition between the high density, urban city centre (i.e. within a radius of 20 km) and the low density, rural areas beyond a 40-50 km radius. This is esentially the same zone in which Briggs (1991) studied changes in agricultural land use. In the case of Mwanza and Shinyanga the inner edge of the zone of transition is considerably closer to the city centre, and the zone itself may be relatively less wide.

In the analyses which follow special attention will be paid to the idea of this transitional area, and its implication in food production activities which result in the marketing and consumption of products in the adjoining urban area. In so doing it will be critical not to loose sight of the fact that the vast majority of the food consumed in the study areas is produced outside these transition zones, and in some cases, at very considerable distances, and that there are also numerous and varied food production activities within what would by any classification be considered urban areas.

The Dar es Salaam milk system

Background

Providing an adequate supply of fresh milk to the residents of Dar es Salaam has proved to be problematic from the early years of the present century. The intensity of the problem has alternated between chronic and acute, and it has at times, for example during the 1948-1950 'milk crisis', been a major concern of municipal and national officials (TNA 33288, Docs. 28 & 70). Succeeding governments have taken a variety of steps to increase the quantity and improve the quality of milk available in the city, including, for example, the establishment of their own production and processing units (in 1921, 1949 & 1975), alienation of land for private dairy producers, large-scale importation of milk and milk powder, establishment of dairy boards and marketing orders, and the construction of modern processing facilities (see Table 10 for a listing of key events in the development of the Dar es Salaam milk system). Government policy and programmes since the 1920s as they relate to the milk and dairy situation in and around Dar es Salaam can be usefully seen in terms of four phases (Table 11). It is also important to note that despite the different policy approaches which characterise these phases, over most of this period the problem of Dar es Salaam's milk supply has been consistently described and discussed in terms of a limited number of key themes, including the low level of management practised by local producers, poor sanitation and resulting risks to public health, demand in excess of supply, difficulties arising from the predominance of direct marketing and the need to develop peri-urban areas specifically for dairy. Most of these themes are as central to today's discussion as they were in the early years of the British mandate.

In the sections which follow each of these phases and themes will be described in some detail in order to set the stage for an analysis of the present situation.

Table 10. Key events in the Dar es Salaam dairy system.

Date	Event
1890s	Ice cream reportedly manufactured in Dar es Salaam (Koponen 1994:452)
1913	Land set aside on the outskirts of Dar es Salaam to assure food supply to city dwellers (Koponen 1994:631)
1921	Establishment of government dairy farm at Temeke to supply city and provide model of modern unit
1928	First discussion of setting a legal standard for milk fat content
1948	'Crisis' in Dar es Salaam milk supply
1948	High incidence of positive TB reaction among Dar es Salaam dairy cattle: 'The danger therefore of tuberculosis being excreted in the milk is a very real one' (TNA 33288, Doc. 23A)
1948	Colonial Office questionnaire on 'Urban Milk Supplies'
1949	Dairy established at Kingolwira Prison (Morogoro) to help supply Dar es Salaam - milk shipped by rail
1949	C.D.C. proposal to develop large scale dairy farm (9,000+ acres) in Ruvu area specifically to supply Dar es Salaam
1948-1950	Over 4,000 acres of land near Dar es Salaam alienated specifically for dairying
1950	Six dairies making daily house-to-house deliveries to 1,000 customers in Dar es Salaam
1951	C.D.C. proposal withdrawn amid doubts about the level of tsetse challenge in Ruvu
1952	'Dar es Salaam Dairy Farmers Association' lobbies for increase in milk price after the price of cotton seed cake is decontrolled
1952	Ten 'approved' (i.e. registered) dairies serving Dar es Salaam, in addition to 45 other dairies selling on small quantities (total milk = 1,500 gal/day)
1955	Temeke Dairy stops house-to-house delivery
1956	Temeke Dairy hands over delivery to 'Express Dairy'
1957	FAO mission to assess milk production potential in Tanzania
1958	Temeke Dairy and Kingolwira Dairy are closed
15.5.1962	Chapter 456, Ord. 1961 No. 61 - 'An Ordinance to make provision for the Dairy Industry and for the Marketing of Milk and Milk produce and to amend the Food and Drugs Ordinance' - enabled the establishment of regional Dairy Boards or Dairy Authorities
1963	Dairy Industry Regulations, 1963 - providing for the licensing of dairies
1963	The Dairy Industry (Establishment of Dar es Salaam Dairy Board) Order, 1963
1960-1962 ?	Dar es Salaam city council proposes 6,000 gal/day capacity dairy plant
1965	UNDP/FAO 'East African Livestock Survey' - consultant recommends establishment of a pasteurising plant with a capacity of 3,000 gal/day 'which could handle the milk supplied by the farmers within the 15 mile radius'
4.2.1966	Dairy Industry Act, 1965 - providing for the establishment of a National Dairy Board to take over form regional boards
23.8.1968	The Dairy Industry (Dar es Salaam Dairy Board)(Dissolution) Order, 1968
28.11.1969	The National Dairy Board (Control of Marketing) (Coastal Zone) Order, 1969 - all milk within Dar es Salaam area, Kisarawe District, Bagamoyo District, Mzizima District must be sold to 'Coastal Dairy Industries Limited'
1970	'Coastal Dairy Industries Limited' open for business
1974-79 (?)	Dairy Phase I Project (IDA Loan 580-TA)
1974	Tanzania Livestock Development Authority (LIDA) established by Act of Parliament No. 13 of 1974
1975	Tanzania Dairies Limited (TDL) established by LIDA, and takes over assets of Coastal Dairies
1975 ?	Tanzania Dairy Farming Company (DAFCO) established

Date	Event
1974-1979	WFP TAN 22471 Phase I, Dairy Development Project, with a large-farm orientation
1983	New Livestock Policy included a shift of emphasis to smallholder dairy and away from large scale units
1984-1992	WFP TAN 22471 Phase II, Dairy Development Project, changed to a smallholder orientation
1988	Milk price decontrolled
1994	30% of dairy cows tested around Dar es Salaam were positive for Brucellosis
1995	Begin privatisation of DAFCO, TDL, etc.
1995	TDL plant in Arusha closes its doors
1995	'Coastal Dairy Farmers Association' (CODAFA) is officially registered
1995	'Milky Foods' is established in Mwenge

Table 11. Four phases of government dairy policy as they relate to Dar es Salaam

Phase	Primary role played by government
1920 - 1958	direct production beside an emergent private sector, training, demonstration and land alienation to foster private sector production
1960 - 1974	regulation of private sector initiatives and expansion of milk supply
1974 - 1984	direct production on large farms and monopoly control of processing and marketing
1985 - 1996	de facto withdrawal from nearly all production, processing, marketing and regulation functions

1920 - 1958

Direct government action in relation to the Dar es Salaam milk supply dates to 1921 and the establishment of the Temeke Dairy Farm, located on the grounds of the Central Veterinary Laboratory approximately 5 km from the centre of the city. In addition to providing a sanitary supply of milk to the hospital and to European and Asian residents, the farm with its nucleus herds of Ayrshire and Holstein cattle was meant to serve as a training and demonstration site. Early experiments at upgrading local stock gave promising results: '25 (cross bred) bulls are now in the hands of Dar es Salaam and Bagamoyo cow keepers and quite a number of half-bred and quarter-bred are in milk, and show signs of proving a success (DVSAH 1926:122) and, 'in the hands of coast dairymen, Indians, Arabs, Syrians, etc., the introduction of European blood is a success' (DVSAH 1927:37). With the completion of the model farm in 1928, the objective was to 'demonstrate that high standards of efficiency and hygiene were not necessarily obtainable only at prohibitive capital cost' (DVSAH 1928:14).

By 1934 the Temeke Dairy was producing approximately 40,900 litres (9,000 gal) of milk annually and there were reported to be 'about 40 non-native dairymen' in and around Dar es Salaam. However, the government's enthusiasm with the progress of the private farmers had clearly waned, as is illustrated by the comments of one Veterinary Officer: 'With few exceptions the manner in which milk for human consumption is produced beggars description. Animals are milked for the most part under the filthiest conditions imaginable. A determined effort is to be made to compel dairymen to conform to the township rules to improve their methods. Persuasion has signally failed to affect any improvement' (DVSAH 1935:33). This

signals the beginning of the long-running concern with health and sanitation issues relating to the Dar es Salaam milk supply. Other themes also began to emerge, such as the idea that milk production around Dar es Salaam was just so profitable that 'in many instances farmers are inclined to starve their calves' (DVSAH 1938:44). This was despite the fact that 'gradually the fresh milk trade of the larger townships, or at any rate the part that is concerned with supplying non-natives, is coming into the hands of Europeans who, on the whole, are better qualified than natives to supply a wholesome product' (DVSAH 1937:21).

During the mid-1940s, with Temeke Dairy producing 122,700 litres (27,000 gal) of milk annually, the notion had become well established that there is a large unmet demand for milk in Dar es Salaam and other large towns. Studies were undertaken of urban milk supplies in general (TNA No. 12342), and specifically to determine why the private sector did not step in to meet this demand, and government put forward proposals for the construction of 'communal dairy sheds to enable dairy men to attain and adhere to hygienic standards' and the reservation of grazing lands for dairy herds near towns (DVSAH 1943:17).[3] Attention began to shift to the possibility of using the grazing land along the Ruvu River Valley, approximately 65 km west of Dar es Salaam, specifically for dairy production. This interest culminated in 1949 with a Colonial Development Corporation (CDC) proposal to develop a large-scale mixed farm, to include dairy, on 10,100 hectares (including 9,000 acres of Ruvu River floodplain). It is interesting to note that CDC's one major stipulation was that the proposal was 'subject only to the enactment and enforcement of strict legislation governing quality standards of grading and labelling milk products' (TNA No. 40511/8). This would appear to be an early recognition of a problem that was to plague Tanzania Dairies Ltd. (TDL) in later years: it is difficult for a modern dairy processing plant to compete and survive if some producers are allowed go directly to the consumers with raw, uninspected milk. The CDC proposal was withdrawn in 1951 amid doubts by local veterinary staff concerning the level of tsetse challenge in the Ruvu area, but in the meantime the government itself acted to increase the Dar es Salaam milk supply with the establishment in 1949 of dairy farm at Kingolwira Prison in Morogoro. Milk from this farm was pasteurised and cooled in Morogoro and shipped to Temeke by train for bottling and delivery. However, even with Kingolwira Dairy supplying Dar es Salaam with an additional 240,900 litres (53,000 gal) per year by 1953, the shortage persisted.

By the mid-1950s some improvement in the standard of local dairy producers was observed, partly, it was reported, in response to the DVSAH extension services. Nevertheless, even following the importation of more grade cattle from Kenya, the levels of production did not increase, a fact attributed to poor management and the difficult climate around Dar es Salaam (DVSAH 1954 & 1956). In 1957 there was an FAO mission to assess milk production potential and only one year later it was reported that 'private farms can now meet the demand for milk in Dar es Salaam' (DVSAH 1958), estimated at 2.7 million litres per year (600,000 gal) (DVSAH 1959). Consequently dairy production at Temeke and Kingolwira Farms was finally stopped in 1958 following the handing over of Temeke's milk delivery activities in 1956 to the privately owned 'Express Dairy'. An additional stimulus for the closure of the

[3] In is interesting to note that the idea communal or group action remains an element of the discussion of peri-urban livestock development in Africa (see de Waal 1995).

Kingolwira farm was 'a growing aversion on the part of consumers ... on account of its being pasteurised' (DVSAH 1955:25). This preference for non-pasteurised milk remains to the present day (Kurwijila et al. 1995:19).

Thus, by 1960 government had withdrawn completely from milk production, processing and marketing, satisfied that these functions were being pursued by private operators. It had apparently achieved its objective of ensuring an adequate supply of milk to the city through the private sector, and in the subsequent period focused on the regulation of these dairy enterprises in order to ensure both the public health and the further development of the dairy industry.

1960 - 1974

In fact, government had taken very tentative steps to establish a regulatory framework for the Dar es Salaam dairy producers some years earlier. For example, in 1928 samples were taken from local herds with the intention (subsequently abandoned) of standardising the butter fat content of milk supplied to townships (DVSAH 1928:36), and by 1952 some dairies were 'approved' (i.e. registered by the municipality), while others were not (TNA File 33288 Doc. 253). Nonetheless, a more formalised system began to take shape with the 1961 ordinance (Chapter 456, Ord. 1961 No. 61) that allowed for the establishment of Regional Dairy Boards or Dairy Authorities, and the Dairy Industry Regulations of 1963 which provided for the licensing of all commercial dairies. Three Regional Dairy Boards were eventually established covering Arusha/Kilimanjaro, Mara and Dar es Salaam: the Dar es Salaam board was created in 1963 through the Dairy Industry (Establishment of Dar es Salaam Dairy Board) Order, and included representatives of producers, distributors, consumers and government. Three years later, however, the FAO East African Regional Livestock Survey commented that only the Arusha/Kilimanjaro board appeared to be functional (FAO 1967:167). In any case the Dairy Industry Act of 1965 provided for the establishment of a National Dairy Board to take over from the regional boards, and the Dar es Salaam board was formally wound up in 1968 with the Dairy Industry (Dar es Salaam Dairy Board)(Dissolution) Order. As initially constituted a majority of members on the National Dairy Board (7 of 11) were to be representatives of the dairy industry (ibid). The last major piece of legislation affecting dairy production in and around Dar es Salaam was the establishment of a market order in 1969 (The National Dairy Board [Control of Marketing] [Coastal Zone] Order) which required that all milk within the Dar es Salaam area, defined as the municipality plus Kisarawe, Bagamoyo and Mzizima Districts, must be sold to 'Coastal Dairy Industries Limited'.

In 1962 the Dar es Salaam milk market was estimated to be in the range of 11,366 litres per day (Kofoed 1962:4) while by the mid-1960 the estimate was 13,600 litres (3,000 gal) per day, of which 70% was produced in and around the city and 28% imported as pasteurised milk from Kenya (Table 12). Most producers were reported to be members of Dar es Salaam Co-operative Creameries, but 60% of the milk was sold by the producers directly to consumers with only 40% being delivered to Express and Karala dairies where it was bottled (but neither cooled nor pasteurised) for delivery (FAO 1967:194). It is important to note that at this point milk consumption in Dar es Salaam was highly skewed: while the city's population was approximately 50% African, they were estimated to consume only 10% of the milk

(Kofoed 1962:6; FAO 1967:173). With an estimated average consumption of 0.01 litres per day amongst the African population of the city, which was thought to be totally inadequate, plans for more fundamental changes to the Dar es Salaam dairy industry began to emerge.

Table 12. Sources of milk moving into the Dar es Salaam market, 1966

Source	Quantity (litres/day)
Dar es Salaam dairy farms:	
24 main producers@ 80 gal/day each	8,728
35 smallholders @ 8.5 gal/day each	1,354
Shipped from Iringa producers	318
Shipped from Bagamoyo producers	(some)
Imported from Kenya	4,091
TOTAL	**14,456**

Source: FAO (1967:194)

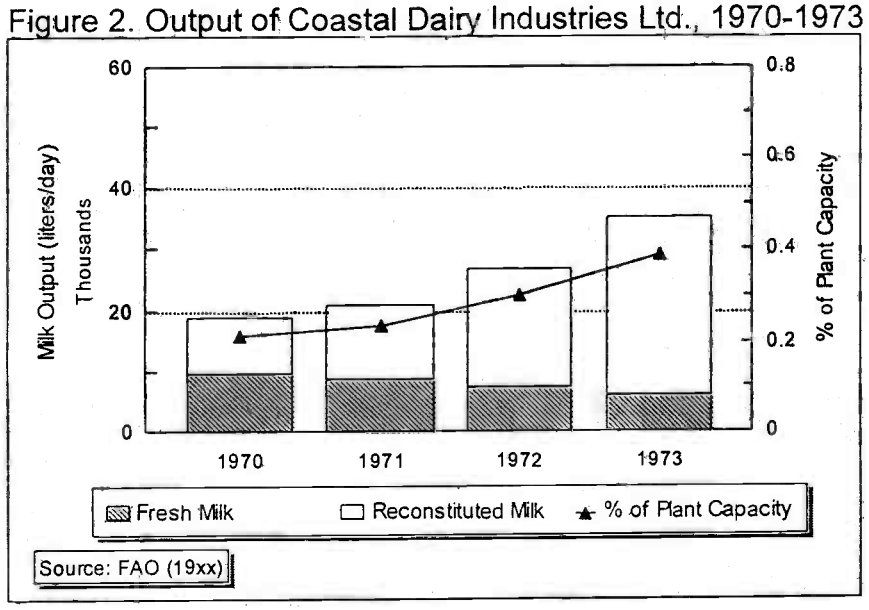
A 1962 FAO study entitled 'Dairy Survey in the Dar es Salaam Area' recommended a dairy processing plant with a capacity of 40,000 litres per day that would primarily function to reconstitute dry milk powder, but would also take in fresh local milk and handle bulk milk imported from Kenya (Kofoed 1962). Earlier the Dar es Salaam Co-operative Creameries had proposed a plant with a capacity of 6,000 litres per day to pasteurise and distribute locally produced milk (ibid). The Dar es Salaam city council subsequently proposed to construct a plant which could process 27,000 litres (6,000 gal) per day of local fresh milk. Another FAO study undertaken in 1965 as part of the East African Livestock Survey pointed out that as only 9-13,000 litres (2-3,000 gal) could be supplied from within a 24 km (15 mile) radius of the city, if the plant were to run efficiently it would have to rely for some years on whole milk imported from Kenya or other areas of Tanzania (Nielson 1966). It was in this light that the FAO consultant recommended that the plant be initially constructed with a capacity of 13,600 litres (3,000 gal) of fresh milk per day, with additional capacity to be added as warranted by increased local production (ibid). However, the main report of the East African Livestock Survey subsequently identified the construction of a plant that would reconstitute dry milk powder as the option with 'greatest appeal' (FAO 1967:174). These various proposals reflect two fundamentally different approaches: one saw the objective primarily in terms of increased milk consumption and, in effect looked to a reconstituting plant as a means to increase consumption by substantially increasing the supply of low priced milk. The other approach, as outlined by Nielson and the members of the Dar es Salaam Co-operative Creamery, saw the construction of the dairy processing plant as a next logical step in the continued development of the local dairy industry, and therefore sought a plant capacity in line with reasonable estimates of future local production.

In the event the decision was made to construct a reconstituting plant of even larger capacity, and indeed the production and distribution of reconstituted milk eventually became the central pillar of government's efforts to supply milk to Dar es Salaam. The new plant, built with the assistance of the Swedish government on the site of the Tanzania Co-operative Creameries depot in Ubongo, opened in 1970 as 'Coastal Dairy Industries Limited' with an installed capacity of 90,000 litres per day. While the company was in effect owned by government, a representative of the local

milk producers sat on the board of directors. Coastal Dairy Industries had a fleet of 14 lorries for distribution of milk to individual customers and private shops, and also sold milk through its own chain of 14 retail kiosks where it was estimated that 50% of the milk was consumed 'on the spot' (ISCDD 1975:42).

The bulk of the fresh milk going to the plant originated from approximately 20 predominately Asian and Arab producers within a radius of 65 kms of Dar es Salaam. In 1970, the first year of the plant's operation, the intake of fresh milk reached 9,000 litres per day (i.e. 60-70% of local production). The subsequent decline in fresh milk intake (Figure 2) was blamed on a lack of collection facilities (ISCDD 1975:42). Despite this decline the plant increased its production of reconstituted milk with powder imported from Kenya, although even by the end of 1973 it was operating at only 40% of its capacity. It is interesting to speculate about other possible causes of the relatively low levels of local milk taken in by the plant. Were the difficult conditions under which milk was produced around Dar es Salaam incompatible with the reduction in price received by producers when selling in bulk to a processing plant with large overheads? Was the continued existence of commercial dairying dependent upon the higher prices received through direct marketing to consumers? The 'problem' of direct marketing of milk had certainly been cited earlier: in 1949, for example, it was reported that 'black market operations' charged up to four times the 'normal price' for milk (TNA 33288, Doc 102A), and this must also have been behind CDC's attempt to insist on much stricter legislation of quality standards and grades.

Figure 2. Output of Coastal Dairy Industries Ltd., 1970-1973



At the close of this phase in government's attempts to ensure an adequate supply of milk to Dar es Salaam there existed a legal framework which, in principle, was sufficient to regulate the production and marketing of milk, but which was apparently ignored by, or irrelevant to most local producers. Even the group of emerging commercial dairymen, which government had previously seen as the obvious source for increased milk supplies, seems to have found it increasingly difficult to live with the constraints of the milk marketing order. At the same time the commitment to a policy of greatly expanded supply based on the reconstitution of imported powdered

milk upset the balance of the whole system by focusing official attention firmly on the processing function and away from local production.

1974 - 1984

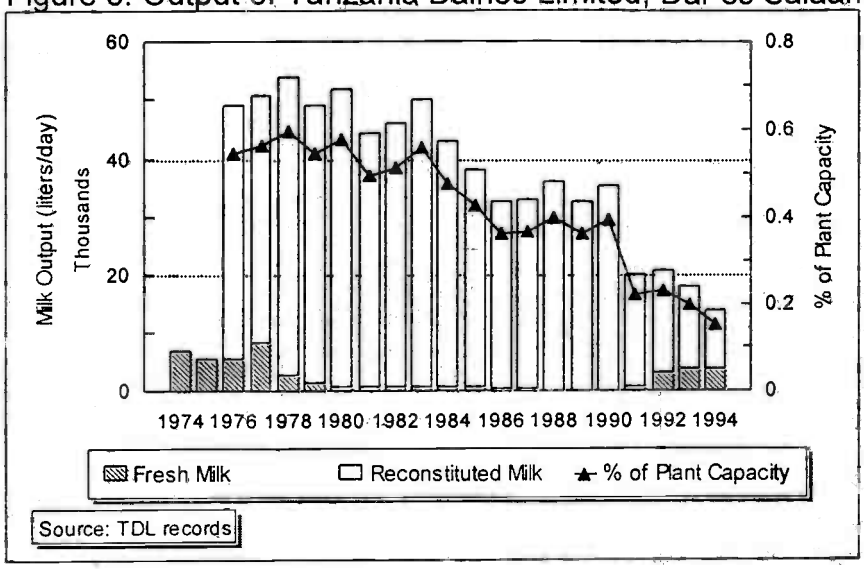
Major economic and social policy decisions taken in the early 1970s set the stage for the next phase in government's intervention in the Dar es Salaam milk supply. Specifically, moves toward direct state involvement in large-scale agricultural production on the one hand, and the advent of centralisation and state control of distribution on the other, created the context in which milk was supposed to be produced, processed and marketed in the city. This context also set the limits within which dairy development was discussed, and reports covering this period, and indeed for a number of years after it, are focused almost entirely on the performance of parastatal enterprises.

A watershed was the establishment of the Livestock Development Authority (LIDA) by Act of Parliament No. 13 of 1974. LIDA went on to establish Tanzania Dairies Ltd. (TDL) and Tanzania Dairy Farming Company (DAFCO) in 1975. TDL took over the operation of Coastal Dairy Industries Ltd. and four other dairy plants scattered throughout the nation, while DAFCO took over or established seven large dairy farms comprising over 40,000 hectares in total. The Ruvu Farm supplied milk to the TDL plant in Dar es Salaam. In addition the National Farming Company (NAFCO) also produced milk on some of its large farms, including the farm in Bagamoyo which also supplied milk to the Dar es Salaam plant. Much of the investment needed to implement the ambitious programmes associated with these policies was provided through the Dairy Phase I Project in the form of an International Development Association (IDA) loan. Another important source of finance was the WFP Dairy Development Project (TAN 22471) which was designed to generate funds for investment in dairy development through the sale of skimmed milk powder and butter oil to TDL for reconstitution and sale as 'toned milk' in urban markets. Between 1996 and 1985 WFP pumped 390 billion shillings into dairy development projects nation-wide (Mtumwa & Tesha 1996:14-23).

During this period the composition and role of the National Dairy Board also changed. The board was enlarged to 13 members in 1967 and 15 members in 1970, but eventually the board's members were not re-appointed and for all intents and purposes it ceased to function (although the statute establishing the board was never repealed). In effect, the role of the National Dairy Board was taken over by LIDA and then TDL, which held what was virtually an official monopoly on milk processing and marketing.

Fresh milk has never made up a significant proportion of the throughput of TDL's Dar es Salaam plant. While in 1976 there was a slight increase in the intake of fresh milk, it subsequently declined sharply (Figure 3). Throughout the period in question the bulk of fresh milk received at the plant originated from the DAFCO and NAFCO large-scale farms: private milk producers in and around Dar es Salaam delivered relatively small quantities of milk to the plant. In any case, the plant's primary role continued to be the reconstitution of WFP milk powder and butter oil, the output of which declined from a high in 1978 of 50,000 litres per day to less than 40,000 litres in 1985.

Figure 3. Output of Tanzania Dairies Limited, Dar es Salaam plant, 1974-1994



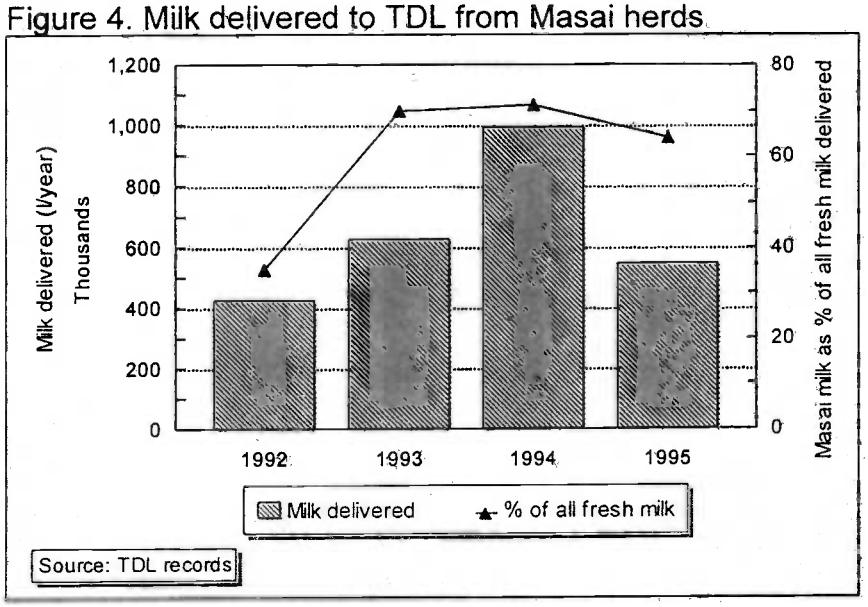
By the mid-1980s government was forced to re-evaluate the large-scale farming policy and its own role in production activities more generally. Production and productivity of the parastatal farms never achieved projected levels, and economic and political pressures for liberalisation resulted in shifts in livestock policy. The 1983 Livestock Policy acknowledged three sources of milk: traditional herds, large-scale farms and smallholders, with the latter two using grade animals. While the large-scale farms (public and private) were still seen as cornerstones of dairy development, the policy stated explicitly that 'emphasis will be given to the development of smallholder dairying on the periphery of urban areas where conditions are suitable for milk production' (Ministry of Livestock Development 1983:15). It is important to note that the momentum toward liberalisation was not overwhelming, as indicated by the fact TDL retained the sole right to import milk processing equipment and to erect and operate milk processing plants (ibid:17).

1985 - 1996

In the subsequent years emphasis on the smallholder dairy sector only increased. While this was in part a conscious policy decision it can also be seen simply as an acknowledgement of the failure of the earlier policy, institutional and regulatory frameworks: throughout the period of large-scale farming, private dairy farmers around Dar es Salaam continued to produce and market fresh milk in significant quantities, largely disregarding the milk marketing order. Donors stepped in to support the general thrust of government policy as evidenced, for example, by the shift in focus of the WFP Dairy Development Programme after 1984, when smallholder dairy production and production in peri-urban areas received increasing attention (Mtumwa & Tesha 1996:5). For its part government suspended the pan-territorial pricing policy for milk in 1988, and in so doing bowed to the reality of the persistent disregard of the milk marketing order in the formn of direct marketing from producers to consumers. In the event this had little positive impact on the quantity of fresh milk delivered to the TDL plant in Dar es Salaam as the price offered to farmers was not increased significantly.

As the programme of economic liberalisation and structural adjustment gained momentum parastatals such as TDL and DAFCO become increasingly marginal. Milk deliveries from large-scale farms dropped to near zero during the period 1988-1990, and by 1991 total output of the TDL plant was only at 20% of capacity. Dairy producers in and around Dar es Salaam continued to use TDL as a buyer of last resort, accepting its relatively low price only when increased production and decreased consumption during the rainy season made direct marketing more difficult. It is interesting to note that since 1992 a major source of fresh milk delivered to the Dar es Salaam plant has been Masai herds kept near Chalinze in Coast Region, 110 km west of the city on the Morogoro road (Figure 4).[4] There is something ironic in the fact that after decades of haranguing to the effect that East African pastoralists should manage their livestock on a more rational and economic basis, TDL limps into receivership supplied only by pastoral herds, whose owners now quite willingly supply the buyer of last resort with relatively low quality milk.

Figure 4. Milk delivered to TDL from Masai herds

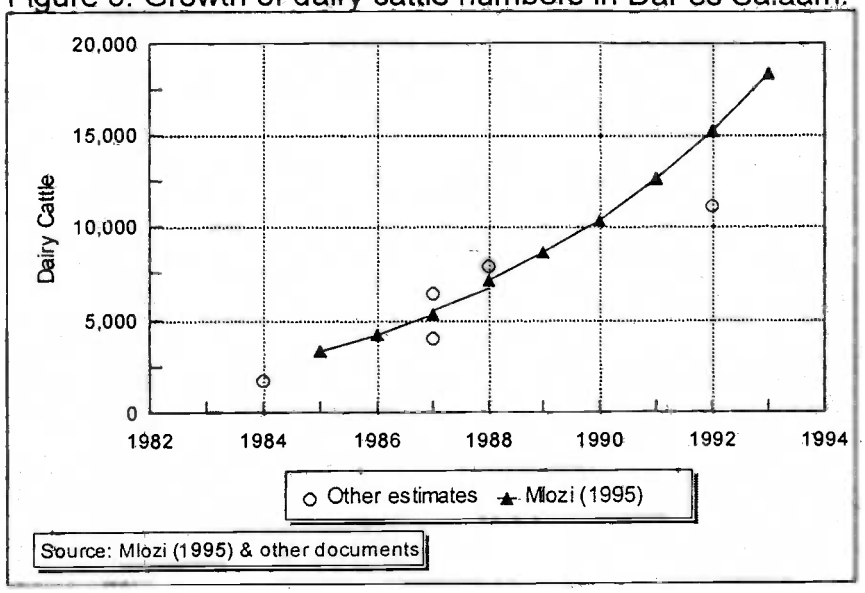


The years following 1985 saw the emergence of another phenomenon which, irrespective of government policy or programmes, had a most significant impact on the Dar es Salaam milk scene. Over the last 15 years there has been a dramatic increase in the number of grade dairy animals kept within the city limits (Figure 5).[5] These animals are owned largely by high and mid-ranking civil servants and are housed within their residential compounds in the city's low and medium density residential areas. This 'indigenous' dairy development initiative, which will be explored in more detail in later sections, has taken place largely outside the realm of government policy, and indeed in many cases contravenes municipal regulations, yet makes a significant contribution to the city's milk supply (Kurwijila et al. 1995).

[4] This trade in Masai milk is dependent on a handful of independent traders who purchase milk from the producers and transport it by private vehicle to the TDL plant in Dar es Salaam.

[5] Caution must be exercised with cattle populations data such as these, because in many cases they simply represent the product of a base population estimate and an assumed annual growth rate. Nevertheless, estimates from several sources appear to confirm the trend and approximate size of the herd.

Figure 5. Growth of dairy cattle numbers in Dar es Salaam.



As of August 1996 TDL is officially in receivership and DAFCO is being privatised. The void left by the disappearance of these organisations and the opportunities created by the new economic climate is beginning to entice other individuals and organisations to invest in dairy production and processing to serve the Dar es Salaam market. In this new environment government now sees its role as limited to regulation, research, monitoring, extension and service (Ministry of Agriculture 1993:7). However, the demise of TDL and the milk marketing order, and the consequent importance of direct marketing, means that there is presently no system in place by which the quality or quantity of milk coming into Dar es Salaam is monitored. Thus, at present government policy in relation to the Dar es Salaam milk supply can be seen as an acknowledgement of a reality that cannot, at least for the time being, be controlled, regulated or even monitored.

Summary

The years since the establishment of Temeke Dairy Farm in 1921 have seen undreamed of change, in the size and composition of Dar es Salaam's population, in the life styles and food consumption patterns of its inhabitants, and in the economic and political context within which they choose to produce and/or consume dairy products. The previous sections have illustrated the variety of policies and programmes through which government sought to assure an adequate supply of milk to Dar es Salaam in the face of these changes. These policies have moved from strategic government intervention in order to foster the development of the private sector, to direct, large-scale involvement in production and processing, to the virtual disappearance of government in relation to dairy production, processing, marketing and regulation that is seen today. Throughout these changes small-scale farmers in and around Dar es Salaam have continued to produce and market fresh milk largely outside, or despite, government's attempts at legislate and regulate.

Recent years have also seen the re-emergence of some old themes. For example, the idea that dairy cattle in and around the city pose a threat to public health was highlighted again in 1994 as a sample of dairy cattle showed 30% positive for

Brucellosis (Ramakhula 1994), which can be compared with six herds which were tested in 1948 and showed between 20% and 73% reactors (TNA No. 33288, Doc. 23A). Other public health concerns have been raised, particularly with the increase in the number of urban cattle. Various authors have pointed to increased health risks such as tetanus and traffic accidents, and the health and environmental problems associated with improper manure disposal (Tukay 1990; Mlozi et al. 1989; Mlozi 1995). One of the most persistent themes in the discussion of the Dar es Salaam milk system relates to the role the city's peri-urban area might play in increasing milk supplies. Several moves have been made specifically to increase milk production in the peri-urban area, including the setting aside of grazing areas, the alienation of over 1,600 hectares specifically for dairy and the Ruvu Valley initiatives. Indeed today the work of one development organisation specifically targets peri-urban dairy producers (Auerböck et al. 1993; AustroProject Association 1996). Nevertheless, enthusiasm for greater peri-urban dairy production has not been universal. Over the years serious questions have been raised concerning such a peri-urban strategy based on considerations such as the level of tsetse challenge and the general agro-climatic conditions (TNA No. 40511/8). The question has been whether under conditions of high tsetse challenge, high temperature and humidity, and a not insignificant dry season, commercial dairy production could ever be economic. A number of observers have insisted that it would make more sense to produce milk in the cooler, wetter, higher altitude areas of Tanzania, and invest in the infrastructure needed to transport it to the Dar es Salaam market. The fact that there have always been a small number of commercial dairy producers in the peri-urban area cannot necessarily be taken as an indication of future profitability or untapped development potential. By and large these producers have relied on the higher returns associated with direct marketing strategies. Milk production in Dar es Salaam's peri-urban zone is yet to prove itself viable in supplying bulk milk to a competitive and efficient processing facility. These are among the issues which are explored in the sections which follow.

Present structure

Cattle distribution and herd characteristics

As indicated in the previous section the number of grade dairy cattle within Dar es Salaam Region has increased dramatically over the last ten years (see Figure 5). There are now estimated to be upwards of 18,000 dairy cattle in the urban area (Mlozi 1995:65) and perhaps an additional 5,000 dairy cattle in adjacent areas (Map 5).

Milk is supplied to Dar es Salaam from grade cattle located in three areas: near to the city centre, at the periphery of the metropolitan area, and as far away as Bagamoyo (70 km) and Iringa (500 km). Of the grade cattle in and around the city, 75% are located within the Dar es Salaam Region while 25% are located in adjacent districts of Coast region (Table 13). The distribution of grade cattle outside the city is closely related to the form of the existing road network, with significant cattle populations in Kibaha along the Morogoro road and also in Bagamoyo.

Map 5. Distribution of dairy cattle in and around Dar es Salaam

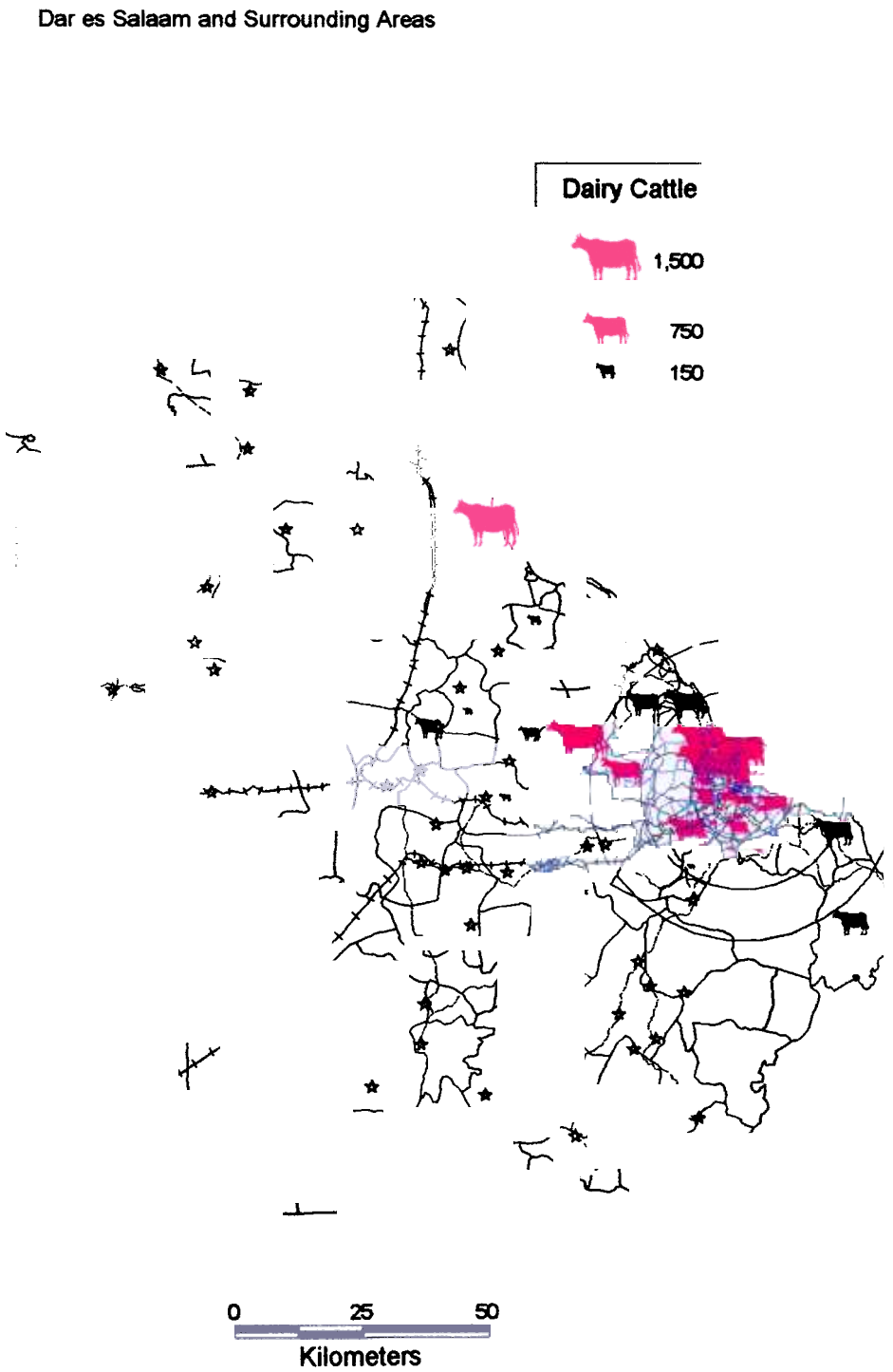


Table 13. Regional distribution of dairy cattle and owners.

	Cattle		Owners	
Region	no.	%	no.	%
Coast	3,506	25	236	16
Dar es Salaam	10,332	75	1,262	84
Total	13,838	100	1,498	100

Source: District rinderpest lists from 1992 and other lists of cattle owners.

Cattle are located in wards classified as urban, rural and mixed, with over 40% of animals and 60% of owners located in urban wards (Table 14). The distribution of dairy cattle in relation to human population density of the individual wards is shown in Table 15. Approximately half of the cattle and 24% of the owners are located in areas with a population density less than 500 persons per km^2 which would, in general, correspond to rural wards in Dar es Salaam region and rural and mixed wards in Coast region. At the other end of the scale, 20% of cattle and 29% of owners are located in areas with a human population density greater than 5,000 persons per km^2.

Table 14. Distribution of dairy cattle by ward type

	Cattle		Owners	
Ward type	no.	%	no.	%
Rural	3,535	26	226	15
Mixed	4,541	33	347	23
Urban	5,762	42	925	62
Total	13,838	100	1,498	100

Table 15. Distribution of dairy cattle in relation to human population density.

Midpoint of population density class	Dairy cattle		Cattle owners	
persons/km^2	no.	%	no.	%
50	4,777	35	274	18
300	1,765	13	90	6
750	1,243	9	196	13
3,000	3,286	24	483	32
7,500	728	5	141	9
18,500	2,039	15	314	21
Total	13,883	100	1,498	100

While herds range in size from 1 to over 300 head, grade cattle are predominately held in small herds, with the average herd size being ten. Overall, 50% of cattle owners have fewer that five animals. The distribution of dairy cattle amongst owners is such that 50% of the herds account for only 13% of all the animals, while the 16 largest herds (approximately 1.1% of all herds) account for 20% of the animals (Figure 6). Maximum herd size increases with decreasing population density, and average herd size is significantly lower in high density areas than in areas with lower population density (Table 16). This points to the existence of what are in effect specialised, commercial dairy herds in the peripheral, lower density areas which are in contrast to the small herds kept essentially as an economic sideline by urban dwellers.

Figure 6. Cumulative frequency distribution of dairy cattle and cattle owners

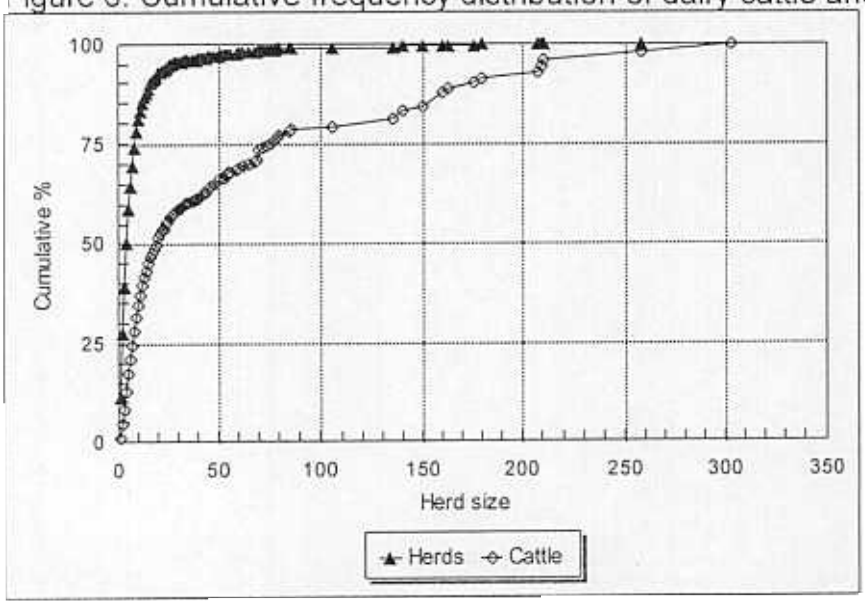


Table 16. Dairy herd characteristics, Dar es Salaam

Midpoint of population density class	Maximum herd	Minimum herd	Median herd	Modal herd	Mean herd	S.E. of mean
50	303	1	4	1	18 a	2.37
300	211	1	8	2	20 a	3.66
750	208	1	3	2	6 b	1.16
3000	176	1	5	2	8 b	0.57
7,500	21	1	4	4	6 c	0.38
18,500	106	1	4	2	7 d	0.49
Total	303	1	5	2	10	0.58
F- value	-	-	-	-	15.6	-
Prob. <	-	-	-	-	0.001	-

Means followed by the same letter are significantly different at $p < 0.05$ using Duncan's Multiple Range test.

The relationship between herd size and distance from the city is illustrated in Figure 7. While there is much variability, there is a tendency for larger herds to be located further from the centre. This point is also highlighted by considering the location of herds larger than 20 head, which represent only 7% of all herds but contain 48% of all the animals. These herds are more prevalent in areas with low population density, which are also those areas away from the city centre (compare Table 15 and Table 17).

Figure 7. Relationship between herd size and distance from city centre

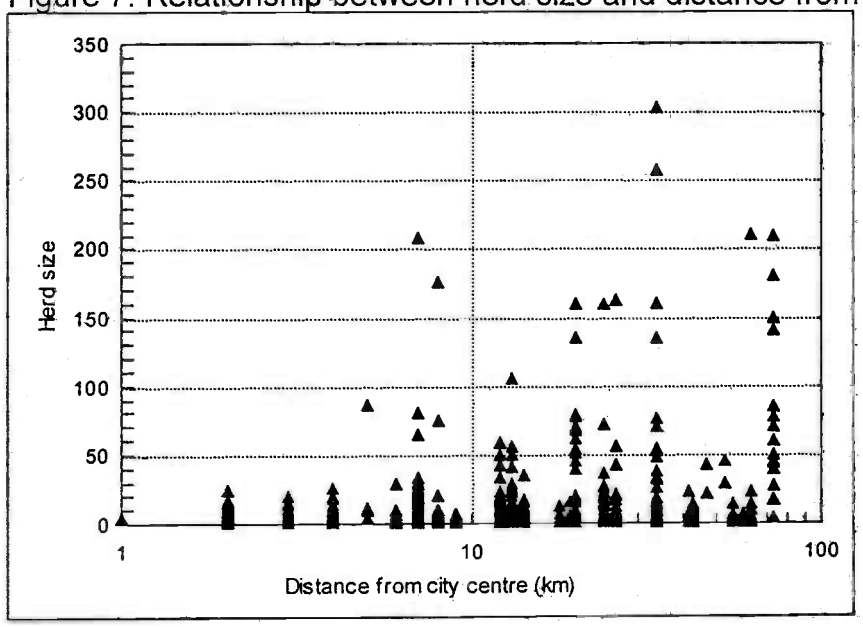


Table 17. Distribution of herds larger than 20 head in relation to human population density.

	Dairy cattle		Cattle owners	
Midpoint of population density class	no.	%	no.	%
50	3,681	55	46	43
300	1,256	19	19	18
750	401	6	6	6
3,000	883	13	22	21
7,500	21	0.3	1	0.9
18,500	478	7	13	12
Total	6,720	100	107	100

Milk supply and distribution

Kurwijila et al. (1995) estimated the daily inflow of milk into Dar es Salaam to be in the order of 50,000 litres as shown in Table 18. These authors built on the analysis of Auerböck et al. (1993) who distinguished between 'urban' and 'peri-urban' producers on the basis of whether or not they had 'grazing land' (p.9), and thus, almost by definition, peri-urban producers were located 'mainly on the outskirts of

the town of Dar es Salaam and Coast Region' (p.10).[6] This distinction results in cattle distribution figures which are in broad agreement with those presented in table 14, which indicate a population of approximately 8,000 cattle in rural and mixed wards and 5,700 in urban wards. It should be noted that these estimates of the milk supplied from different sources are based on assumptions concerning two major parameters, the proportion of the total population of grade animals that is in lactation at any given time, and the average daily milk yield per lactating cow. Estimates of available milk will be sensitive to changes in these key parameters.[7]

Table 18. Estimated daily inflows of milk to Dar es Salaam

	Milk supplied		Cattle	Owners
Source	litres/day	%	no.	no.
Peri-Urban	22,000	44	7,990	806
Urban	8,000	16	3,112	522
Masai	4,000	8	-	-
Others	2,000	4	-	-
Imports	14,000	28	-	-
Total	50,000	100	11,102	1,328

Source: Kurwijila et al. (1995) & Auerböck et al. (1993)

There are three major channels through which milk is distributed to consumers in Dar es Salaam, and these channels reflect to some degree the origin of the milk. Thus, milk produced in and around central residential areas is usually delivered by the producer (or more likely his or her employee) to nearby consumers, or picked-up by the consumers at the place of production. Larger producers in outlying areas deliver milk to institutional customers or sell it through kiosks and shops. This milk is transported to the city in small lorries and on public buses. There are more than 30 specialised milk kiosks in Dar es Salaam and many small, independent shops in residential areas also sell fresh milk and yoghurt. The sale of milk through kiosks is essentially monopolised by one individual who uses a network of 14 kiosks (some of which were originally established by Coastal Dairies and subsequently taken over by TDL) to sell milk produced on his own farm as well as milk shipped from Iringa and Tanga. These kiosks sell fresh, boiled and sour milk by the glass and litre. At the time of the field research they were engaged in a promotion whereby the purchaser of a glass of milk was offered a 'free' tea bag or spoon of coffee powder to flavour the milk.

As indicated in the section on the history of the Dar es Salaam milk system, the fact of producers by-passing official marketing channels and going directly to the consumers has been much lamented over the years. Even before the demise of TDL most producers disregarded the milk marketing order which requires all milk to be sold to TDL. Instead they have tended to market directly to consumers and use TDL as a market of last resort, a place to off-load the seasonal surplus milk. Over the last four years this trend has continued to the point where the rapidly growing

[6] The analysis of Auerböck et al. (1993) was based on the same rinderpest lists used in the present study.

[7] While a number of surveys of dairy producers in and around Dar es Salaam have been conducted, including Bangole (1988), Auerböck et al. (1993:47), Kurwijila et al. (1995), a full picture of herd structures and dynamics, breeding, production levels and marketing strategies is yet to emerge.

number of urban producers are supplying only the most negligible amounts of milk to the plant (Table 19). The increase in milk from mixed and rural wards reflects the contribution from Masai herds based near Chalinzi in Coast Region (also see Figure 4).

Table 19. Source of fresh milk delivered to TDL's Dar es Salaam plant.

	1992		1993		1994		1995	
Ward type	**litres**	**%**	**litres**	**%**	**litres**	**%**	**litres**	**%**
Urban	226,890	54	104,262	53	86,925	7	34,278	6
Mixed & Rural	193,627	46	93,268	47	1,097,991	93	584,312	93
Total	420,517	100	197,530	100	1,184,916	100	618,590	100

Source: Extracted from TDL records; 1995 data covers January-October only.

The motivation for this end-run around the marketing regulations is the substantial differential between the price offered to producers by TDL and the retail price (in December 1995 TDL was offering 140 Tsh/litre while the retail price in Dar es Salaam was approximately 400 Tsh/litre). The fact that producers and consumers are in relatively close proximity, and that individual producers have relatively small quantities to market on a daily basis, means that producers can effectively capture this substantial margin. This situation has persisted because TDL was either unwilling or unable to increase the price offered for fresh milk, despite the fact that since the abandonment of pan-territorial pricing for milk in 1988 it has had the right to adjust prices offered to producers to reflect local conditions.

Processing & manufacturing

Little of the milk consumed in Dar es Salaam is subject to any formal processing. Milk shipped from Iringa is pasteurised at the farm using the hofferisation process, milk from the co-operative in Tanga is also pasteurised before it is shipped, and all milk that passes through the TDL plant is pasteurised and toned. However, these three sources account for a relatively small proportion of all milk entering Dar es Salaam, the remainder of which is sold to the consumer either as fresh, boiled or soured. There is a sense from available studies that the largest proportion of liquid milk is boiled before consumption, which would go some way to protecting consumers against disease organisms carried in the milk. It is also important to note again the long-standing aversion to pasteurised milk on the part of Dar es Salaam consumers (DVSAH 1955:25; Kurwijila et al. 1995:19).

In recent years there have been several private initiatives in relation to milk processing and the manufacture of dairy products. Some of these plants rely solely on imported powder. One recently opened plant is based on equipment purchased from a non-operational dairy in Iringa. The plan is to produce cheese and yoghurt, and the plant has the capacity to receive and handle both up to 4,000 litres of fresh and/or re-constituted milk daily. However, all such initiatives face the same problem as TDL, in that unless direct access by the milk producers to the retail market is restricted (through a milk marketing order, health regulations, or consumer

preferences), the manufacturing plants are unlikely to attract sufficient quantities of fresh milk to make the exercise worthwhile.

Estimates of consumption and demand

There have been a number of attempts to estimate consumption of milk and milk products by residents of Dar es Salaam (Kofoed 1962 Kurwijila et al. 1995). Early estimates indicated that the members of the European and Asian populations consumed significantly greater quantities of milk per capita than Africans (Kofoed 1962), and if these estimates were correct, these two minority groups (25% of the population at the time) accounted for 88% of total consumption.

More recent attempts to estimate consumption have relied on either macro statistics or micro-level consumption surveys, and Kurwijila (1988) highlights the need to distinguish between estimates of per capita milk consumption and per capita milk supply. Most of the official estimates are in fact the latter. From a survey of 120 households in Dar es Salaam, Kurwijila et al. (1995) estimated that 80% consumed raw milk and that on average they consumed 7.9 litres per week. The other most commonly consumed dairy products were reported to be fermented milk (40% of households reported consuming an average of 4 litres per week) and UHT milk (24% of households reported consuming an average of 6 litres per week).

Kurwijila et al. (1995) then estimated a unmet demand for milk in Dar es Salaam in the order of 10,000 litres day, although the basis for this estimate is unclear. Official retail prices indicate that the relative price of fresh milk has risen somewhat faster that both maize and eggs (Figure 8), which may indicate that demand for milk is increasing faster than supply. This is in contrast to the situation found in Mwanza where the retail price of milk has fallen relative to the price of maize (Nyamrunda & Sumberg 1996).

Figure 8. Changes in retail price of milk, maize and eggs, 1990-1995.