Tanzania
Human Resource Development Survey

Additional Materials

by

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THE UNITED REPUBLIC OF TANZANIA

THE NATIONAL MASTER SAMPLE (NMS)

Technical Report

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FOREWORD

The National Master Sample (NMS) 1993 Technical Report is the second in the series, the first having been published during March 1991. Unlike the first report which covered only the rural part of Tanzania Mainland, the 1993 report includes both the rural and urban areas. Further, a discussion of the revision of the rural component of the NMS is dwelt on at length.

Effort to establish the urban component of NMS started in 1989 with a proposal of the sample design. The frame creation was pursued during the second half of 1990. The urban component of the NMS was used for the 1990/91 Labour Force Survey. Both components of the NMS were used for the 1991/92 HBS and Nutrition Module. AGSASU started utilizing the revised rural NMS during the 1991/92 crop season.

For the last ten years Mr. Hans Pettersson of Statistics Sweden has undertaken several short term missions on sampling issues. The missions pursued since 1988 have played a big role to shape the 1993 technical report. This technical assistance by SIDA through Statistics Sweden is gratefully appreciated.

Further, word of thanks goes to Mr G.M. Naimani, Lecturer in Statistics at the Department of Statistics, University of Dar es Salaam. As it was the case for the 1991 report, he has again played a key role in editing the manuscript.

We hope the readers of this second book in the series will find it to be a useful publication. We also encourage our readers to give us their suggestions in order to facilitate future improvements. The NMS is planned to be revised once every five years.

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CHAPTER 1

BACKGROUND

1.1 Introduction

The rural component of National Master Sample (NMS) with 50 villages was created in 1985 and has been used for the 1986/87, 1987/88 and 1989/90 Agricultural Sample Surveys (AGSASU) in Tanzania. The sample design and other technical aspects of the rural NMS are contained in the technical report entitled 'Rural National Master Sample' of March 1991.

Efforts to establish the urban component of NMS started in 1989 with a proposal of the sample design given by Mkai and Pettersson in a mission report TANSTAT 1989:9[1].

This report is intended to give an overview of the old rural NMS together with the description of the revised rural NMS and the urban component of NMS.

1.2 Overview of the old NMS and description of the revised rural NMS.

Creation of the frame and selection of Primary Sample Units (PSUs):

While work on the creation of the old frame started during November 1984, the exercise for the new frame started in June 1990 and was finalized by November 1990. Creation of the frame was initially important for purposes of stratification. In the new rural NMS, villages rather than wards are the Primary Sample Units. Unlike 1984 when the frame consisted of 1759 wards basing on 1978 census, the current frame using 1988 census has 8505 villages listed. In 1984, information was collected for each rural ward on name, code number and population according to the 1978 census. Further, as much as it was possible, information on agro-ecological zones and cropping pattern was sought by ward. Cropping pattern was desegregated by main cereal and main cash (export) crop. Also information on accessibility/remoteness of ward to the regional headquarter was solicited.

As regards the former frame, information was collected in two stages.

Firstly, whatever was certainly available in Dar es Salaam at the Bureau of Statistics or other ministries was collected;

Secondly, information was sought from regions whenever there were gaps. Creation of the frame proved more difficult than anticipated because since 1978 new wards have been created. Worse still, it was very difficult to get information on the villages making up those wards. In such circumstances, the 1978 wards were resorted to. The auxiliary information was solicited by sending

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[1]SAMPLING IN TANZANIA II. Mission Report during April 7 to April 30, 1989 by Hans Pettersson.

questionnaire to the Regional Agricultural Development Officers (RADOs) through the Regional Statistical Officers (RSO).

As far as the new frame is concerned, some necessary adjustments were made in accordance with the 1988 census data. As a result of this the following changes were made:

(i) Eighteen wards that were rural during 1978 census but urban in 1988 census were excluded.

(ii) Eight wards that were originally urban but were considered completely rural during 1988 were included in the new frame as rural wards and consequently assigned strata according to their location in the map.

(iii) Villages with special enumeration areas (EAs) e.g. Balangdalalu in Hanang district and Mgamba in Rufiji district having few rural characteristics were also excluded from the frame.

(iv) Wards such as Maweni in Tanga, Mishamo in Rukwa, Katumba in Rukwa and Mahuta in Newala that were categorized as neither wards nor villages during the 1978 census, were now assigned to strata in line with their location during 1988 census and consequently being part of the new frame.

(v) Furthermore, villages that had changed to wards by 1988 were included under the stratum they belonged to in 1978. Some villages due to population increase following the 1988 population census, were elevated to ward status e.g. Mwawaza in Shinyanga and Nzuguni in Dodoma.

(vi) New villages were found in old wards e.g. Mtakuja and Namkungwi in Lisekese ward Masasi district. These were included in Lisekese ward forming one Primary Sampling Unit in the same strata.

(vii) Wards that changed to migratory population e.g. Kakesio in Kiteto, and those which ceased to exist, e.g. Orkesmet (Engasmet), were excluded from the new frame.

(ix) Lastly, for the villages that moved to another ward, it was automatically included in that PSU.

In line with the above observations, during November 1990, Pilot study was conducted by a team from the headquarter in three regions Morogoro, Iringa and Mbeya for sampling purposes of the current rural NMS. It was discovered that there was a delay in village registration because funds from the headquarter reached the RSOs a bit later. Again, one seminar on labour force conducted in Morogoro, interfered with the registration exercise. For the case of Mbeya region, the team found out that Kibwawa ward as it was known during 1978 population census had together

with its villages ceased to exist during 1988 population census because of water from lake Rukwa that had overflooded almost all the villages in the ward. The villages shifted to neighboring areas but now bearing new names e.g. Kibwawa village became Mbaha, and Kikondo village was renamed Iseche.

Creation of the PSUs and Stratification:

For the purposes of rural component of the old NMS - where fifty villages were used, wards were used as PSUs. Many wards however were formed to be too small to be convenient PSUs. A lower limit of 5,000 people by 1978 census was used for PSUs. Wards with population less than 5,000 by then were combined with one or more adjacent ward(s). Splitting of large wards was not done because the exercise would require setting well defined boundaries between the two parts. It was thought that the time and resources to be put in such an exercise would not pay off. It was further decided that the 1978 population census figures be used as measure of size for the PSUs. It was realized that population growth since 1978 varied between PSUs, thus making some of the size measures out of date. It was however difficult to get reliable up to date figures. A total of 1538 PSUs were created. During June 1985 a decision was made after lengthy discussions that 150 strata be formed. As much as possible the strata were to be of equal size in terms of population. The average size os such strata were put at 96,000 persons as per 1978 population census. This gave more strata in regions with large population. By utilizing the 1988 census data for the revised rural NMS, the size of these strata was found to be in the range of 100,000 to 120,000 persons.

It was also decided during 1985 that the strata should be identified into three categories:

(i) Large town surrounding strata.

(ii) Low density strata

(iii) Other strata

The same categorization has been used for the new rural NMS. Large town surrounding strata were formed around eight large towns whose industrial and commercial activities were considered high. Village life in such strata is to a great extent affected by the activities in the town. Nine such large town surrounding strata were formed, two of those around Dar es Salaam city and the rest each around the current municipalities of Tanga, Mwanza, Arusha, Mbeya, Moshi, Morogoro and Iringa. These strata were then grouped into three superstrata each having three strata as shown in table 1.1 below.

Table 1.1 Strata and Superstrata in large town surrounding areas

Area	Stratum No.	Superstratum No.
Dar es Salaam	1	1
	2	
Tanga	3	
Mwanza	4	2
Arusha	5	
Moshi	6	
Morogoro	7	3
Iringa	8	
Mbeya	9	
Total	9	3

Low density strata were formed in twelve low districts as categorized during 1978 census, each districts forming a separate stratum. Table 1.2 shows the strata together with subsequent superstrata.

Table 1.2 Strata and Superstrata in low density districts.

Region	District	Stratum No.	Superstratum No.
Arusha	Monduli	10	4
	Kiteto	11	
Tanga	Handeni	12	
Morogoro	Mahenge	13	5
Coast	Rufiji	14	
Lindi	Liwale	15	
Ruvuma	Songea	16	6
Mbeya	Chunya	17	
Rukwa	Mpanda	18	
Singida	Manyoni	19	7
Tabora	Tabora	20	
	Urambo	21	
Total		12	4

In 1978 these districts had a population density of less than 10 persons per square kilometer while in 1988 the same districts had a population density of less than 20. These strata were smaller, with about 70,000 persons in 1978 and an estimated population of 96,000 people in 1988 using 1978 population annual growth rate of 3.2%. The rest of the PSUs were grouped into the "other strata" i.e. 129 in all. Table 1.3 give regions and districts containing the "other strata" category.

Table 1.3 Strata and Superstrata in "other" rural areas

Region	District	Stratum No.	Superstratum No.
Dodoma	Mpwapwa	22	8
	Mpwapwa	23	
	Dodoma (R)	24	
Dodoma	Kondoa	25	9
	Kondoa	26	
	Dodoma (R)	27	
Dodoma	Dodoma (R)	28	10
	Dodoma (R)	29	
	Dodoma (U)	30	
Arusha	Arumeru	31	11
	Arumeru	32	
	Mbulu	33	
Arusha	Mbulu	34	12
	Hanang	35	
	Hanang	36	
Kilimanjaro	Rombo	37	13
	Moshi (R)	38	
	Rombo	39	
Kilimanjaro	Pare	40	14
	Rombo	41	
	Moshi (R)	42	
Kilimanjaro Tanga	Pare	43	15
	Handeni	44	
	Korogwe	45	
Tanga	Muheza	46	16
	Lushoto	47	
	Lushoto	48	
Tanga	Muheza	49	19
Morogoro	Kilombero	50	17
	Morogoro (R)	51	
	Kilosa	52	
Morogoro	Kilosa	53	18
	Morogoro (R)	54	
	Mahenge	55	
Pwani	Bagamoyo	56	19
	Rufiji	57	
Pwani Lindi	Kisarawe	58	20
	Kilwa	59	
	Lindi (R)	60	

Table 1.3 Continued

Lindi Mtwara	Lindi (R) Lindi (R) Masasi Mtwara (R) Masasi Masasi	61 62 63 64 65 66	21 22
Mtwara	Mtwara (R) Newala Newala	67 68 69	23
Ruvuma	Mbinga Mbinga Tunduru	70 71 72	24
Ruvuma Iringa	Songea (U) Njombe Ludewa	73 74 75	29
Iringa	Mufindi Mufindi Njombe	76 77 78	25
Iringa	Njombe Iringa (R) Mufindi	79 80 81	26
Mbeya	Kyela Rungwe Kyela	82 83 84	27
Mbeya	Mbozi Ileje Rungwe	85 86 87	28
Mbeya Singida	Chunya Mbeya Manyoni	88 89 90	30
Singida	Iramba Singida (R) Singida	91 92 93	31
Singida Tabora	Iramba Igunga Nzega	94 95 96	32
Tabora	Igunga Tabora (R) Tabora (R)	97 98 99	33
Rukwa	Sumbawanga(U) Sumbawanga(R) Sumbawanga(R)	100 101 102	34
Kigoma	Kasulu Kigoma (R) Kasulu	103 104 105	35

Table 1.3 Continued

Kigoma	Kasulu Kibondo Kibondo	106 107 108	36
Shinyanga	Kahama Kahama Kahama	109 110 111	37
Shinyanga	Shinyanga (R) Shinyanga (U) Shinyanga (R)	112 113 114	38
Shinyanga	Maswa Maswa Shinyanga (R)	115 116 117	39
Shinyanga	Bariadi Maswa Bariadi	118 119 120	40
Shinyanga Kagera	Bariadi Ngara Karagwe	121 122 123	41
Kagera	Karagwe Bukoba (R) Bukoba (R)	124 125 126	42
Kagera	Bukoba (U) Muleba Muleba	127 128 129	43
Kagera Mwanza	Biharamulo Biharamulo Geita	130 131 132	44
Mwanza	Sengerema Sengerema Geita	133 134 135	45
Mwanza	Geita Kwimba Kwimba	136 137 138	46
Mwanza	Sengerema Ukerewe Magu	139 140 141	47
Mwanza Mara	Kwimba Magu Serengeti	142 143 144	48
Mara	Musoma (R) Tarime Tarime	145 146 147	49

Table 1.3 Continued

Mara	Tarime Tarime Serengeti	148 149 150	50

Note: (R) stands for Rural and (U) for Urban

The new stratification is quite identical to that of Old NMS. The Primary Stratification Variable was agro-ecological zone. Often information on cropping pattern was used in adjusting the strata so formed. Another stratification variable which was sometimes used was "accessibility/remoteness". In a situation where two strata were to be formed in the same agro-ecological zone one stratum was made close to the urban area and the other remote from the urban area. It was not necessary that PSUs forming a stratum be adjacent.

For Mara, Mtwara, Lindi and Rukwa regions no adjustment for crop information was found necessary. Adjustment for crop information was found to be practical only in four out of the remaining fifteen regions i.e. Dodoma, Kilimanjaro, Tanga and Kigoma. In these regions, the cropping pattern was less complex. Complexity in the other regions, which warranted adjustment, with regard to cropping pattern made it difficult to improve on stratification.

Fifty "superstrata" were created by combination of strata. These are as shown in tables 1.1, 1.2. and 1.3. Table 1.4 gives the number of strata by type and region.

Table 1.4 Number of Strata by type and region

Region	Town surrounding	Low density	Other	Total
Dodoma	-	-	9	9
Arusha	1	2	6	9
Kilimanjaro	1	-	7	8
Tanga	1	1	6	8
Morogoro	1	1	6	8
Coast & DSM	2	1	3	6
Lindi	-	1	4	5
Mtwara	-	-	7	7
Ruvuma	-	1	4	5
Iringa	1	-	8	9
Mbeya	1	1	8	10
Singida	-	1	5	6
Tabora	-	2	5	7
Rukwa	-	1	3	4
Kigoma	-	-	6	6
Shinyanga	-	-	13	13
Kagera	-	-	10	10
Mwanza	1	-	12	13
Mara	-	-	7	7
T O T A L	9	12	129	150

All stages of stratification for the old Rural NMS were accomplished by August 1985.

The procedure for the sample selection:

The size of NMS in terms of number of Rural and Urban clusters to be selected has been determined on the basis of the objectives of the survey programme in Tanzania as well as constraints in terms of resources. For the old Rural NMS a system of three modules was adopted, a module A and two additional modules B and C. This was designed so as to facilitate regional, zonal as well as national estimates depending on user needs and cost constraints. Table 1.5 give the structure of the old NMS.

Table 1.5 Structure and size of the NMS for Tanzania

M O D U L E	DOMAIN OF STUDY			
	Rural areas	D'Salaam	Other urban areas	Total
MODULE A				
No. of PSUs	50	30	30	110
No. of domains of study	1	1	1	3
ADDITIONAL MODULE B				
Additional No. of PSUs	92	-	-	92
MODULE A+B				
No. of PSUs	142	30	30	202
No. of domains of study	5	1	1	7
ADDITIONAL C				
Additional No. of PSUs	401	-	-	401
MODULE A+B+C				
No. of PSUs	543	30	30	603
No. of domains of study	19	1	1	21

The A + B + C rural component of the old NMS was formed by drawing between 2 to 8 PSUs in each of the 150 strata. Table 1.6 give number of selected PSUs per stratum together with the possible estimates to be obtained for the different modules.

Table 1.6 Summary of the three modules - the rural sample

Module	No. of sample PSUs	Selection	Results
A+B+C	543	2-3 PSUs/Stratum	Regional estimates
A+B	142	1 PSU/Stratum	Zonal estimates
A	50	1 PSU/Superstratum	National estimates

As far as sample selection procedure is concerned for the recent rural NMS, this started in December 1990 with the sample geared towards regional estimates. The sampling is the same as the one used for the old NMS. However minor modifications in line with 1988 population census were made. A total of 150 strata similar to the old NMS have were formed. A total of 541 villages were selected using systematic probability proportional to size (PPS) selection procedure for module A+B+C rural sample. This was done stratumwise, that is, from each stratum 2 - 8 PSUs were independently selected. For module A sample 50 superstrata were formed by grouping the 150 strata into 50 superstrata having three neighboring strata each. Two villages were then selected per superstratum for module A sample giving a total of 100 villages for the rural sample. The module A rural sample will be used for national estimates. Selection of households is by simple random sampling (SRS) without replacement procedure.

The selection exercise ended in February 1991 with the keying in of the information regarding the selected PSUs completed in April 1991. Unlike the old NMS sample design, the current rural NMS has been designed to facilitate just the regional and national estimates. However,if zonal estimates are needed, the design could easily be modified to suit the demand. Table 1.7 gives a summary of the two modules of revised rural NMS.

Table 1.7 Summary of the two modules for the revised rural sample

Module	No. of Sample PSUs	Selection	Results
A + B + C	541	2-8 PSUs/Stratum	Regional estimates
A	100	2 PSUs/Superstratum	National estimates

Of the 100 villages selected for the module A sample, none of them come from the earlier 50 villages of module A despite keeping the same boundaries of earlier fifty superstrata. Table 1.8 give a list of 100 villages of the new rural NMS.

Table 1.8 List of the 100 PSUs and name of village(s) by district and region, for module A

REGION	DISTRICT	PSUs (Villages)
DODOMA	Kondoa	1. Idindiri
	Kondoa	2. Itundwi
	Mpwapwa	3. Mlali Bondeni
	Mpwapwa	4. Lwihomelo
	Dodoma Rural	5. Mindola
	Dodoma Rural	6. Sasajila

ARUSHA	Arumeru	7. Oldadai
	Arumeru	8. Maroroni
	Babati	9. Tsamasi
	Hanang	10. Endaswold
	Mbulu	11. Silaloda
	Ngorongoro	12. Kisangiro
KILIMANJARO	Rombo	13. Marangu
	Same	14. Mtii
	Moshi Rural	15. Kondeni
	Hai	16. Tella
	Hai	17. Karansi
TANGA	Lushoto	18. Vuga Bazo
	Lushoto	19. Kweshindo
	Muheza	20. Kigongomawe
	Muheza	21. Kigombe
	Handeni	22. Saunyi
	Handeni	23. Tiliani
MOROGORO	Kilosa	24. Ulaya
	Kilosa	25. Kitaita
	Morogoro Rural	26. Kanga
	Ulanga	27. Biro
	Ulanga	28. Iragua
PWANI	Bgamoyo	29. Msolwa
	Kibaha	30. Dusunyala
	Rufiji	31. Utunge
LINDI	Kilwa	32. Hanga
	Lindi Rural	33. Hingawali
	Lindi Rural	34. Nanganga
MTWARA	Mtwara Rural	35. Utende
	Newala	36. Miyuyu
	Newala	37. Namahonga
	Masasi	38. Mpombe
	Masasi	39. Mbonde
RUVUMA	Songea Rural	40. Kilangalanga
	Sungea Rural	41. Lipaya
	Mbinga	42. Langiro
IRINGA	Iringa Rural	43. Tagamenda
	Mufindi	44. Njonjo
	Njombe	45. Korintho
	Ludewa	46. Luana
	Makete	47. Matamba
	Iringa Urban	48. Ilula-Mwaya
MBEYA	Mbeya Rural	49. Mkunywa
	Mbeya Rural	50. Isongo
	Mbeya Rural	51. Isunura
	Kyela	52. Mbula
	Rungwe	53. Kyimo
	Mbozi	54. Ilolo
	Mbeya Urban	55. Dodoma

SINGIDA	Iramba	56. Ndulungu
	Iramba	57. Nsungu
	Manyoni	58. Chibumangwa
	Singida Urban	59. Unyamikumbi
TABORA	Nzega	60. Butandula
	Igunga	61. Choma
	Tabora Rural	62. Itaga
	Urambo	63. Kamsekwa 'B'
	Urambo	64. Nsendakanoge
RUKWA	Mpanda	65. Kamjela
	Sumbawanga	66. Kapewa
	Sumbawanga	67. Mititi
KIGOMA	Kibondo	68. Kazilamihunda
	Kibondo	69. Nyakasanda
	Kasulu	70. Rusesa
	Kasulu	71. Kasangezi
SHINYANGA	Bariadi	72. Zaanzi
	Maswa	73. Mwashegeshi
	Shinyanga Rural	74. Shimondoli
	Shinyanga Rural	75. Igaga "A"
	Kahama	76. Mgaya
	Kahama	77. Mwendakulima
	Meatu	78. Mgaya
	Meatu	79. Mwendakulima
KAGERA	Karagwe	80. Ahakishaka
	Karagwe	81. Kahundwe
	Bukoba Rural	82. Bunazi
	Bukoba Rural	83. Kasambya
	Muleba	84. Mageta
	Muleba	85. Burungura
	Biharamulo	86. Katende
	Ngara	87. Kanazi
MWANZA	Ukerewe	88. Nabweko
	Magu	89. Nyangiri
	Mwanza	90. Igombe
	Kwimba	91. Sanga
	Sengerema	92. Nyamteleka
	Geita	93. Bukwimba
	Geita	94. Nyabulanda
	Geita	95. Nyaseke
MARA	Tarime	96. Omoche
	Tarime	97. Ochuma
	Serengeti	98. Nyamburi
	Musoma Rural	99. Musanja
	Musoma Rural	100. Nyamisisye

Table 1.9 below gives the number of selected PSUs (villages) by module and type of strata by region for the revised module A rural sample.

Table 1.9: Selected PSUs (villages) by type of strata and module by region.

	Town Surounding		Low Density		Other		Total	
	A	A+ B+ C	A	A+ B+ C	A	A+ B+ C	A	A+ B+ C
Dodoma	-	-	-	-	6	36	6	36
Arusha	1	4	1	2	4	24	6	30
Kilimanjaro	-	4	-	-	5	28	5	32
Tanga	1	4	1	1	4	24	6	29
Morogoro	-	4	1	1	4	24	5	29
Coast	1	10	1	1	1	15	3	26
Lindi	-	-	-	1	3	28	3	29
Mtwara	-	-	-	-	5	28	5	28
Ruvuma	-	-	-	1	3	28	3	29
Iringa	1	3	-	-	5	24	6	27
Mbeya	1	3	1	1	5	24	7	28
Singida	-	-	1	1	3	25	4	26
Tabora	-	-	1	2	4	25	5	27
Rukwa	-	-	1	1	2	24	3	25
Kigoma	-	-	-	-	4	30	4	30
Shinyanga	-	-	-	-	8	26	8	26
Kagera	-	-	-	-	8	30	8	30
Mwanza	1	2	-	-	7	24	8	26
Mara	-	-	-	-	5	28	5	28
Total	6	34	8	12	86	495	100	541

Unlike the old rural NMS, the current NMS does not have the A + B module for the zonal estimates. However at request, the module could be developed to suit the needs.

CHAPTER 2

DESCRIPTION OF THE URBAN NMS

2.1 Introduction

The rural part of NMS has been in operation since 1986. So far three rounds of AGSASU have made use of the sample. According to survey plans, the following surveys have/will be conducted:

(i) Labour Force Survey, LFS 1990/91

(ii) Household Budget Survey, HBS 1991/92

(iii) Agricultural Census 1992/93

(iv) National Demographic Survey, NDS 1991/92

(v) Other social surveys e.g. health and nutrition (at request)

(vi) The National Informal Sector Survey (NISS) currently in progress.

With the exception of the Agricultural Census, all the above surveys need urban estimates. So far, Labour Force Survey (November 1990 - October 1991), Household Budget Survey and Nutritional Module from December 1991 to November 1992 have been utilizing the urban NMS.

2.1.1 Sample Frame

The frame for the urban NMS is the census sample of 1988. For each of the 94 district headquarters (total number of districts being 103), it was targeted to have 50 urban EAs in the census sample. Where the districts headquarter had less than 50 urban EAs all were taken. In the census, an EA was designed to have 300 - 500 people using 1986 projections of population of the 1978 census. The EAs were made to be equally sized in the census. The urban EAs were grouped into three domains, namely:

(i) The City of Dar es Salaam

(ii) The nine municipalities:- Dodoma, Arusha, Moshi, Tanga, Morogoro, Iringa, Mbeya, Tabora and Mwanza.

(iii) Remaining urban areas which included:- the remaining 10 regional headquarters - Kibaha, Mtwara, Songea, Singida, Sumbawanga, Kigoma, Shinyanga, Bukoba and Musoma. Other urban localities including remaining district headquarters and other small towns which are not district headquarters.

2.1.2 Stratification of EAs within Basic Domain of Study

Apart from stratification to secure a sufficient sample size in the basic domain of study, a secondary stratification was introduced in larger towns. The basic secondary stratification variable was "approximate economic levels," which was assumed to be difficult to get information on. As a proxy, type of housing neighborhood (and sometimes residents' activities) was used. The neighborhoods were:

1. Surveyed - low density
2. Surveyed - medium density
3. Surveyed - high density
4. Apartment flats
5. Non-surveyed (squatter) settlements.

Enumeration areas (EAs) in low density residents areas as well as in designated apartment flats were considered high income and those in medium density and the rest of apartment flats middle income. The rest were to be low income. It was assumed that the stratification would work well in Dar es Salaam and the nine municipalities, thus the stratification exercise was done in these two domains only. A total of 609 EAs were involved.

2.1.3 Field work on urban stratification

The urban stratification is part of construction of NMS-urban frame. It was decided that the PSUs (which are 1988 census EAs) be stratified according to economic level of the people in the EAs. The income classification (stratification) was done using type of housing neighborhood and other information from the leaders in the respective area. The stratification of EAs according to economic level was done for the city and municipalities only since the differences in income levels were much more distinct in these areas. Other regional headquarters and towns were assumed to be more less equal in income level.

Stratification for the nine municipalities was done during July 1st to July 24th 1989 where three teams of three officers each, 2 from Bureau of Statistics headquarters and Regional Statistical Officer (RSO) of the respective region were involved. It took about three weeks for each team to complete the work in three municipalities, which implies about a week per municipality.

In Dar es Salaam, the work started about 3 months later due to other commitments in the office by the staff. The work was done by two teams of two officers each from headquarters and one officer from regional office (the RSO and assistant RSO) who worked on the two districts - Kinondoni and Temeke and later another team of the officers from headquarters (one from each team involved in the first two districts) and the RSO completed the work for the remaining district - Ilala.

Each team was provided with introductory letters from the Government Statistician to respective city and municipal directors, EA maps, description of EAS and list of "ten-cell leaders". From the directors each team was provided with introductory letters to wards and branches where the EAs are located.

With the help of local leaders, the team checked the boundaries of the 609 EAs and their neighborhood. EAs resident activities were also probed into at the time of this survey. Then, one team sat together and decision on which income level to categorize the EA was made and jotted down in a special form named UNMSI.

The probing was necessary since it sometimes happen that not all officers in the apartment flats are of high income level but junior officers, and in some non-surveyed areas in urban fringe included bungalows of medium or even high income households only. Thus, type of housing neighborhood is not a pure determinant of the income level of the residents. With this probing effort made by the teams, the chances of putting an EA in a wrong income level, by only considering whether it is surveyed (high, medium, or low density) or non - surveyed were highly minimized.

Table 2.1 give the summary of number of EAs in each neighborhood and income level for each city zone (Dar es Salaam only) and municipality.

Table 2.1 Summary of stratification results for urban NMS

Domain	Number of EAs in Economic level			
	High Income	Middle Income	Low Income	Total
1. Dar es Salaam	10	37	107	154
Kinondoni	4	16	31	51
Ilala	6	14	32	52
Temeke	0	7	44	51
2. Municipalities	43	121	291	455
Dodoma	5	24	21	50
Arusha	11	14	25	50
Moshi	4	22	25	51
Tanga	4	25	22	51
Morogoro	4	3	43	50
Iringa	7	8	36	51
Mbeya	1	1	48	50
Tabora	4	6	41	51
Mwanza	3	18	30	51

2.1.4 Household stratification

Stratification of Households within the EAs:

From the result of two pretests of households Budget Survey (HBS) 1991/92, conducted during March and May 1991 in Iringa and Tanga respectively, it was observed that comparison between certain composition of assets possessed by the household and their reported expenditure, brought the same result when categorized by income levels with minor differences. For each income level, the households were arranged in descending order, from that with the highest to that with the lowest reported expenditure.

It was thus decided to use these compositions to stratify the households into high, middle and low income levels during listing of households in the clusters for the HBS 1991/92 frame.

2.2 **Sample size**

When considering sample size for the urban NMS it was agreed that sufficient number of EAs be selected in each domain of study. The minimum number of EAs was set to be 30 in each domain. A proportional allocation of EAs to domain was carried out for the three domains. The segmentation of population into high, middle and low income areas was more pronounced in large towns. This lead to large variations between EAs for some important characteristics in Dar es Salaam and the nine municipalities than in the remaining urban areas. It will also have an impact on the cost of field work in these areas. Due to this variations in EAs for some characteristics a disproportionate allocation of EAs for the domains was used. It was agreed to oversample in Dar es Salaam and under sample in small urban localities. It was then decided to allocate 50, 40 and 30 EAs to Dar es Salaam, the nine municipalities and the remaining urban areas respectively.

For Dar es Salaam and the nine municipalities further allocation of EAs to income strata was carried using proportional allocation as follows:

For each stratum, let

N_s = Total no. of EAs in the stratum in the city/municipalities

N_c = Total no. of census sample EAs in the city/municipalities

n_s = No. of EAs to be selected from each stratum for the city/municipalities.

If N_m = Total no. of EAs from all strata desired for NMS in the city/municipalities.

Then $n_s = N_s \times N_m/N_c$

For example, for the city of Dar es Salaam, we have N_s =10, N_c =154 and N_m=50 EAs. So we obtain the following sample allocation:

High income stratum should have

10 * 50/154 = 3.25 taken to be 3

Middle income stratum should have

10 * 50/154 = 12.01 taken to be 12

Low income stratum should have

107 * 50/154 = 34.74 taken to be 35

So it was decided to select 4 high, 12 middle and 36 low income EAs - a ratio 1 : 3 : 9 giving a total of 52 EAs for the NMS Dar es Salaam domain. Using the same method for the NMS municipalities domain we came up with 4 high, 11 middle and 25 low income EAs giving a total of 40.

For the other towns domain, it was decided to give top priority to the ten regional headquarters first, i.e. each regional headquarter was allocated one PSU (EA), then the rest (20 PSUs) were sampled from the district headquarters and the other towns.

With this design, the EAs were identified into the 17 strata as given in table 2.2 below.

Table 2.2. Number of strata for the different stratification criteria.

Area	Criterion	Number of strata
Dar es Salaam	High income	1
	Middle income	1
	Low income	1
Nine Municipalities	High income	1
	Middle income	1
	Low income	1
10 Regional headquarter		10
Other urban localities		1
Total		17

The proposed minimum design for the urban NMS is summarized in the following table:

Table 2.3: Minimum design for the urban NMS

Dodoma census	Sample size for NMS EAs	Sample Size for 1988 detailed Questionnaires Frame for NMS (EAs)	Frame for 1 9 8 8 sample (EAs)
a. Dar es Salaam	52	154	2856
b. 9 municipality. Dodoma, Arusha, Moshi Tanga, Morogoro, Iringa, Mbeya, Tabora and Mwanza	40	455	1933
c. Remaining 10 regional HQs	10	485	929
d. Other urban	20	1903	2094
TOTAL	122 (1.6%)	2997 (38%)	7812

NB: The number of EAs in the census differ with actual enumerated due to modification in some EAs. In total there were about 94 urban localities in the whole country (Tanzania Mainland).

2.3 Selection Procedure

Selection of EAs:

The selection of EAs was done using the census- sample of EAs as the sampling frame. Systematic random sampling procedure was used to draw the sample. For Dar es Salaam city, the 154 EAs for the detailed questionnaire in the census were ordered in the three economic level strata. A systematic random sample of 52 EAs was then drawn.

For the nine municipalities the 435 EAs which were selected in the detailed questionnaire of census were ordered in the three economic level strata. A systematic sample of 40 EAs was drawn. In the other remaining 10 regional headquarters a systematic random sample of 10 EAs was selected from the 485 EAs selected in the census. Selection of the EAs in the other urban areas was done by drawing 30 EAs out of about 1900 EAs used for detailed questionnaire in these areas.

Table 2.4 give names of the selected branches in region, district and urban locality as depicted in the 1988 Population Census.

Table 2.4: List of 122 EAs and names of Branches by regional, district and urban locality as per 1988 Population Census.

Region	District	Name of Urban locality	Name of Branch
Dodoma	Dodoma	Dodoma	1. Chamwino 2. Makole 3. Chang'ombe 4. Majengo
Arusha	Monduli Arusha	Namanga Arusha	5. Kimokua/Namanga 6. Sekei 7. Sekei 8. Tindig 9. Ngarenaro
K'njaro Moshi	Mwanga Moshi	Mwanga	10. Mwang 11. Bondeni 12. Majengo 13. Majengo 14. Kiusa 15. Pasua
Tanga Tanga	Lushoto Tanga	Mlalo	16. Mlalo 17. Majengo 'A 18. Ngamiani Kusini 19. Ngamiani Kaskazini 20. Amboni Magharibi 21. Mabawa Magharibi
	Handeni	Chanika	22. Kwamgumi
Morogoro	Kilombero Morogoro	Mkamba Morogoro	23. Mkamba 24. Mwembe Songo 25. Mji Mkuu 26. Sabasaba 27. Mazimbu
COAST Kibaha	Bagamoyo Kibaha Mafia	Bagamoyo Kilindoni	28. Dunda 29. Maili Moja 30. Kilindoni
D'Salaam	Kinondoni	D' Salaam	31. Masaki 32. Kimara 33. Minazini 34. Makumbusho 35. Mkunguni 36. Kilimani 37. Baruti 38. Mapipa 39. Kwajongo 40. Vigaeni 41. Kwapakacha

			42. Mbuyuni
			43. Msisiri
			44. Mtambani
			45. Mkwajuni
			46. Jitegemee
			47. Mwembeni
			48. Tanganyika Packers
			49. Upanga Mashariki
	Ilala		50. Kivukoni
			51. Amana
			52. Ilala
			53. Ilala Quarters
			54. Kariakoo Mashariki
			55. Gerezani Mashariki
			56. Mwembe Madafu
			57. Tabata
			58. Miembeni
			59. Matambani
			60. Kombo
			61. Kipawa
			62. Minazi Mirefu
			63. Madenge
			64. Kisiwani
			65. Malapa
	Temeke	Dar Salaam	66. Uwanja wa Taifa
			67. Chango'ombe
			68. Tuamoyo
			69. Mbagala
			70. Mbagala
			71. Rangi Tatu
			72. Azimio
			73. Sandali
			74. Maganga
			75. Temeke
			76. Tandika
			77. Kilimahewa
			78. Mtono Mtongani
			79. Sabasaba
			80. Buriani
			81. Magurumbasi
			82. Kiungani
Lindi	Nachingwea Lindi (U)	Nachingwea Lindi	83. Kilimanihewa 84. Wailes
Mtwara	Masasi Mtwara	Masasi Mtwara	85. Nyasa 86. Likombe
Ruvuma	Mbinga Songea	Mbiga Songea	87. Mbinga Mjini 88. Lizaboni
Iringa	Iringa	Iringa	89. Gangilonga 90. Kwakilosa 91. Kwakilosa 92. Mtavila 93. Mivinjeni

Mbeya	Chunya Kyela Mbeya	Chunya Kyela Mbeya	94. Chunya 95. Bondeni 96. Iyela 97. Sinde 98. Nzovwe 99. Nonde
Singida	Iramba Singida	Old Kiomboi Singida	100. Old Kiomboi 101. Unyankindi
Tabora	Igunga Tabora	Igunga Tabora	102. Igunga Mjini 103. Isevya 104. Mbugani 105. Ng'ambo
Rukwa	Mpanda Sumbawanga	Mpanda Sumbawanga	106. Nsemulwa 107. Jangwani
Kigoma	Kigoma	Kigoma	108. Mwanga Kusini
Shinyanga	Bariadi S'nyanga Meatu	Bariadi S'nyanga Meatu	109. Sima 110. Old shinyanga 111. Mwamhunzi
Kagera	Bukoba	Bukoba	112. Miembeni
Mwanza	Magu Mwanza	Magu Mwanza	113. Itumbili 114. Pamba 115. Pamba 116. Nyamanoro 117. Butimba 'A' 118. Mbugani 119. Buzurunga
	Geita	Karumwa	120. Karumwa
Mara	Bunda Musoma	Bunda Musoma	121. Bunda Mjini 122. Bweri

Having identified both the PSUs (villages) for the rural component of NMS as well as selected Enumeration Areas EAs for the urban, the following is the structure of the NMS for Tanzania Mainland.

Table 2.5 Structure and size of the NMS for Tanzania

MODULE	DOMAIN OF STUDY				
	Rural	Dar es Salaam Areas	Municip alities	Other urban Areas	Total
Module A No. of PSUs	100	52	40	30	222
No. domains of Study	1	1	1	1	4
Additional Module B + C					
Additional No. of PSUs	441	-	-	-	441
Module A + B + C No. of PSUs	541	52	40	30	663
No. of domain of study	19	1	1	1	22

For this new NMS, the urban domain has been split up into two domains: The nine municipalities and the regional headquarters/ district head quarters/other small towns following the request of the urban planners. While for the rural areas, villages are the PSUs, the Enumeration Areas as found in the 1988 population census are PSUs for the urban domains.

As mentioned earlier, this new NMS is not designed to meet the zonal estimates because no such request came up during the preparation stage. Consequently, module A + B essentially for zonal estimates is missing in this NMS design.

2.4 Sampling Weights

Calculation of sampling weights:

With the help of Mr. Hans Pettersson of Statistics Sweden, two statisticians from the sample survey section - the late Mr. S.N. Maghway together with Mr. Makbel calculated the weights for the NMS clusters i.e. EAs.

Two alternatives were considered.

Alternative 1

This is a straight forward alternative which is given by :

$$W_{hk}=\frac{N_h}{n_h}x\frac{\sum_h A_{hk}}{a_k}$$

Where N_h = number of EAs in census stratum h

n_h = number of sampled EAs in census stratum h

A_{hk} = number of EAs in census stratum h and NMS stratum k.

a_k = number of sampled EAs in NMS stratum k.

Alternative 2

Two situation can arise in this alternative way of calculating the weight. The first situation is when the sampling interval I_k falls completely within the A_{hk} EAs in stratum hk. The second situation is when sampling interval overlaps several census strata. For the two situations the following formula was used:

$$W_{hk}=\frac{\sum_h \frac{V_h}{A_{hk}}xN_h}{\sum_h \frac{V_h}{A_{hk}}xn_h}x\frac{\sum_h A_{hk}}{a_k}$$

Where V_h/A_{hk} is the proportion of the sample that falls into census stratum h to the selection interval.

When actual calculation of weights for estimation of some characteristics was carried out, it was found that alternative 2 gave better estimates than alternative 1 for the two situations.

CHAPTER 3

FIELD ORGANIZATION IN DEVELOPING THE NMS

3.1 Introduction

For this particular report, field organization is categorized into two parts. That of the new rural NMS and urban NMS. Generally, for the rural NMS no more field procedures were undertaken apart from that conducted during the previous rural NMS development. However, there was some constant communication going on between Takwimu Head quarter and the RSOs through telephone and mails as regards changes in the names of wards and villages as per 1988 population census. Furthermore, in rare cases, there was a need for some officers from the Head quarter to travel to some regions in which their wards/villages boundaries had changed substantially since 1988. All in all, most of the organization of the revised rural NMS was done at the head office. The following is thus, the organization system as conducted during the previous rural NMS:

3.1.1 The Pre-Pilot Test

Selection of PSUs was accomplished in September 1985. A Pre-Pilot Test was conducted in November 1985 to test village listing procedures within selected PSUs, among other things. This was done in three wards in rural areas of Temeke district, Dar es Salaam region. Three teams of four members each worked in each of the wards, i.e. Mbagala, Chamazi and Vijibweni. There was no objective criteria used for the selection of the three wards. The Pre-Pilot showed that it was difficult to get reliable village population figures from records at the ward level, probably due to sub-urban environment. Difficulties were also reported in making meaningful appointments with ward officials. The Pre-Pilot also tested schedules for the household listing. This experience is detailed in the methodology report for AGSASU.

3.1.2 The Pilot Test

Four regions were selected for the pilot test, i.e. Dodoma, Kilimanjaro, Lindi and Rukwa. However Lindi and Rukwa were dropped due to heavy rains. They were replaced by Morogoro and Iringa. Districts involved during the Pilot test exercise were Kilosa (Morogoro), Moshi Vijijini (Kilimanjaro), Dodoma Rural (Dodoma) and Njombe (Iringa).

Twelve officers from Takwimu headquarters and the respective RSOs were involved, i.e. four officers per region. The twelve from headquarter attended a one week training seminar at Kibaha during the second week of January 1986. During the training emphasis was put on household listing. No field practical was done to expose the participants to the realities of tracing the PSU boundaries and listing of villages as well as estimating village population within PSUs. Among the conclusions from the pilot survey was that projected population from 1978 census and recorded 1985 or 1986 population at ward level will allow arriving at reliable village population figures without having to visit each village in the PSU.

3.2 Training

All Regional Statistical Officers and a few middle level statisticians and statistical officers were trained for 3 days at Kibaha on, among other things, the procedure of arriving at the master sample of villages. Trainers came from the Agricultural as well as Sample Surveys Sections of Takwimu. There was also a consultant from Statistics Sweden to help with the training. A document titled "NMS Listing Instructions for the 1986/87 Agriculture Survey - March 1986" was used extensively.

3.3 Logistics

Table 3.1: Teams for the listing

ZONE	REGION	TEAM	
1	Dodoma	F.H. Marevi	: Team Leader
	Singida	N. Mwombeki	: Assistant Team Leader
	Tabora	P.J. Hango	: RSO Dodoma
		S.N. Masawe	: RSO Singida
		A.T.Tengamaisho	: RSO Tabora
2	Arusha	I.G. Komba	: Team Leader
	Kilimanjaro	E. Mtweve	: Assistant Team Leader
	Tanga	A.H. Maphito	: RSO Arusha
		I. Mwenda	: RSO Kilimanjaro
		E.H. Lukindo	: RSO Tanga
3	Morogoro	S.T. Mwisomba	: Team Leader
	Coast	Anna Mlay	: Assistant Team Leader
	Dar es Salaam	M.V. Domotali	: RSO Morogoro
		H.A. Makuka	: RSO Coast
		E.D. Kipanga	: RSO Dar es Salaam
4	Lindi	N.K. Mwingira	: Team Leader
	Mtwara	A.K. Ntinika	: Assistant Team Leader
	Ruvuma	S.S. Gimbi	: RSO Lindi
		P. Mboya	: RSO Mtwara
		F.L. Kalembo	: RSO Ruvuma
5	Iringa	W.D. Ndossi	: Team Leader
	Mbeya	G.O. Temba	: Assistant Team Leader
	Rukwa	H.K.Lwilla	: RSO Iringa
		W.N. Mwanjoka	: RSO Mbeya
		M.O. Swedi	: RSO Rukwa
6	Kigoma	H. Lusau	: Team Leader
	Kagera	N. Ndaki	: Assistant Team Leader
	Mwanza	P. Bayona	: RSO Kigoma
		L. Mutalemwa	: RSO Kagera
		M.N. Massaba	: RSO Mwanza
7	Shinyanga	U.G. Mtenga	: Team Leader
	Mara	D. Maimu	: Assistant Team Leader
		P.M. Kato	: RSO Shinyanga
		K. Basiga	: Ag. RSO Mara

3.3.1 Travel arrangements

The country was divided into seven zones for the purpose of this exercise. The zone with the officers involved is shown in table 3.1, above.

The zoning was in such a way that the number of PSUs was between 5 and 9 in each to ensure equal workload. Each RSO was scheduled to work in his/her respective region only. Seven vehicles were used one for each zone. The entire field work was anticipated to take 10 weeks, starting from April 1986. All the teams left Dar es Salaam for the listing exercise as planned. Petrol tanks were stationed in the following tows - Bukoba, Mwanza, Lindi, Arusha, Mbeya, Singida and Kigoma. These were offered through SIDA. During 1986 there was serious fuel shortage and these tanks provided the strategic reserve.

3.3.2 Problems encountered in the field

The problems encountered included mechanical breakdown of the vehicles and short supply of petrol in almost all regions involved.

3.4 **Data Processing**

One of the major responsibility of the team leader was to select one village in the PSU. For further information see the document quoted in para 3.2

3.5 **Field organization for the Urban NMS**

3.5.1 Introduction

As stated earlier, in Dar es Salaam, the stratification exercise started three months later due to other commitments in the office by the staff. The work was done during 13/11/1989 - 20/12/1989 where two groups of 3 officers each worked on each district of the region, and later on joined the third group for the third district. The list of officers and municipalities/District worked on is given in the table below:

Table: 3.2: List of officers by municipalities/district they worked on.

Group	Municipalities/District	Officers
1	Arusha	Chuwa, Makbel and Mtweve (RSO Arusha)
	Moshi	Chuwa, Makbel and Mwenda (RSO Moshi)
	Tanga	Chuwa, Makbel and Lukindo RSO Tanga)
2	Morogoro	Mwingira, Mgaya and Domotali (RSO Morogoro)

	Iringa	Mwingira, Mgaya and Lila (RSO Iringa)
	Mbeya	Mwingira, Mgaya and Mwanjoka (RSO Mbeya)
3	Dodoma	Ndimila, Ruyobya and Hango (RSO Dodoma)
	Tabora	Ndimila, Ruyobya and Maphito (RSO Tabora)
	Mwanza	Ndimila, Ruyobya and Masaba (RSO Mwanza)
4	Temeke	Ndimila, Maghway and Matola (RSO Dar es Salaam)
	Ilala	Maghwy, Makbel and Matola (RSO Dar es Salaam)
	Kinondoni	Mwingira, Makbel and Hasani (Asst. RSO Dar es Salaam)

3.5.2 Methodology used

Introductory letters from the Government Statistician were submitted to the municipal/city director which explained the aim of the visit and help needed by the officers who were going to perform the work. Other introductory letters from the city/municipal director were sent to the ward officials, who are the key persons for the help. The city/municipal planners and surveyors helped to identify which areas are surveyed (low, medium or high density) and un-surveyed.

For each ward, all selected EAs were identified. Then, the team, which included statistical officers and ward secretary, branch chairman and sometimes "Diwani" sat together to grade the EA.

The decision arrived at was then filled-in in form UNMS 1: when all EAs were visited and identified in the municipal/city, it followed the meeting with the directors, planners and surveyors to give their views on the stratification. Where there were differences, it was noted in the UNMS 1 and appropriate column for "Maelezo Ziada".

3.5.3 Field work problems

Ten cell leaders:

Since the list of ten cell leaders taken to the field was the one used during the demarcation exercise of 1988 population census, many changes occurred in between. Some of the ten cell leaders migrated out of the EAs, others resigned and unfortunately others died. This sometimes could have misled the EA boundary if care had not been taken.

EA boundaries:

It became extremely difficult to identify boundaries of some EAs due to absence of prominent features such as water kiosks, road or street name, big tree etc. In such cases, the use of the cell leaders of the respective EAs in walking around all their houses were necessary. This problem was mainly encountered in squatter areas as well as areas with no street names or all those that had altered names. In some cases, all households in the EAs were transferred to other places for a special use e.g. in Kurasini Dar es Salaam, Habours authorities had shifted people for the habours extension.

Environment:

In some EAs two or more environments may be there e.g. high density and apartment flats in one EA where no one can be neglected. In this case, all types were put in the forms with the dominant one being the first.

It was unclear whether to classify staff-quarters as high density or as apartment flats. Also there are areas reserved for commercial and industrial activities, but people invaded them. It was therefore difficult to put them as either squatters or surveyed; and if surveyed as low or medium or high density. All these difficulties were jotted down in the respective forms. Furthermore, hardly could one meet an EAs that is purely urban or rural. Practically these EAs are mixed with special categories like police quarters (line).

Income class definition:

An outstanding question from the people (Municipal/city directors, ward and branch leaders) was about the criteria used in drawing conclusion as regards the income class of the EAs inhabitants. Though much was explained that the criteria used was by mere looking at the neighbourhood of the EAs; considering its inhabitants' occupations, tastes, entertainments, etc. and using their instinctive knowledge, leaders were not easily convinced. The method looked very subjective to them.

CHAPTER 4

SOME TECHNICAL ASPECTS ON NMS

4.1 Basic Formulae for Estimation

4.1.1 Module for the Old Rural NMS

As for the previous NMS, the first and second stage selections are done with PPS, the measures of size now being 1988 population (first stage) and estimated population 1989 (second stage). The second stage selection is done in line with AGSASU round three conducted during 1989/90. The third stage is usually a systematic simple random sample.

Let Y_{hijk} be the observation on variable Y for household k in village j in ward i in stratum h.

Village Estimates:

- Estimate of total for village hij:

$$\hat{Y}_{hij} = \frac{N_{hij}}{n_{hij}} \sum_{k}^{n_{hij}} y_{hijk}$$

where: N_{hij} = Number of households in village hij

n_{hij} = Number of sampled households in village hij

- Estimate of average for village hij:

$$\bar{y}_{hij} = \frac{1}{n_{hij}} \sum_{k}^{n_{hij}} y_{hijk}$$

Ward estimates:

- Estimate of total for ward hi:

$$\hat{Y}_{hi} = \frac{M_{hi}}{M_{hij}} \hat{Y}_{hij}$$

M_{hi} = Estimated population 1989 in ward hi

M_{hij} = Estimated population 1989 in village hij.

- Estimate of average for ward hi:

$$\bar{y}_{hi} = \frac{\hat{Y}_{hi}}{N_{hi}} = \frac{M_{hi} N_{hij}}{M_{hij} N_{hi}} \frac{\sum y_{hijk}}{n_{hij}}$$

N_{hi} = Number of households in ward hi.

Stratum estimates:

- Estimate of total for stratum h:

$$\hat{Y}_h = \frac{A_h}{A_{hi}} \hat{Y}_{hi}$$

A_h = Population 1988 in stratum h

A_{hi} = Population 1988 in ward hi

- Estimate of average for stratum h:

$$\bar{y}_h = \frac{\hat{Y}_h}{N_h}$$

N_h = Number of households in stratum h.

National Estimates:

- Estimate of total:

$$\hat{Y} = \sum_h \hat{Y}_h$$

- Estimate of average:

$$\bar{y} = \frac{\hat{Y}}{N}$$

N = Number of households

Estimate of a ratio:

$$\hat{R}=\frac{\hat{Y}}{\hat{X}}$$

where X is a variable which is highly correlated to the study variable Y.

4.1.2 Revised Rural Module A NMS

Let y_{hij} be the observation on variable y for household j in village i of stratum h.

Village and Stratum Estimates:

- Estimate of total for village hi:

$$\hat{Y}_{hi}=\frac{N_{hi}}{n_{hi}}\sum_{j=1}^{n_{hi}} y_{hij}$$

where N_{hi} =Number of households in village hi
n_{hi} =Number of sampled households in village hi.

- Estimate of mean for village hi:

$$\hat{\bar{Y}}_{hi} = \frac{\hat{Y}_{hi}}{N_{hi}} = \frac{1}{n_{hi}}\sum_{j=1}^{n_{hi}} y_{hij}$$

- Estimate for total in stratum h:

$$\hat{Y}_h = \sum_{i=1}^{2} \frac{A_h}{2A_{hi}} \hat{Y}_{hi}$$

where A_h =1988 Population in stratum h
A_{hi} =1988 population in village hi.

- Estimate for the mean in stratum h:

$$\hat{N}_h=\sum_{i=1}^{2} \frac{A_h}{2A_{hi}} N_{hi} \quad \rightarrow \quad \hat{\bar{Y}}_h=\frac{\hat{Y}_h}{\hat{N}_h}$$

where $\hat{N}_h$ = Estimated number of households in stratum h.

National Estimate.

- Estimate of total:

$$\hat{Y} = \sum_{h=1}^{50} \frac{Ah}{2} \sum_{i=1}^{2} \frac{1}{A_{hi}} \frac{N_{hi}}{n_{hi}} \sum_{j=1}^{n_{hi}} y_{hij}$$

- **Estimate of mean:**

$$\hat{N}=\sum_{h=1}^{50}\frac{A_h}{2}\sum_{i=1}^{2}\frac{1}{A_{hi}}N_{hi} \quad - \quad \hat{\bar{Y}}=\frac{\hat{Y}}{\hat{N}}$$

where $\hat{N}$ = Estimated number of households in Tanzania Mainland.

4.1.3 Urban Sample

Let y_{hij} be the observation on variable y for the j-th household of the i-th EA in stratum h.

EA Estimate

- **Estimate of total for EA hi:**

$$\hat{Y}_{hi} = \sum_{j} w_{hi} y_{hij}$$

where N_{hi} = Number of households in EA hi
n_{hi} = Number of sampled household in EA hi.
w_{hi} is given by

$$w_{hi} = \frac{\sum_{h}\frac{V_h}{A_{hi}} \times N_h}{\sum_{h}\frac{V_h}{A_{hi}} \times n_h} \times \frac{\sum_{h} A_{hi}}{a_i}$$

where V_h/A_{hi} is the proportion of the selection interval that falls into census stratum h.

- **Estimate of mean for EA hi**

$$\bar{Y}_{hi} = \frac{\hat{Y}_{hi}}{N_{hi}}$$

Stratum Estimate.

- **Estimate of total for stratum h:**

$$\hat{Y}_h = \sum_{i}\sum_{j} w_{hi} y_{hi}$$

where A_h = Number of household in stratum h
A_{hi} = Number of households in EA hi.

- **Estimate of mean for stratum h:**

$$\bar{Y}_h = \frac{\hat{Y}_h}{M_h}$$

where M_h = Number of households in stratum h.

National Estimate.

- **Estimate of total:**

$$\hat{Y} = \sum_{h=1}^{50} \hat{Y}_h$$

- **Estimate of mean:**

$$\bar{Y} = \frac{\hat{Y}}{N}$$

where N = Total Number of households

4.2 Adjustment of estimates

From NMS we can estimate the total rural population on mainland using the initial weights. The estimate is 15.61 millions. If we started with the population of 1978 and extrapolate to 1987 with a growth of 2.2% per year (the growth rate between 1967 and 1987) we get an estimate of 17.475 millions. The NMS- estimate is probably a bit low. We can use the external estimate to form a ratio estimate that is better than our simple unbiased NMS - estimate.

The estimate will be:

$$\hat{Y}^1 = \hat{Y}\frac{Z_{proj}}{\hat{Z}}$$

where $\hat{Y}$ = the estimate of any total from NMS

$\hat{Z}$ = the estimate of the population total from NMS

Z_{proj} = (population total 1978) x $(1.022)^9$

The ratio $\frac{Z_{proj}}{\bar{Z}}$ is equal to $\frac{17\ 475}{15\ 610} = 1.119$

Thus

$$\hat{Y}^1 = (1.119) x \hat{Y}$$

4.3 The self-weighing Assumption

In some first stage units there have been substantial population changes since 1978. Further, the estimates of 1986 population in the second stage units (villages) turned out to be poor in some cases. These deficiencies in the measures of size made it necessary to abandon the self weighing. To retain the self weighing would mean that the workload of the enumerator would be extremely heavy in some villages.

It was decided to abandon the self-weighing in 14 villages. The weights in the 14 villages deviate by at least 20% from the "equal" weight. The maximum and minimum are 50% and -50%. Estimates have been calculated using equal weights for some of the listing variables. As can be seen in the table below the bias due to equal weights assumption is negligible for estimates of ratios and percentages. For totals, however, equal weights could not be used.

Table 4.1 Estimates of some characteristics using correct weights and equal weights.

Characteristic	Estimates using: Correct weight	Equal weights
Proportion of females (%)	52.10	52.20
Proportion of households in agriculture (%)	97.40	97.10
Average household size	4.92	5.03
Holder per household in agriculture	1.06	1.06
Total population (million)	15.61	16.20
Total female population (million)	8.13	8.45
Total number of households (mill)	3.17	3.22
Total number of households in agriculture (million)	3.09	3.12
Total number of holders (million)	3.27	3.35

4.4 Calculation of initial sampling weights

The initial sampling weight are the weights before corrections for non-response. In the table below the sampling weight for Kindi village has been calculated. The weight is calculated for the 1986/87 Agricultural Sample Survey (AGSASU) - sample (n = 3216).

Example

KINDI VILLAGE

	Stratum	Ward	Village Sample household
Population 1978:	291 775 \ / 291775 / 11495	11 495 / = 25.38	1st stage sampling weight
Estimated population 1986:		12 941 \ 12941 / 8629	8 629 = 1.45 2nd stage sampling weight
Number of household in the selected villages (1365) and selected households (50):			1365 50 \ / 1365 / 50 = 27.3 3rd stage sampling weight

Total weight: 25.38 x 1.45 x 27.3 = 1 005.

This is the initial sampling weight for Kindi village.
An estimate of total using the initial weights could be expressed as:

$$\hat{Y} = \sum_h \frac{A_h}{A_{hi}} \frac{M_{hi}}{M_{hij}} \frac{N_{hij}}{n_{hij}} \sum_k Y_{hijk}$$

Where for Kindi village:

$$\frac{A_h}{A_{hi}} \frac{M_{hi}}{M_{hij}} \frac{N_{hij}}{n_{hij}} = 25.38 \times 1.45 \times 27.3 = 1005$$

4.5 General correction

In 4.2 a general correction of sampling weights is described. The correction follows from the application of ratio estimation procedure.

The correction factor is 1.119. For Kindi village this means that the weight becomes: 1005 x 1.119 = 1124.

4.6 Correction of sample weights for non-response

Non-response can often be taken care of by compensatory weighing. That is in the cases where the non-response is very large and we can assume that the non-responding households do not differ substantially from the responding households with regard to survey characteristics.

As an example let us say that of the 50 households in Kindi village, 7 have not responded. We have no reason to believe that the non-responding households differ considerably from the responding.

A correction factor that will compensate for the non-response is then: $\frac{50}{43} = 1.163$.

The final sampling weight for Kindi village is then,

1124 x 1.163 = 1307.

If we, for example, are estimating the total area under maize, we add all the maize area for the 43 responding households in Kindi village. This sample total is multiplied by the final sampling weight 1307. The result is the estimate of total area under maize for Kindi village. If we add all strata total estimates we get the total estimate for the rural mainland.

CHAPTER 5

SAMPLING ERRORS

5.1 Introduction

In this section the calculation and analysis of sampling errors of some socio-economic and demographic variables is discussed. During the previous report it was only some of the demographic variables that were dealt with. Data on agricultural variables were not yet available from AGSASU by then. Furthermore, data specifically from the new rural NMS design for the 100 villages and the newly developed urban NMS were not available during the writing up of this report. Therefore, the analysis does focus on the former rural NMS design which consisted of 50 villages. Thus, the purpose of the section is primarily to give an example of how sampling errors could be calculated and analysed in NMS - Surveys. A secondary purpose is to present some empirical reports from sampling error calculations for some AGSASU characteristics. In this section, unlike for the old rural NMS, more of the results are presented following a study conducted by Prof. Kumar from Statistics Department of the University of Dar es Salaam together with the Officers from Sample Surveys Section of Takwimu. The study was actually a follow up of the mission carried out by Pettersson of Statistics Sweden.

5.2 Calculation

In the previous report, calculations were mainly carried out for demographic characteristics which include: total population, total female population, population of households in agriculture, number of holders per household and population of females. The socio-economic characteristics that now have been included in the analysis are: total cropped area, maize area, paddy area ; total cattle, male calves, female calves and cows.

The estimates are calculated from the AGSASU round three subsample of NMS that consisted of 3216 households in 50 villages. Estimates of the variances (VDNMSU) in both cases were calculated using the collapsed stratum method. Variances under the assumption of simple random sampling (VDSRSU) with the same sample size, were then calculated. The ratio UDNMSU/VDSRSU is defined as the design effect (DEFF). From DEFF, the intra-cluster correlation coefficients (ROH) were calculated. The RHO's were used for between and within village variance calculations.

5.3 Results

5.3.1 Variances and coefficients of variation

The variances and coefficients of variation for both categories of characteristics are shown in table 5.1 below.

Table 5.1 Vari[illegible] and coefficients of variation (CV).

Parameter	Estimate	Variance	CV (%)
Total population	15.6×10^6	1.96×10^{11}	2.8
Total female population	8.1×10^6	0.52×10^{11}	2.8
Proportion of households operating a holding	0.974	4.42×10^{-5}	0.7
Number of holders per household operating a holding	1.1	1.35×10^{-4}	1.1
Average household size	4.9	1.2×10^{-2}	2.4
Proportion of females	0.521	2.0×10^{-5}	0.9
Proportion of females:			
- in households with no holders	0.515	0.773×10^{-9}	5.4
- in households with 1 holder	0.421	0.22×10^{-4}	0.9
- in households with 2 holders	0.544	0.185×10^{-9}	2.5
Average household size:			
- in households with no holders	2.97	0.067	8.7
- in households with 1 holder	4.79	0.012	2.3
- in households with 2 holders	8.37	0.112	4.0
Total cropped area	3.4×10^6	0.16×10^{11}	3.7
Maize area	1.3×10^6	0.48×10^{11}	16.8
Paddy area	0.2×10^6	0.13×10^{11}	57.0
Total cattle population	14.4×10^6	7.16×10^{11}	5.8
Male calves	7.3×10^6	2.15×10^{11}	6.4
Female calves	2.1×10^6	1.64×10^{11}	19.3
Cows	4.4×10^6	1.40×10^{11}	8.5

It can be seen that even in quite heavily clustered sample as the AGSASU - sample the variances are generally low for the national estimates of demographic characteristics. However, for small subclasses, the variances can be high. (Refer households with no holders and with 2 holders constituting just 3% and 4% respectively of the population).

5.3.2 Design effects (DEFF)

DEFF which is defined as the ratio of the variance of the estimate obtained from the sample to the variance of the estimate obtained from the simple random sample of the same size, depends on the number of units in the cluster. It tends to increase as number of units in clusters increases.

The design effect has two primary uses:

(i) For estimating sample size

(ii) For appraising the efficiency of more complex plans (designs). That is, judge whether the complex plan is advantageous in efficiency relative to its cost and complexity.

If the DEFF for the estimate is close to one, then it implies that the NMS design is as good as the simple random sample design for estimating that parameter. It also implies that there is not much variation between clusters (villages). Therefore, one can

go for small sample of villages and can take larger sample of households within the villages. However, it is seen from the values of DEFFs worked that most of the characteristics have values which are far from one (i.e between 3.58 and 8.71). It indicates that the variation between clusters (villages) is larger and it is expected so because the villages tend to be more clustered geographically.

The design effects for both demographic and socio-economic characteristics are shown in table 5.2

Table 5.2 Design effects (DEFF).

Characteristic	DEFF
Total population	5.8
Total female population	4.2
Proportion of households operating a holding	4.9
Number of holders per household operating a holding	3.9
Average household size	3.7
Proportion of females	1.7
Proportion of household operating a holding among:	
- households with one member	2.1
- households with 2 - 9 members	3.5
- households with 9> 10 members	1.0
Average household size for:	
- households with no holders	1.0
- households with one holder	3.8
- households with 2 holders	1.0
Proportion of females in:	
- households with no holders	1.3
- households with one holder	1.7
- households with 9> 12 holders	1.5
Total cropped area	8.7
Maize area	7.6
Paddy area	4.6
Total cattle	7.2
Male calves	5.5
Female calves	6.2
Cows	3.6

Through investigating some of the demographic characteristics it is seen that the design effect for the estimate of proportion of females is not far from one, implying that for this characteristic the NMS-design is almost as good as a simple random behaved characteristic for cluster sampling. That is, there is no much variation between villages (or any cluster of comparable size) in proportion of females. Thus, if the only purpose is to estimate proportion of females, we could do so with very small sample in terms of villages and take a large sample of households within villages. However, the design effects for some of the other estimates are considerably higher. For instance, household size has a design effect of 3.7, implying

that the NMS [illegible] has a variance that is 270% higher than a simple random sample of the same size. So, in order to minimize sampling errors for this characteristics we need to take large number of villages with hopefully small average number of households within villages. For the agricultural and socio-economic characteristics we find that the design effect for total maize growing area is considerably high. It is about 4.3, implying that the NMS sample has a variance which is 330% higher than a simple random of the same size. This is an indication that there is much variation between villages in terms of areas under maize cultivation. This is infact the nature of such characteristics as they tend to be more clustered geographically. This is different from demographic subclasses which are generally well distributed over the population and hence over the sample clusters. The design effects in demographic subclasses decline with decreasing subclass size so that the DEFF for the subclasses is less than the DEFF for the total sample. For example in household size category, there are few households in each village with no holders and therefore the sample is very close to a simple random sample (no clustering). Unlike for the demographic subclasses, the design effects for the socio-economic subclasses are generally less well distributed over sample clusters. For the case of cattle keeping, the design effect decline more slowly with decreasing subclass size than it does for the demographic subclasses. For instance, the DEFF for each of the subclasses, male calves, female calves and cows is more than the DEFF for the total cattle.

5.3.3 Variance components in AGSASU

In this particular report only six characteristics mainly demographic of the 1986/87 AGSASU have been singled out for between village variation calculations. These are shown in table 5.3 below.

Table 5.3 Between - village variation

Characteristic	Between - village variation. Proportion of the total variance (%)
- Total population	84
- Total female population	77
- Proportion of households operating a holding	81
- Number of holders in household operating a holding	76
- Average household size	74
- Proportion of females	43

From the table it is seen that the proportion of the total variance that it is attributable to the between village variation is 74 - 84 per cent except for the proportion of females. The proportion of females is exceptional because there is very small variation of the proportion between clusters of reasonable size. As far as design effects for the agricultural variances are concerned, one could for sure expect that there should be much

higher between village variance contribution for such socio-economic characteristics, most likely in the range 75 - 90%

5.3.4 Intra - cluster correlation coefficients (ROH)

Intra - cluster correlation coefficients measures the level of heterogeneity/homogeneity within villages. Unlike DEFF, ROH(ρ) is independent of n, the sample size within village. ROH is therefore a convenient measure when one wants to analyse the effects of different sample sizes for a particular sample design and type of cluster. Table 5.4 below gives intra - cluster correlation coefficients (ROHs) for some demographic and socio-economic characteristics of the 50 villages in the sample.

Table 5.4 Intra-cluster correlation coefficients (ROH).

Characteristic	ROH
- Total population	0.076
- Total female population	0.051
- Proportion of households operating a holding	0.061
- Number of holders per household operating a holding	0.046
- Average household size	0.043
- Proportion of females	0.011
- Total cropped area	0.321
- Maize area	0.273
- Paddy area	0.148
- Total cattle	0.256
- Male calves	0.189
- Female calves	0.218
- Cows	0.108

From the table the ROH is lower for proportion of females than for the other demographic variables. Again for the Agricultural characteristics, the ROH is lower for paddy growing areas than for the other estimates. Consequently for both cases the precision loss is high when the within village sample is reduced.

In the previous report it was anticipated that ROH's for characteristics in AGSASU could be much higher than for the demographic characteristics. However this was not quite so as the results suggest. It is only the maize growing areas and male calves characteristics that agree with the expectations.

5.3.5 Relative variances for different sample sizes in NMS

From the estimate of ROH for a particular characteristic it is possible to calculate relative variance (rel - variances) for different sample sizes. One can thus study the effects on the variances of changes in the number of sample villages and/or the number of sample households within villages. The following table shows the relative variance values for some socio-economic characteristics as depicted from AGSASU round three 1989/90 during masika season.

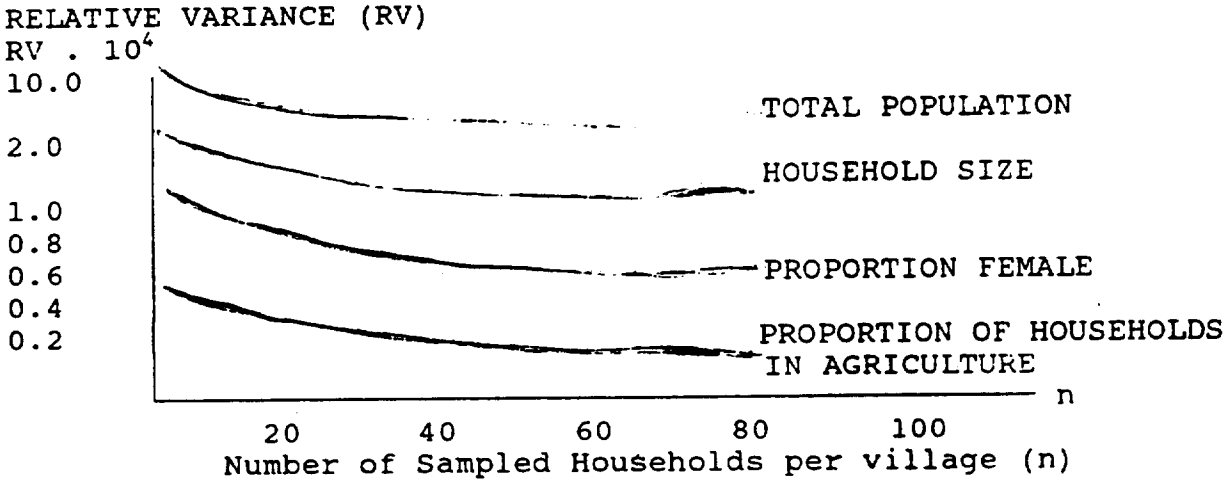
Table 5.5: Relative Variance for Some Agricultural and livestock Characteristics

PARAMETER	RELATIVE VARIANCE
Total cropped Area	$5.8 * 10^{-3}$
Maize Area	$28.3 * 10^{-3}$
Paddy Area	$2.5 * 10^{-3}$
Total cattle	$3.5 * 10^{-3}$
Male calves	$71.7 * 10^{-3}$
Female calves	$39.0 * 10^{-3}$
Cows	$29.8 * 10^{-3}$

5.3.6 Varying number of households in the 50 villages

By keeping constant the number of villages at the old NMS sample size (50 villages), the number of sampled households per village has been in the range 20 - 50 and 25 - 100 for the demographic and Agricultural/Socio-economic characteristics respectively. Diagram 1 below show the relative variance against number of households for demographic/ socio-economic and agricultural characteristics. In diagram 1 the Y - axis shows the relative variances (= RV) and the x - axis the number of sampled households per village (n).

Diagram 1 Relative Variance vs number of households



From the graphs it is obvious that the demographic characteristic that is most sensitive to changes in sample size within village is the proportion of females. That is, if the sample within village is reduced from 60 to 30 households (50% reduction) the relative variance in proportion of females will increase by 60% (the CV increases by 26%). For the average households size (with a higher ROH), this will however increase by only 26% (and CV by 12%) for the same reduction. For the

agricultural characteristics, the graphs show that livestock characteristics that is male calves, female calves and cows are more sensitive to change in sample size within village than the total area and the cereal crop growing areas. For the later characteristics, substantial changes in the within village sample result in only moderate changes in variances. For such characteristics within village the sample size should therefore be kept as low as possible.

5.3.7 Varying number of villages, constant number of households (3200)

When number of households is kept constant, varying number of sampled villages has effect on the variances of some characteristics as seen in diagram 2. In diagram 2 below it is seen that the precision gain from increasing number of sample villages is smallest for the characteristic proportion of females that has shown least contribution of the between village variance to the total variation. For the other demographic characteristics the gains are however substantial. For instance, if the number of villages is doubled from 50 to 100 (with the sample remaining at 3200 households) the variance for average household size will be reduced by 40%. As the previous report points out, the gains in precision of the agricultural characteristics due to increasing number of sample villages is quite high. This is quite displayed in the following graphs of relative variances against number of villages.

Diagram 2. The relative variances

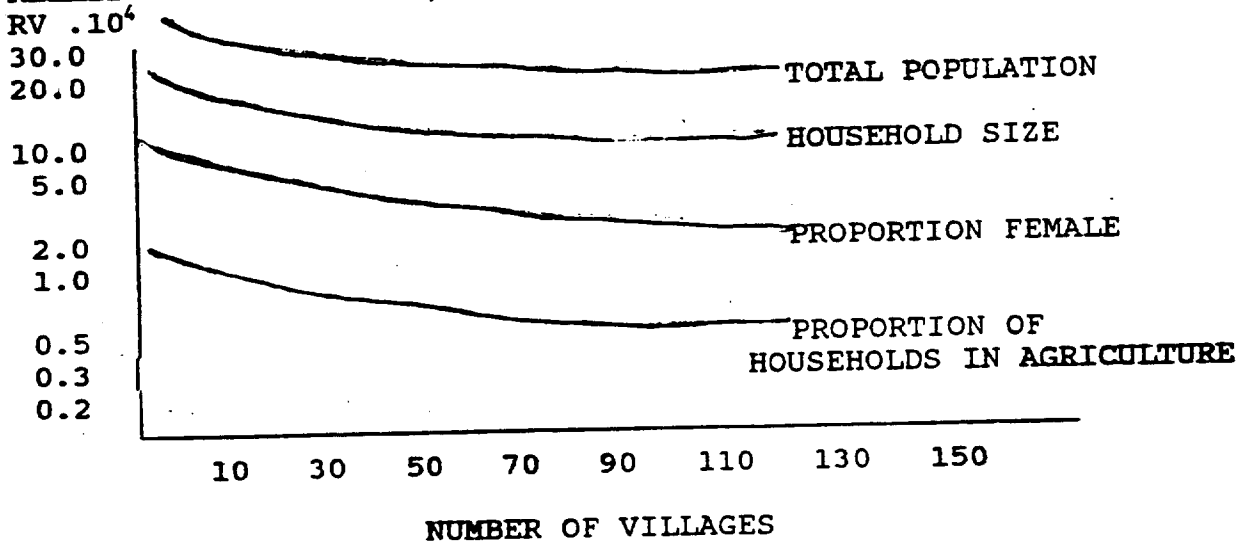


Diagram 3:

RELATIVE VARIANCE

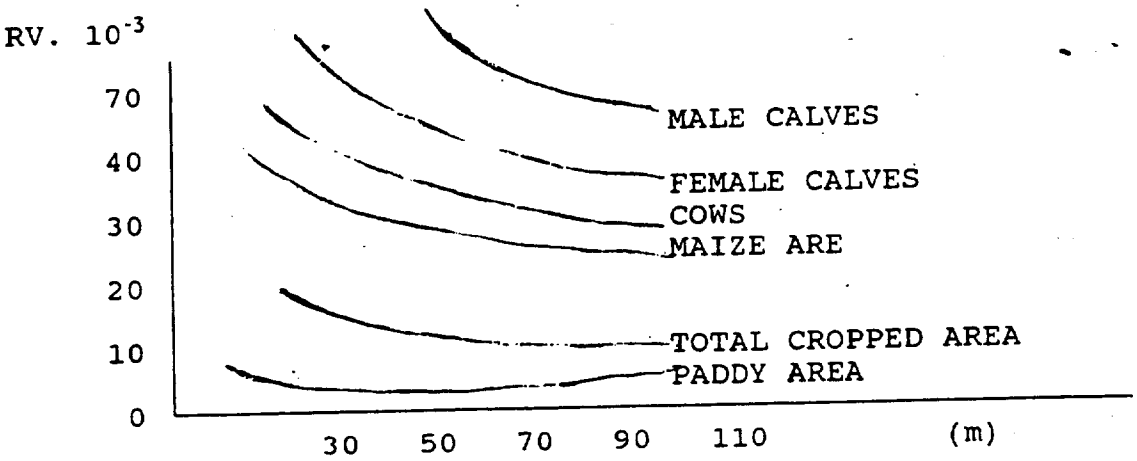
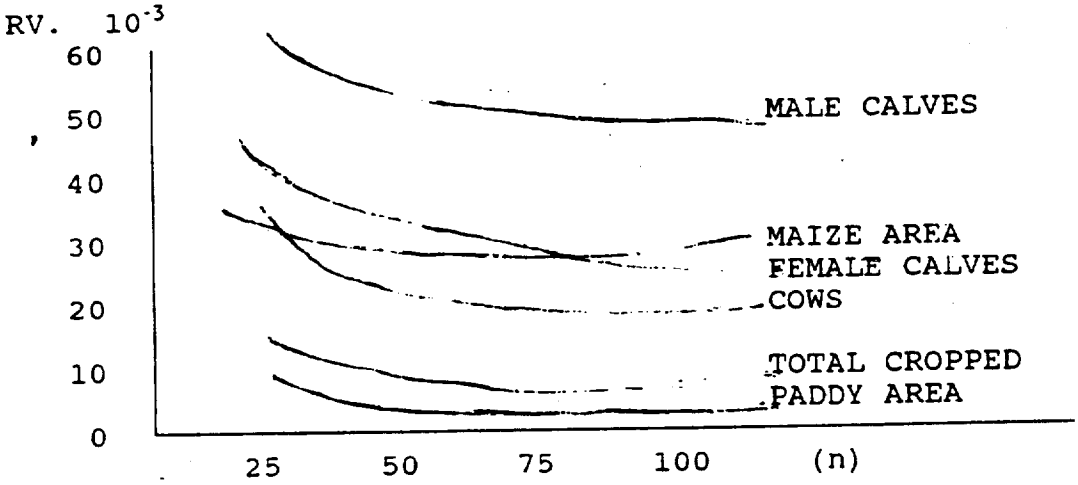


Diagram 4:



NUMBER OF VILLAGES

Diagrams 3 and 4 show that the gains in precision is quite substantial for the cattle keeping characteristics as the number of villages is doubled. This is so because cattle keeping is very unevenly distributed over the population. Thus an expansion of the sample of villages would improve the estimates considerably.

5.4 **Discussion**

Sample design in future surveys:

The suggestions as regards the sample design in future surveys, is to some extent limited to only the few characteristics both demographic and agricultural that have been analysed. However, this will give some useful hints to improvement of the design. As far as the agricultural characteristics are concerned, the cost (in terms of increased variance) for reducing the number of sample households is low for areas under cultivation e.g. paddy and maize. As such, sample households can be reduced

considerably with just fairly small increases in the variances. Consequently, expansion of the sample will result in comparatively smaller gains in variances. In this case, the overall technique for cost minimization is to keep the household sample size as far down as possible. Nevertheless, there is a limit to how small the sample could be. This limit is determined by several factors amongst which the following are the major ones: Firstly, there are small possibilities for stratification of households within villages other than for a few characteristics and therefore to meet precision requirements for such small subclasses the total sample size must be kept above a certain level. Secondly, the sample size is further influenced by the field force available to handle the workload situation. The estimates for agricultural characteristics obviously need bigger village sample than the fifty village sample because in majority of the cases such characteristics like cattle keeping are unevenly distributed over the sample. Thus, although doubling the village sample (from 50 villages to 100 villages) will mean reducing costs interms of getting better estimates of the characteristics, still there is rising costs interms of village selection, transport and supervision. Here it is suggested that in order to strike a balance, it is worthwhile to do away with the tradition of using two interviewers per village and adopt in this new rural NMS design (of 100 villages) system of one interviewer per village. This will keep the same number of interviewers even when the number of villages has been doubled.

5.5 Calculation Methods

Introduction:

Methods utilized in calculations in this report are basically similar to those used in the previous technical report. The only advantage in the recent report over the previous one is that calculations are further extended to analyse estimates of some agricultural/socio-economic characteristics e.g. areas under crop growing and size of livestock; Furthermore, estimated number of households is now elaborated.

The following are the formulas used for calculations.

1. Estimate of total:

$$\hat{Y}=\sum \hat{Y}_h$$

With

$$\hat{Y}_h=K_h*\sum\sum\sum y_{hijk}; \quad K_h=\frac{A_h}{A_{hi}}*\frac{M_{hi}}{M_{hij}}*\frac{N_{hij}}{n_{hij}}$$

Where;
y_{hijk} is the value of the characteristic under study for the k-th household in the j-th village of the i-th ward for stratum h.

A_h = 1978 population in stratum h

A_{hi} = 1978 population in PSU hi (ward)

M_{hi} = Estimated population 1986 in PSU hi

M_{hij} = Estimate population 1986 in village hij

N_{hij} = Number of households in village hij

n_{hij} = Number of sampled households in village hij.

2. Estimate of ratio:

$$\hat{R}=\frac{\sum \hat{Y}_h}{\sum \hat{X}_h}$$

3.(a) Variance (NMS)

(i) Arrange Y for each village in ascending order.

(ii) Make pairs of consecutive Y, i.e. (Y_1, Y_2), (Y_3, Y_4), ... (Y_{L-1}, Y_L)

Where

$\hat{Y}_L$

is the last total estimate for the village

(iii)

$$\hat{V}(\hat{y})_{NMS}=\sum_{i<j}^{L} (\hat{y}_i-\hat{y}_j)^2$$

where

$\hat{V}(\hat{y})$

is the estimate of variance

NB: If you have an odd number of villages, the last difference would be

$(Y_{L-2}$ - (average of $(Y_{L-1} + Y_L)))$

3.(b) Variance (SRS): Under Simple Random Sampling

(i) Find square of total from responding households i.e.

$(\hat{T})^2$

(ii) Find sum of square of responses i.e

$$\sum\sum\sum a_{ijk}^2$$

(iii) Estimate total number of households in the population

$\hat{M}_o$

as first weight x second weight x No of households x 1.23 (raising factor for 1978 - 86)

(iv)

$$\hat{V}_{SRS}(\hat{Y}) = \frac{\hat{M}_o^2}{n(n-1)} \left[\sum\sum\sum a_{ijk}^2 - \frac{\hat{T}^2}{n}\right]$$

n = number of households

4. DESIGN EFFECTS (DEFF)

$$DEFF = \frac{\hat{V}(\hat{Y})_{NMS}}{\hat{V}(\hat{Y})_{SRS}}$$

5. Estimate of Intracluster correlation coefficients (ROH) (cluster = village)

$$ROH = \frac{DEFF-1}{(\bar{n}-1)}$$

6. Estimate of between village variance.

$$\hat{V}_b(\hat{Y}) = \frac{S_b^2}{m}$$

m = number of villages, where

$$S^2 = m * \bar{n} * \hat{V}_{SRS}(\hat{Y})$$

and

$$S_b^2 = ROH * S^2$$

$\bar{n}$ = Average number of households per village.

So;

$$\hat{V}_b(\hat{Y}) = \frac{ROH * m * \bar{n}}{m} * \hat{V}_{srs}(\hat{Y}) = ROH * \bar{n} * \hat{V}_{srs}(\hat{Y})$$

7. Estimate of within village variance.

$$\hat{V}_w(\hat{Y}) = \hat{V}(\hat{Y}) - \hat{V}_b(\hat{Y}) = \hat{V}_{srs}(\hat{Y})\,[1 - \bar{n}.ROH]$$

Relative variance for different m and n.

$$RELV(\hat{R}) = \hat{V}(\hat{R}) / \hat{R}^2$$

where

$$\hat{V}(\hat{R}) = \frac{\hat{S}_b^2}{m} + \frac{\hat{S}_w^2}{m\bar{n}}; \quad \hat{S}_b^2 = ROH * \hat{S}^2; \quad \hat{S}_w^2 = \hat{S}^2 - \hat{S}_b^2 = \hat{S}^2 * (1 - ROH)$$

so;

$$RELVAR(\hat{R}) = \frac{\hat{S}^2}{\hat{R}^2}\left(\frac{ROH}{m} + \frac{1 - ROH}{m\bar{n}}\right) = \frac{\hat{S}^2}{m\hat{R}} * \left[ROH + \frac{(1 - ROH)}{\bar{n}}\right.$$

CHAPTER 6

COST FOR DEVELOPING THE URBAN NMS

During the development of the new NMS no substantial costs were incurred. Unlike the old rural NMS which included costs on allowances, transport and stationeries, the development of the new rural NMS was mainly desk work. The design was the same and the frame was based on data from the 1988 population census. Nevertheless, field work was conducted by one officer in Mbeya region for a period of two weeks. Lunch allowance was also paid to the two desk officers who complied the frame and selected the sample.

One would anticipate considerable costs in developing the urban component of the new NMS. But this was not the case because in this exercise most of the information used was extracted from the 1988 population census. However, there was some field work conducted within the city of Dar es Salaam and all the municipalities in order to classify the Enumeration Areas (EAs) in the frame into low, middle and high income levels. The cost incurred in performing this task was again very minimal and difficult to trace.

Received
October 27

Mr. Motoo Konish,
Resident Representative
World Bank Resident Mission
P.O.BOX 2054,
DAR ES SALAAM

Re: PROGRESS REPORT ON HUMAN DEVELOPMENT SURVEY

As per Agreement of september 1 1993 concerning data gathering on Human Development Survey. I am submitting this progress report. The report covers

(a) Data gathering team
(b) Logistics
(c) Coverage of clusters as of 15th October 1993
(d) Problems

(a) Data gathering Team

Two teams of interviewers were formed for the purpose of data gathering. One team had 16 interviews and two supervisors while the other team had fifteen interviewers and two supervisors, making a total of 31 interviewers and four supervisors. As you may recall during training for this survey I had recruited thirty three interviews and five supervisors (excluding myself) After Pre-testing of the questionnaire two interviewers and one supervisor were dropped due to poor performance while the other supervisor fell sick. A full list of interviewers and supervisors is shown in Appendix 1.

(b) Logistics

Each team had three vehicles making a total of six vehicles. Of these, four were hired from Makondeko Tours and Travel Company and two from the University of Dar es Salaam. In addition to transport each group took with them the required number of questionnaires, maps for urban clusters, instruction manuals and research clearance.

(c) Coverage

Data gathering from 13 clusters in Tanga regions was done between 6th and 11th september. Later two teams of interviewers had to go back to Tanga region to re-interview some sections of the questionnaire, particularly the expenditure section; this work was completed by 18th September.

As of 15 th October, group 1 (see appendix 1) had covered clusters in Arusha, Mwanza and Mara regions. In Mara where there were 7 clusters , one cluster (Nyamburi) could not reached due to heavy rains which had washed away a bridge 8 Kilometers from the village. We could not walk to the cluster because it was still raining. In Nabweko Mwanza region, only 8 households were interviewed due to transport problems. Nabweko is a cluster located in a small island. There is one reliable boat going there once a week. if leaves Nansio (Ukerewe Island) every Sunday at 10 a.m and arrive at the island at around 3.PM. It leaves the island at the Island at Sunday at 10 a.m and arrive at the island at around 3PM. It leaves the Island on Monday at 7.30 am.

Since there were only four interviewes by the time we went to Nabweko they could not interview more than two households each. We tried to hire the boat but the owner refused because it had already been committed to fishing business. Our only best option was, to increase the number of households to be interviewed in some of the remaining cluster and that has already been done.

By the said date group 1 had covered 33 out of the 78 clusters that had to be covered in upcountry regions by mid November.

Group 2 had, by the same date covered Kilimanjaro, Lindi, Mtwara and Ruvuma one cluster in Coast Region and five clusters in Iringa regions making a total of 34 clusters. This represents about 44 percent of the 70 upcountry clusters that the group had to cover by mid November.

Taking into account that data gathering in upcountry regions started in earnest around 21st September and interviewers took time to gain speed the achievement was not bad. Now that they have gained speed, taking an average of one and a half hours per household, we should be able to meet the deadline.

(d) Problems

In addition to the mentioned two accessibility problems we also faced sickness problems. One interviewer got sick for about 8 days and could not do any work. Two others got sick for 3 day and did not interview for two days each. Two interviewers had to be fired -one because of poor performance (not only was be slow but the quality of the work very poor). The other was fired because he was inciting other interviewers not to cooperate with supervisors. Lastly I had to come to DSM briefly to sort out logistical problems with Makondeko as well as to ensure that data gathering in Dar es Salaam starts. Now everything is moving.

Sincerely

Prof. HKR Amani

cc: Charles Griffin
World bank, Washington D.C (Please authorise Payments)

cc: Luisa Ferreira
World Bank, Washington D.C

Appendix 1

Supervisors, Interviewers and their Regions

Group 1: Supervisors

1. Prof. HKR AMANI
2. Dr. S. S. Ngware

Interviewers:

1. Bupe Philemon
2. Shimimana Ntuyabaliwe
3. Pantalcom Shoki
4. Helen Kitilye
5. Waziri Barnabas
6. Vicky Peter
7. Adolf Ndunguru
8. Christine Lissu
9. Jamhuri William
10 John Kimario
11 Rose Maeda
12 Leonard Marwa
13 Josephat Kweka
14 Moyo Ndonde
15 Peter Elias
16 Mika Samuel

Regions

Arusha, Singida, Tabora, Shinyanga, Mwanza, Kagera , Mara and part of Morogoro and part of Coast

Group 2 **Supervisors** 1. Phillip Mpango
2. Hamisi Mwinyimvua

Interviewers

1. Kokuteta Baregu
2. Hope Kaiza
3. Ole- Loluba
4. Laura Kilasara
5. Alusaria Swai
6. Grace Kalanje
7. Frida Teye
8. Alfredo Mziray
9. Chimile I. P
10 George Magembe
11 Frida mkumbo
12 Moulin Bakirane
13 David Charles
14. Margaret Ruhuza
15 Msonga Kinyanganyanga

Regions

Kilimanjaro, Lindi, Mtwara, Ruvuma, Iringa, Dodoma, Mbeya, Rukwa, Kigoma, part of Coast and part of Morogoro.

28/2/1994

To Charles Griffin
AF2 - PH
Room J 10003
World Bank, Washington D.C.

From Prof. H.K.R. Amani
Department of Economics
University of Dar es Salaam

Re: FINAL REPORT ON THE HUMAN DEVELOPMENT SURVEY

I have the honour to present to you my final report on Human Development Survey that began in earliest on the 18th September 1993. This report is divided into the following components

(a) A flashback to the preparation for the survey
(b) Organization of the survey
(c) Coverage and duration of the survey: planned and Actual
(d) Problems and lessons

(a) Flashback to the Preparation

On 2nd September 1993 I had sent to you my "final" report on the survey preparation. The report should not have been final because preparations continued until 15th of September even though they were due for completion by 31st August. We organized a pretesting trip to Tanga region where five survey teams covered all the 13 clusters in the region between 5th and 11th September. One team was left to pretest the questionnaire in DSM. Later we realized that exercise was worth "billion of dollars" as it enabled us to discover two very important problems, namely: problems related to the questionnaire and those related to the understanding of the questionnaire by the numerators and supervisor. On the questionnaire we decided to drop some of the questions because they contributed little to the value of the data we were collecting; this enabled us to save on the amount of paper to produce the questionnaire. On enumerators' understanding of the questionnaire we spotted serious problems with the expenditure section of the questionnaire. Many enumerators did not register positive values for payment in kind even in obvious cases such as households which consumed their own produce.

Since the five teams in Tanga were sent to different districts and one team was left in DSM it was impossible to communicate these problems for immediate correction.

Upon our return to Dar es Salaam we found out that the team we had left behind did not do much because of poor supervision. The few questionnaire that were completed by this team had more or less similar problems as mentioned above. The decision was then made to extend training for at least three days.

(b) Organization of the Survey

The final organization of the survey took into account the following factors

(a) Among the enumerators there were eleven University students who had to be back for studies by 12th October 1993.

(b) I had to fire the Dar es Salaam supervisor and break-up the DSM team.

Consequently two groups each with two teams were formed. One of the teams was to cover Kilimanjaro, parts of Coast region, Lindi, Mtwara, Ruvuma, Iringa, Mbeya, Rukwa, Kigoma and Dodoma regions. This group comprised of two teams each with one supervisor and two vehicles and five enumerators. One team containing University students had to return to DSM on 12th October. The other group had two supervisors and 16 enumerators and the group was to cover Arusha, Mwanza, Mara, Kagera, Shinyanga, Tabora, Singida and Morogoro. This group was large because it had to take six enumerators from the former DSM team of eight enumerators.

(c) Coverage and duration of the Survey: Planned and Actual

Initially the Survey was planned to be completed by the end of November. However, this plan was not achieved because of a number of reasons. First the survey was slowed down by rains in some parts of the country particularly the North-western part. Some clusters could not be reached when it was raining. Teams had to wait for rains to stop to reach such cluster. Secondly in some clusters interviewing could not start before 1 PM since almost every cluster member was busy working on the farm. As a result coverage of such clusters was finished very late, if not the second day, and movement to the next cluster was thus delayed. Thirdly there was a conflict between supervisor Philip Mpango and his enumerators. This conflict ended up in the team returning to Dar es Salaam without covering Iringa, Mbeya and Dodoma. Enumerators found the supervisor too strict to the extent of not caring for the health etc. However the supervisor also thought the enumerators were not cooperative to the extent of delaying the progress of the survey. I had to replace Mr. Mpango with Mr. Mwinyi and sent the team to cover Iringa and Mbeya and assign my team to cover Dodoma. Fourthly and probably the most important reason is that we underestimated the whole exercise. If we had considered the three factors I have mentioned above, we could have planned well.

As for Dar es Salaam the main problem has been supervision. Interviewing started late because of some delays in preparing questionnaire. However once that was completed by the end of October interviewing should have proceeded smoothly without problems if supervision was provided frequently. This is the most

disappointing part of the whole survey. The survey in Dar es Salaam was not completed until close to the end of January. I had to do the supervision myself. In addition some enumerators in DSM did not take part because of school commitment.

On coverage, all clusters except two were visited. The two not visited were made inaccessible due to heavy rains which washed away bridges. In terms of number of households interviewed, we managed to cover an average of 22 households per cluster. In some clusters the number was very small mainly due to logistical problems. For example if it was found absolutely necessary to move to the next district before offices close on a Friday so that we can get clearance to work on Saturday and Sunday then the last cluster in a district was not fully covered. To offset such low numbers in some clusters more than 25 households were interviewed in some clusters whenever possible.

(d) Problems and Lessons

In addition to some of the problems outlined above there are some more.

i) Very poor official responses in urban areas. We could not get good cooperation from local government leaders in urban areas. As a result there were delays in selecting households and interviewing them. Quite often some households refused to be interviewed and we had to replace them. We used our list of replacements but at times this also failed. The picture was quite different in rural areas where the response was, I should say, very good.

ii) The organization of the teams was good but my selection of the supervisors left much to be desired. I thought I did a good job but I must admit, I failed in this.

iii) I think I also made a mistake by hiring Makondeko. Even though we faulted on the initial payment, but subsequent action by Makondeko partly let us down. First Makondeko sub-contracted individuals whose financial position appear to be weak. As a result money for fuel and maintenance was not given regularly, forcing us to delay and/or pay for fuel ourselves. In one instance the two teams going to Lindi via Dar es Salaam had to wait for two days for Makondeko to arrange funds for transport. Of the vehicles we hired from Makondeko only one was theirs. This implies that Makondeko did not have enough vehicles to meet our needs.

Lessons

Some of the main lessons which we can learn from this whole survey are

i) While training was well done many of the enumerator could not take part in the survey since they had to go back to school. Apparently we spent a lot of money training them but their contribution to the survey was not much. If training had been completed by end of August then the outcome would have been different.

ii) Leaving only two teams in the field to cover so many clusters during a rainy season is something I would not repeat. It would be advisable to have five to six teams (as originally planned) each covering three to four regions. We would have saved a lot of time and probably funds

iii) I think we all have learned that such a big survey requires more time to plan than we had. Delays in getting funds for example could have been avoided if planning had started earlier. But this is some we could not have done as certain things are beyond our control.

iv) Personally this survey has made a lot of impact on my experience. I have realized my organizational weaknesses and to some extent my naivity. I think after I have rested and regain my strength I will sit down and write a detailed report on this survey so that others can make use of our experiences.

Concluding Remarks

May I take this opportunity to thank all of you, particularly Charles Griffin, Luisa Ferreira, Dr. Malangalila and Betty Sakaya for all the support and guidance. It has been wonderful working with you.

Sincerely

Prof. K.K.R. Abani

UNIVERSITY OF DAR ES SALAAM
DEPARTMENT OF ECONOMICS
P.O. Box 35045 — DAR ES SALAAM — TANZANIA
Telephone No: 40052
Telegrams: UNIVERSITY DAR ES SALAAM

3/16

Our Ref:

Your Ref:

July 15, 1994

To Charles Griffin
AF2-Ph
Room J10003
World Bank, Washington D.C.

RE: FINAL REPORT ON THE HUMAN RESOURCE DEVELOPMENT SURVEY (HRDS) IN ZANZIBAR

I have the honour to present to you my report on HDS in Zanzibar. This report is divident into the following sections.

(a) Preparation for the survey
(b) Execution of the survey
(c) Coverage and duration of the survey
(d) Problems and Lessons

(a) Preparation of the Survey

Since I had never been to Zanzibar before the preparation of the survey began on 6th June 1994 when I made a days' trip to Zanzibar in order to get some information on the possibilities of undertaking the survey within two to three weeks. In particular I sought information on sampling frame, recruitment of a local research assistant, logistics and a lot of details on how I should organize the survey taking into account social-cultural and political attributes of Zanzibar and Pemba. I spent about six hours with the government statistician (GS), Mr. Ali Athumani and his colleagues. From my discussion with them

i) I finally decided to accept your offer to execute the survey

ii) I got good information on the sampling frame

iii) I was able to make tentative decisions on recruitment of enumerators and a research assistant as well as on transport arrangements.

I communicated to you on (i) and (ii) above soon after I had returned from Zanzibar. On (iii) I decided to recruit from among the mainland HRDS enumerators. It would have been ideal to recruit enumerators from Zanzibar but we did not have time to train them. I recruited one of the Senior Statisticians in the GS office to be my assistant. This was necessary for logistical reasons.

I spent three days with potential enumerators going through the questionnaires and plans for field work. All the enumerator were females (I was so advised by GS) due to some social/cultural attributes which would have made it difficult to use male interviewers.

(b) Execution of the Survey

(i) Sampling Frame

As agreed before our Sampling Frame consisted of all the Enumeration Areas (EAs) used in both the most recent Household Budget Survey (HBS) and the Demographic and Health Survey in the HBS/Demographic and Health Survey (DHS). Using systematic random sampling we selected 24 EAs or about 24% of the Sampling Frame. This selection method was used in order to ensure a good spread of the coverage.

The sampling frame covers Agro-Ecological Zones in Zanzibar as shown below

Island	Urban	Rural Coral	Rural Non-Colar	Total
1. Unguja (DHS)	24 (308)	15 (138)	15 (357)	54 (803)
2. HRDS	6 (24)	3 (15)	4 (15)	13 (54)
3. Pemba (DHS)	15 (100)	15 (117)	15 (417)	45 (634)
4. HRDS	5 (15)	4 (15)	2 (15)	11 (45)
5. Zanzibar (DHS)	39 (408)	30 (255)	30 (774)	99 (1437)
6. HRDS	11 (39)	7 (30)	6 (30)	24 (99)

Rows 1, 3 and 5 show the composition of the Sampling Frame while Rows 2, 4 and 6 show HRDS sample. The numbers in brackets show the number of EA in each category. The selected EA's are shown in Appendix table 1.

ii) Selection of Households

Unlike in the Mainland HRDS in Zanzibar and Pemba we did two things slightly different. First we were lucky to get the most recent (1994) list of households in each EA. So we used this list for the selection of Households. Secondly, in Zanzibar we could not use Balozi's (ten cell leaders) because of political reasons. Instead we used Sheha's ("Ward"

government leaders) to accompany us to the selected households. Again we used systematic random sampling in the selection of households to ensure good spread of coverage in each EA.

iii) Duration of the Survey

The survey was planned to be done within two weeks effective June 13th. Due to the delay in getting money for the survey, work could not start until 18th June. However despite that delay the survey was completed on 28th June. This has been possible due to

- Enumerators were very knowledgeable about the questionnaire and experienced in administering it.
- I had picked an adequate but manageable (in terms of supervision) number of enumerators. As a result we were able to cover two to three clusters a day.
- Zanzibar and Pemba are very small islands and all the clusters in each district were close to one another. Hence it was easy to reach them.
- The plan of Action was well designed to allow coverage of at least two clusters a day.
- The number of households interviewed in each cluster ranged between 9 and 10. This enabled us to form two to three teams of enumerators with each enumerator covering an average of 5 households a day.
- The identification of EAs and reaching them was made very easy by recruiting a Zanzibari who has been to all the EA before.

(c) Problems and Lessons

In undertaking the HRDS in Zanzibar we did not encounter as many problems as we did in the Mainland. We did not experience problems in supervision, logistics or in the health conditions of the enumerators. On these everything turned out to be perfect.

However we had some very poor cooperation from some households in Pemba. The problem was particularly serious in Utaani and Kipangani cluster - both in Wete town. Apparently there was a conflict between the Sheha and his people. In Utaani for example out of the ten households selected seven refused to be interviewed giving all sorts of excuses. We had to go through the replacement exercise more than once to get the required number of households.

6/16

On lessons learned, one is quite obvious, namely: If a Survey is well planned and employs well trained and experienced enumerators its chance of success is very high. Another lesson concerns logistics. As pointed out earlier, the clusters in Zanzibar were quickly accessible hence not much time was spent travelling. This does not mean that in a big survey one should select only quickly accessible clusters; the selection should be based on the purpose of the survey as well as on available resources. Lastly it is necessary to point out that having someone in the team who knows and quickly acceptable to people in the chosen clusters makes it very easy to administer the survey. In this case Mr. Idi Haji was extremely resourceful.

In conclusion, I found the work in Zanzibar easier than I expected, taking into account that I had not been in Zanzibar before. I would like to thank all those who made this survey completed in time. In particular I thank Charles Griffin, Luisa Ferreira, Dr. Malangalila, Betty Sakaya, Mariane Mwakangale, Zanzibar Government Statistician Mr. Ali Athumani and his staff and lastly but not least all the six enumerators who gathered the information we needed. It has been a wonderful experience.

Sincerely,

H.K.R. Amani

Prof. H.K.R. Amani

September 3, 1993

49/02

Mr Roy Southworth,
Senior Operation Officer,
World Bank Resident Mission,
Dar es Salaam.

Dear Roy,

RE: FINAL REPORT ON THE PREPARATION FOR HUMAN DEVELOPMENT SURVEY.

As per agreement of 17th August 1993 concerning the Preparation of the Human Development Survey, I am submitting my final Report. As it was in my first report, this report covers the following:

a). Data Gathering/Data Entry Team
b). Training
c). Development of Survey Instrument
d). Field Testing
e). Logistics for field work.

(a) Data Gathering/Data Entry Team.

All the thirty three interviewers and five Supervisors who were recruited by July 30 are still with me. There have been no changes. As for data entry the seven people who were identified for training have now been recruited and training for them would start on September 3.

(b) Training

Training of interviewers continued very smoothly. During the period August 23 we spent more time going through Research Tools and Instruments to make sure that interviewers are fully acquainted with the survey instrument and tools. I am now sure that they will do a good job. The last two days of August we reviewed our achievement on the training, discussed field work plan and went through the Swahili version of the questionnaire.

(c) Development of Survey Instrument

Since my last report, I have fully participated in the translation of English version of the survey Instruments and tools and that exercise has been completed at my satisfaction. In addition, I have fully participated in the updating of the Interviewers' and Supervisors' Manuals.

(d) Field Testing

Although we did not undertake any additional field -testing of the survey instruments and tools I am not worried about the quality of the interviewers, Supervisors and the survey instruments. Nevertheless we will do one more kind-of pre-testing. Five teams will be going to Tanga region to gather data from the actual (intended) clusters. This time the Swahili version of the questionnaire will be used. Should there be any big problems with the questionnaire (something unlikely) we will do everything possible to correct it within the shortest time possible.

(e) Logistics for fieldwork

Since my last report I have been able to finalize transportation arrangement. I have hired four vehicles from Makondeko Tours and Travel Ltd and two from the University. Other Logistical requirements that were mentioned in my previous report have now been completed except duplication if questionnaire. We have printed just enough to cover Tanga region. If everything goes well we will duplicate the remaining 5,000 by september 7.

We are about 5 days behind schedule but this has been due to unforeseeable events such as delays in getting financial support and of course the need to properly develop survey instruments and tools. I am more than convinced that this exercise will succeed.

Sincerely

Prof H.K.R Amani

cc. Mr. Charles Griffin
AF2 - PH
Room J 10003
World Bank, Washington D.C

cc. Luisa Ferreira
AF2 - PH
Room J 100026
World Bank, Washington D.C

REGION DISTRICT BRANCH

KUSINI PEM MKOANI KENGE JA

5	5	2	1	0	1

EA No 0 0 1

EST EA POP 3 8 8

CENSUS VILL No

GE NAME MKUNGU

OF EA 1: 10000

REFERENCE 10/7799

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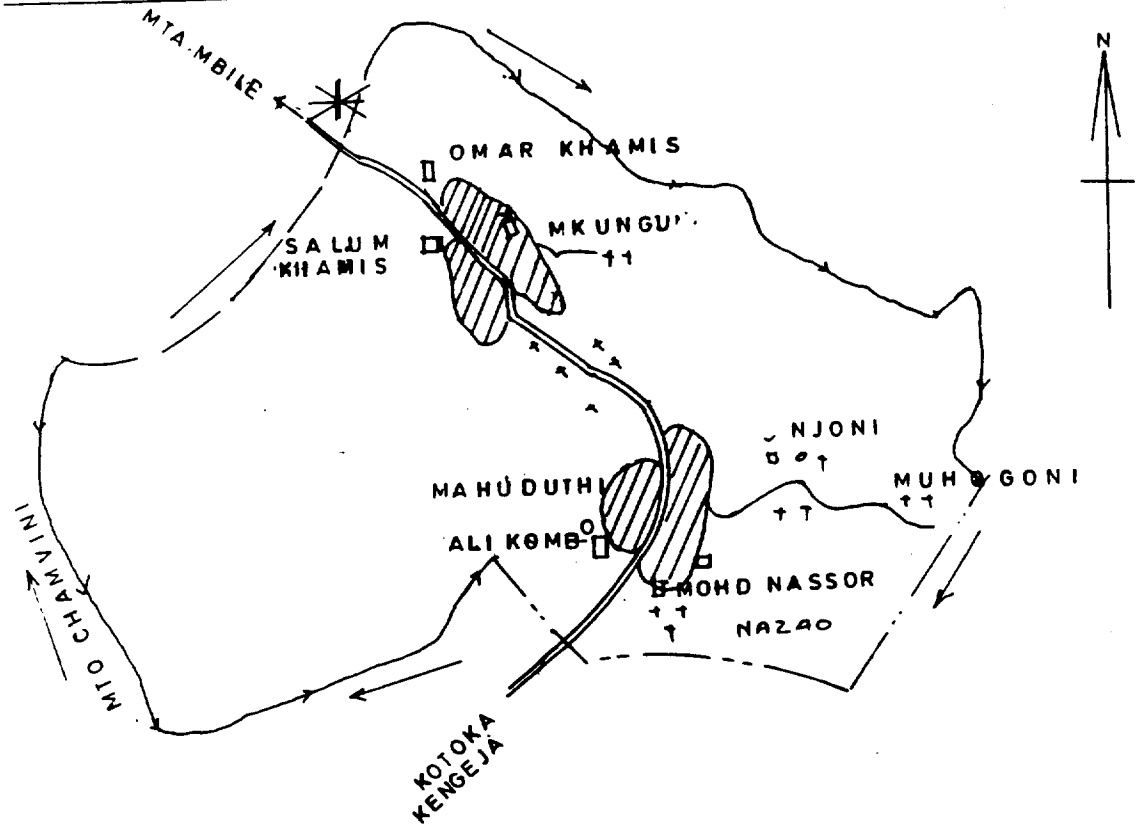


ROAD
RIVER
TRACK
WARD BOUNDARY
EA BOUNDARY
SETTLEMENT CLUSTER
SCATTERED SETTLEMENT
VILLAGE CHAIRMAN'S HOUSE
MOSQUE
STARTING POINT

K

REGION KUSINI

DISTRICT CHAKE

BRANCH VITONGOJI

EA N° 0 0 1

EST

EA POP 4 4 4

E 5 5

1

0 7 1

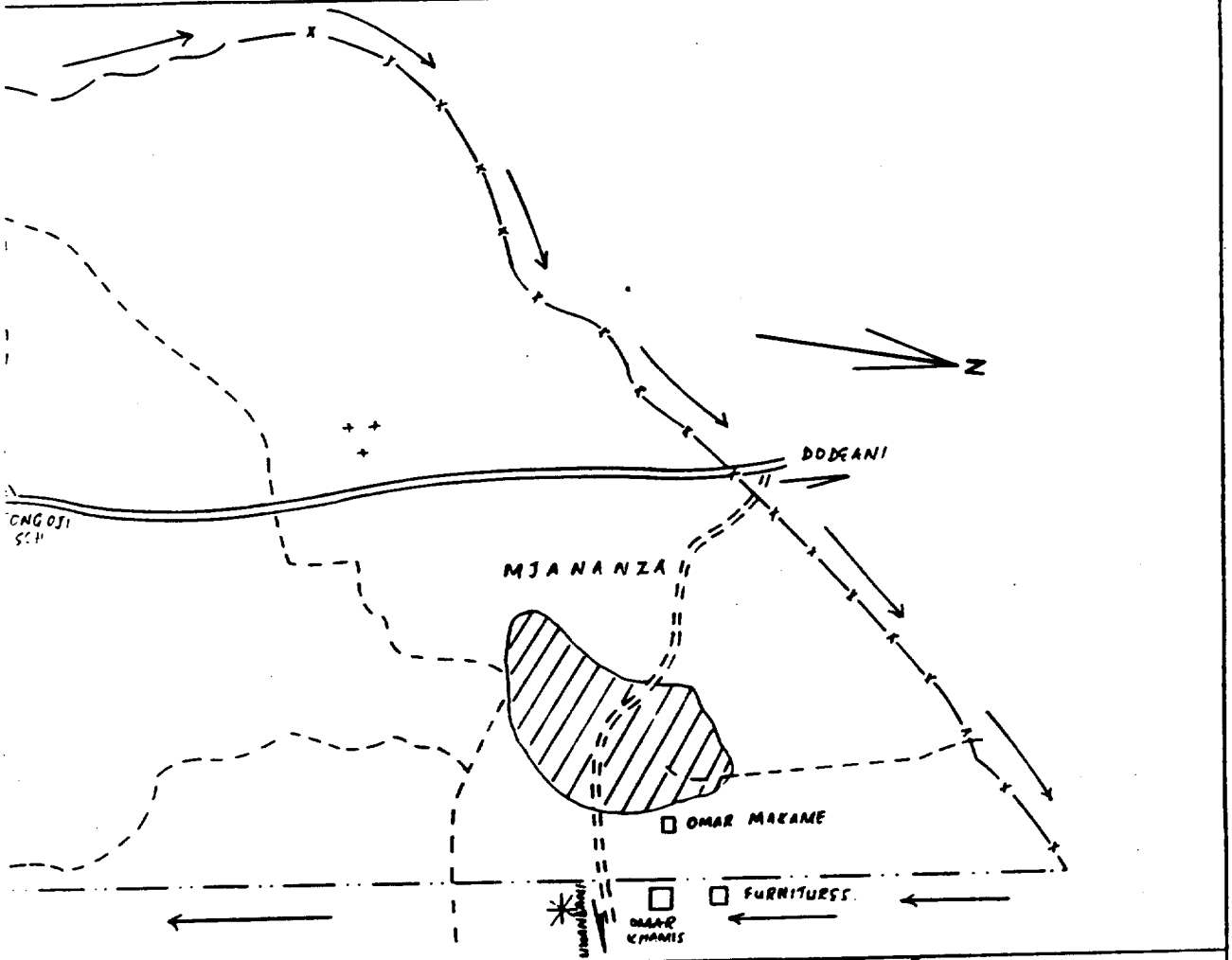
E NAME MJANANZA

CENSUS VILL N°

OF EA 1 : 10000

REFERENCE 10/8523

APPROX SCALE



REGION	DISTRICT	BRANCH	EA N°	0	0	5
KUSINI	MKOANI	MUAMBE	EST EA POP	450		
5 5	2	1 1 1				

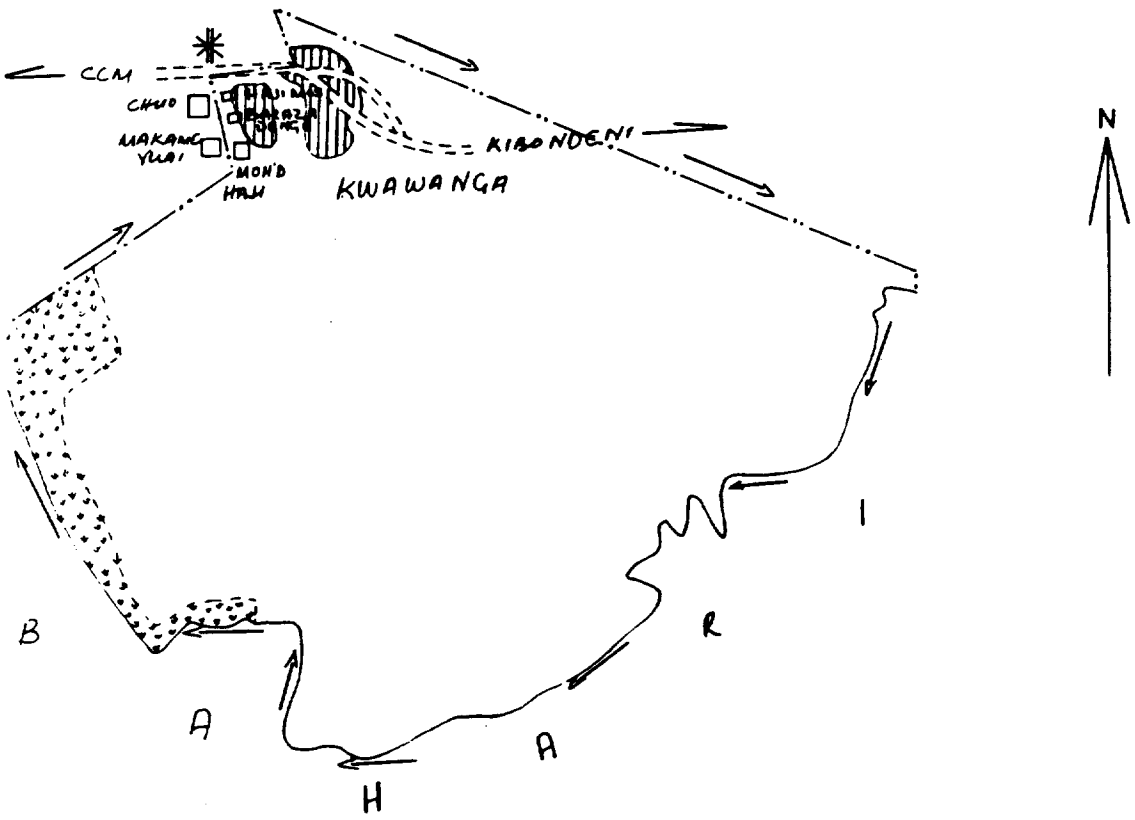
CENSUS VILL N° ☐☐

E NAME KWAWANGA

OF EA 1/10.000

REFERENCE 10/7799 & 10/7793

APPROX SCALE 1200 M



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EA BOUNDARY
DISTRICT BOUNDARY

SETTLEMENT CLUSTER
SCATTERED SETTLEMENT
VILL. CHAIRMAN'S HOUSE
MOSQUE
STARTING POINT

REGION DISTRICT BRANCH

EA No 0 0 7
EST
EA POP 3 7 6

ME KUSINI PEM CHAKE CHANJAANI

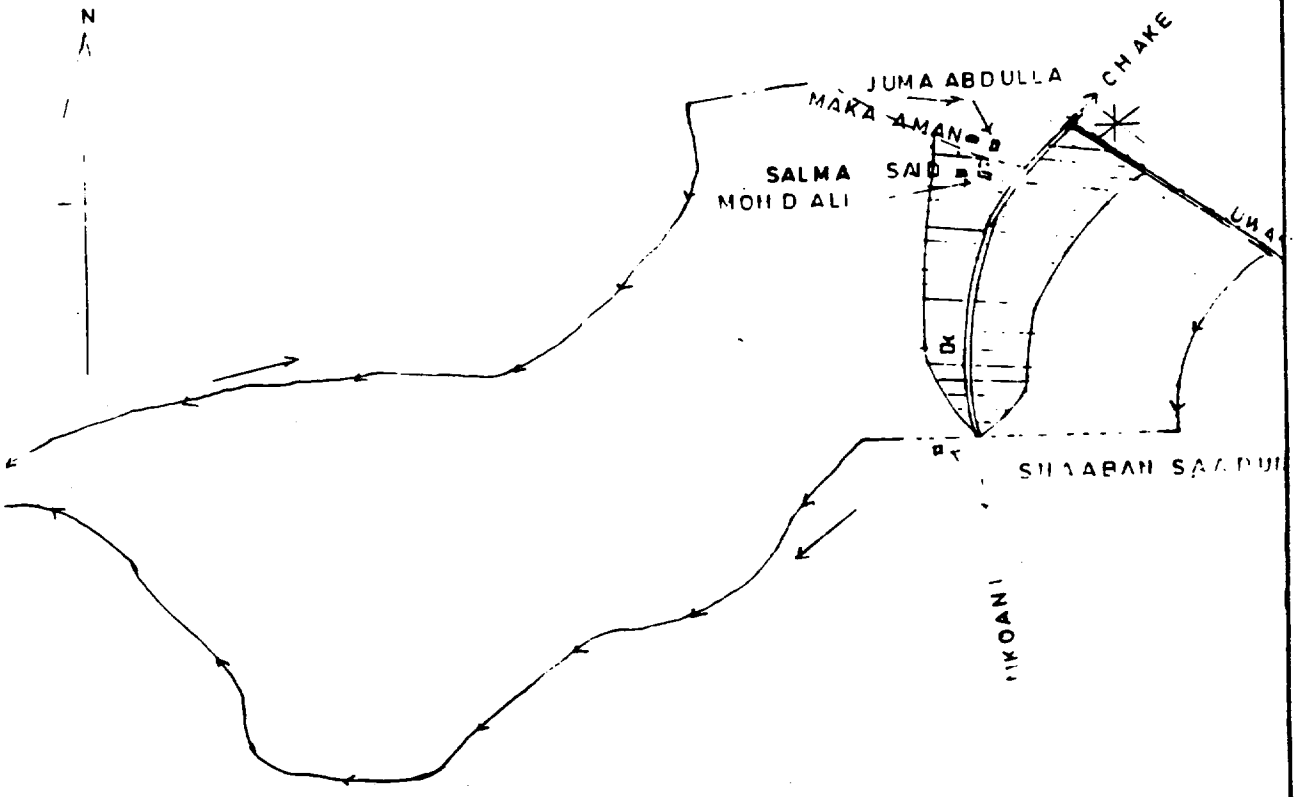
E 5 5 | 1 | 0 1 2

GE NAME CHANJAANI

CENSUS VILL No [ ]

APPROX SCALE
0 200 400m

P OF EA 1:10000
REFERENCE 10/8517/9817/7717



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EA BOUNDARY
SETTLEMENT CLUSTER
SCATTERED SETTLEMENT
VILLAGE CHAIRMANS HOUSE
MOSQUE
STARTING POINT

K

EA REGION: KASKAZINI (5 4)

DISTRICT: WETE (1)

BRANCH: UTAANI (1 7 2)

EA Nº: 0 0 3

EST EA POP: 4 10

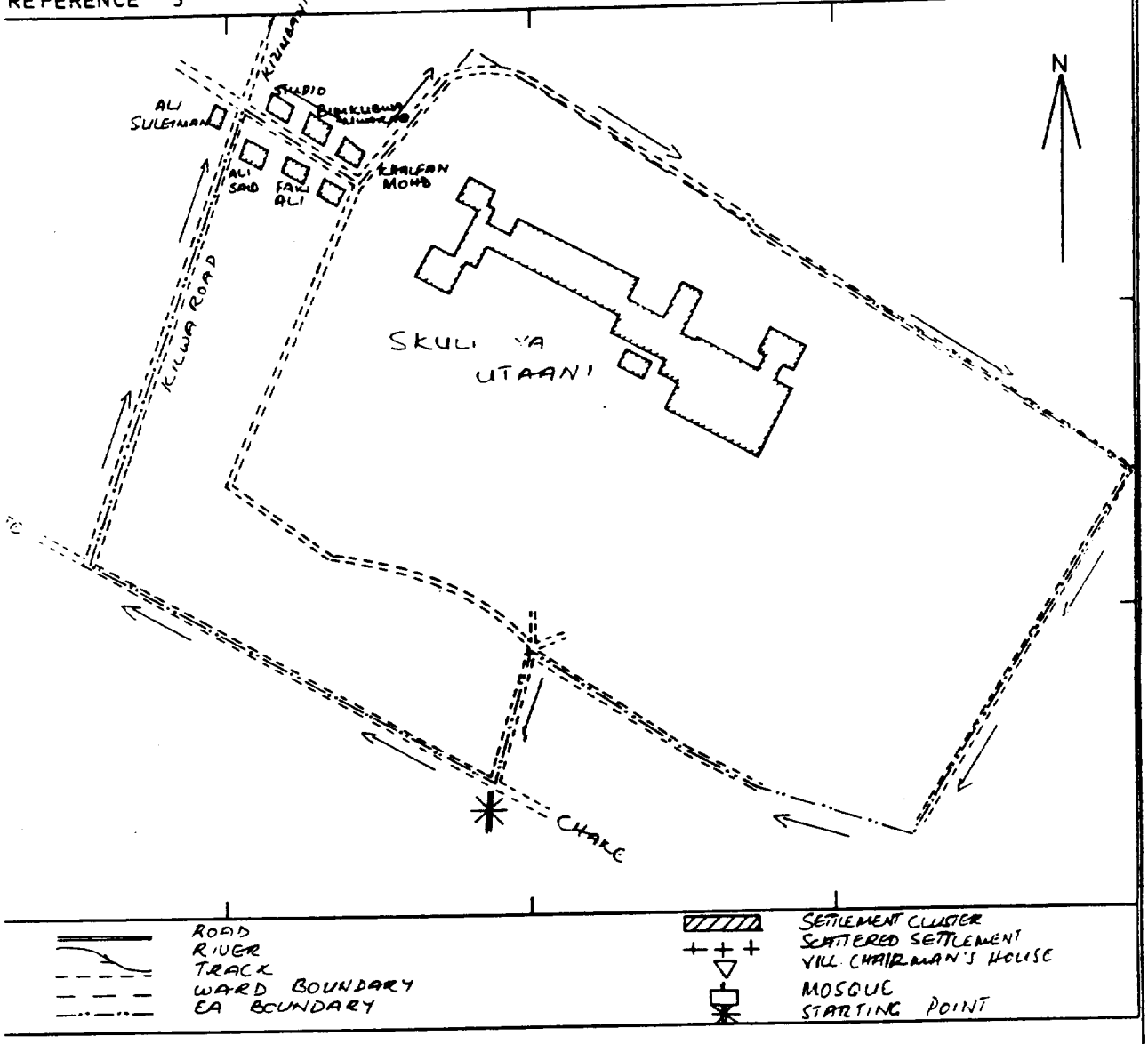
CENSUS VILL Nº:

GE NAME: UTAANI

OF EA: 1/2 500

REFERENCE: 5

APPROX SCALE: 50 100m

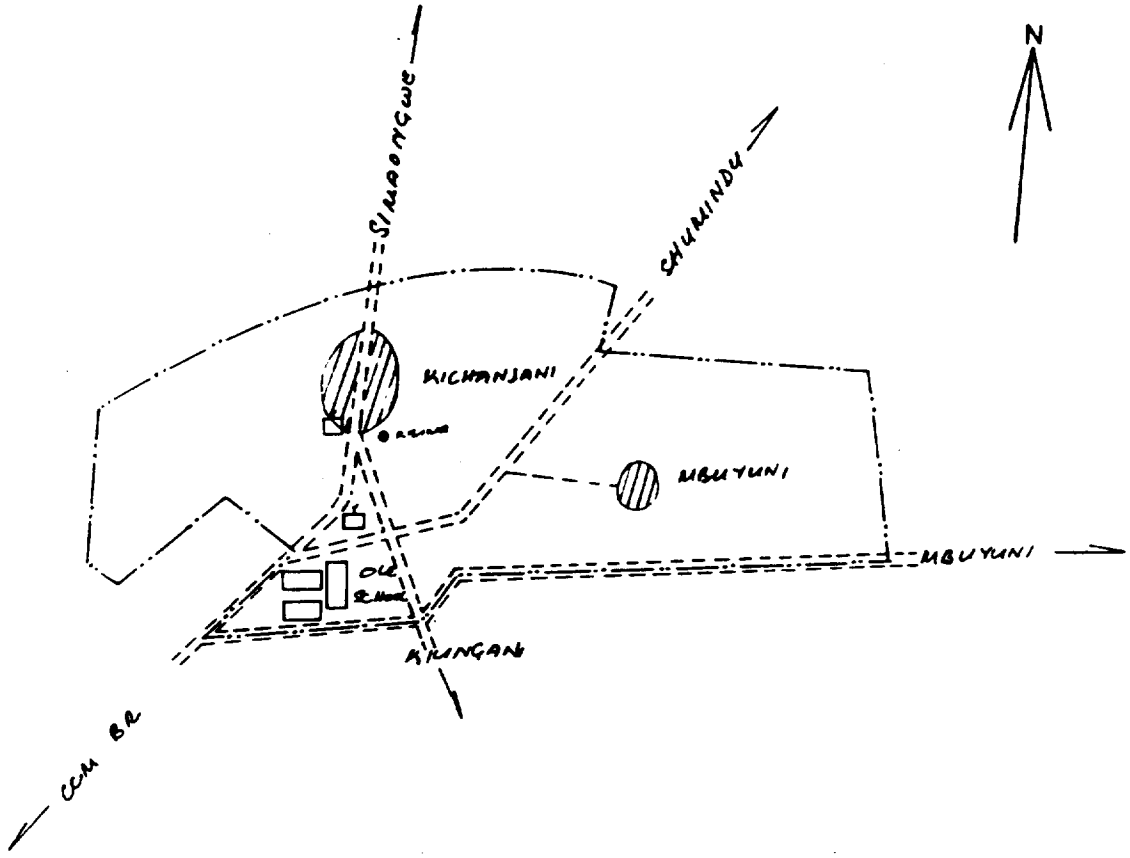


REGION	DISTRICT	BRANCH	EA Nº	0	1	2
KASKAZINI	WETE	OLE	EST EA POP	305		
5 4	1	0 7 1				

E NAME MBUYUNI CENSUS VILL Nº

OF EA 1/10000 APPROX SCALE

REFERENCE 10/8523



ROAD
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WARD BOUNDARY
EA BOUNDARY
DISTRICT BOUNDARY

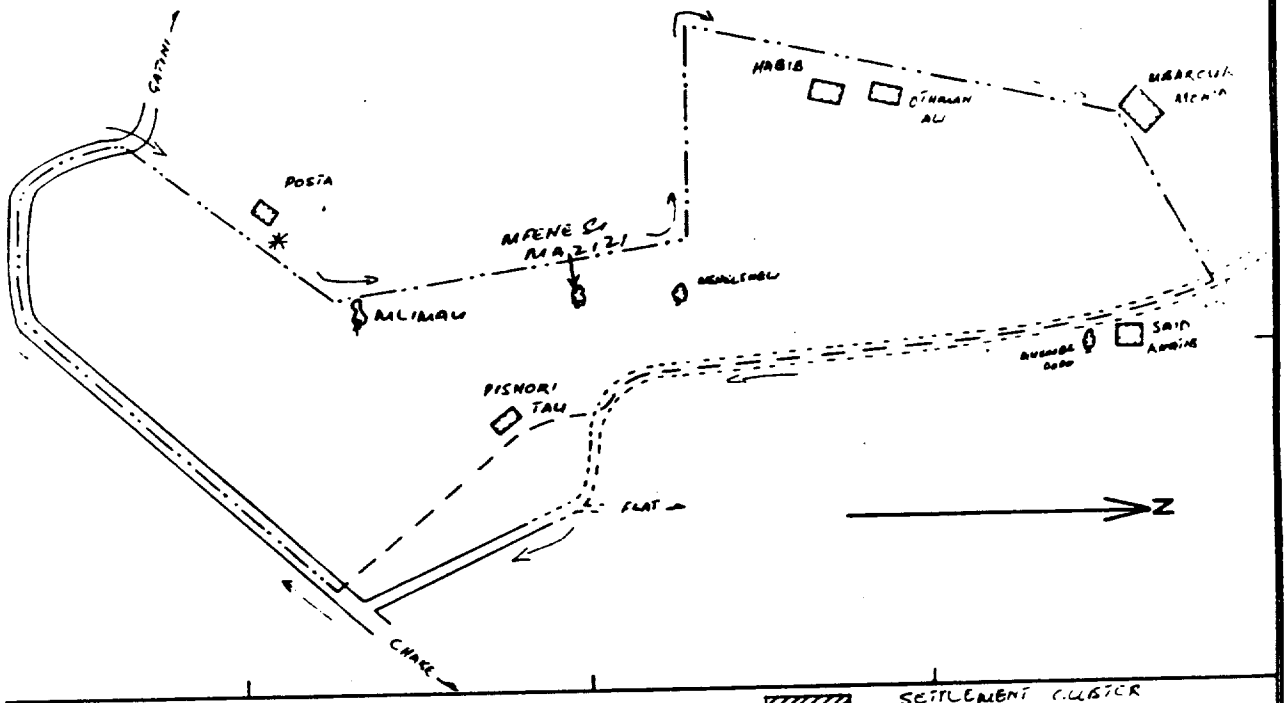
SETTLEMENT CLUSTER
SCATTERED SETTLEMENT
VILL. CHAIRMAN'S HOUSE
MOSQUE
STARTING POINT

EA REGION	DISTRICT	BRANCH	EA Nº	0	0	5
KUSINI	MKOANI	NGOMBENI	EST EA POP	402		
5 5	2	0 1 2				

E NAME MKARAFUUNI - A. CENSUS VILL Nº

F EA 1/2500 APPROX SCALE 0 76 152m

EFERENCE 3



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EA BOUNDARY
SETTLEMENT CLUSTER
SCATTERED SETTLEMENT
VILLAGE CHAIRMAN'S HOUSE
MOSQUE
STARTING POINT

EA REGION	DISTRICT	BRANCH	EA N°	0	0	2
KASKAZINI	MICHEWENI	MAKANGALE	EST EA POP	5 0 0		
5 4	2	1 1 1				

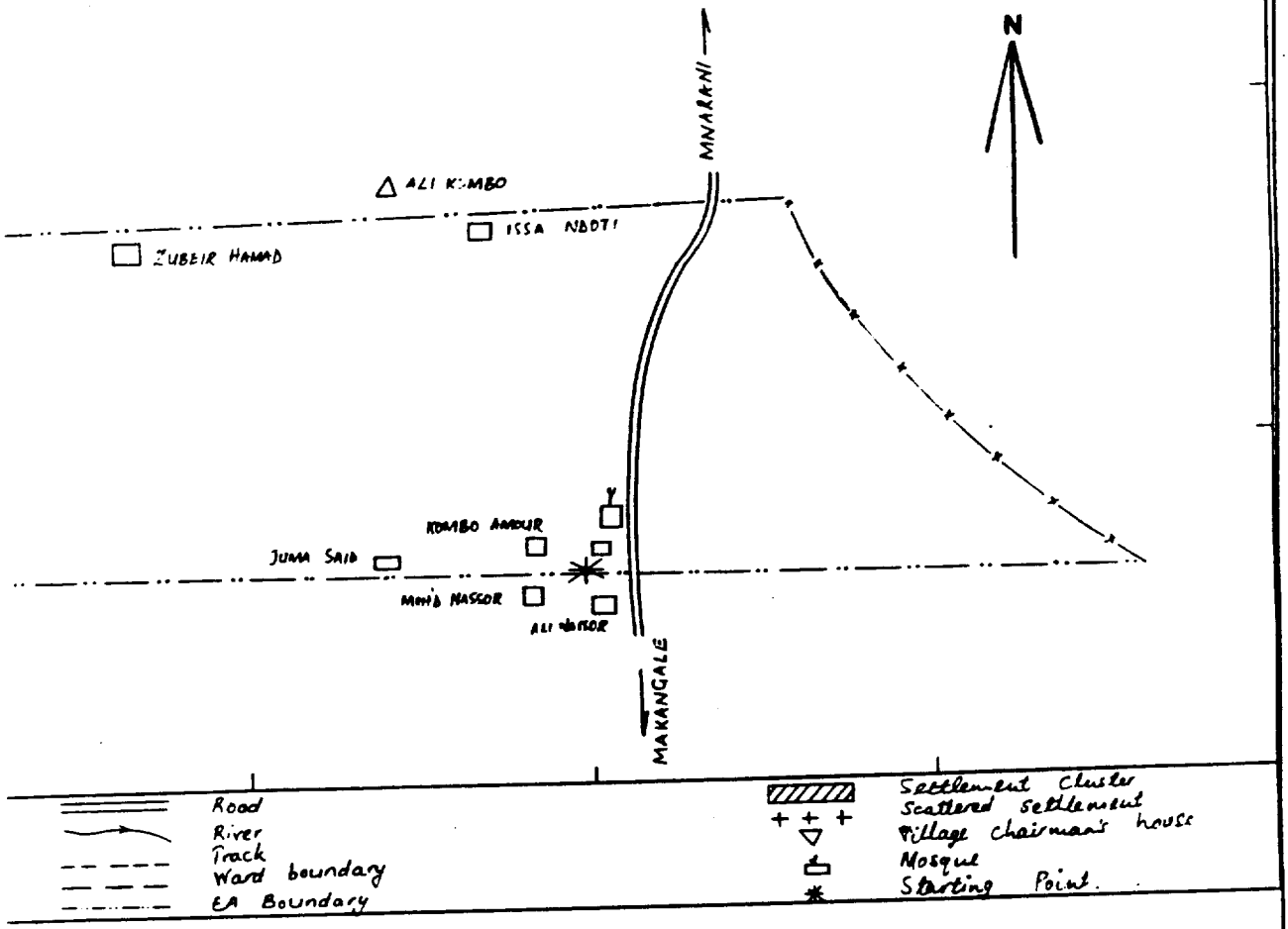
E NAME MAWEMATATU

CENSUS VILL N° | |

E EA 1:50,000

EFERENCE P1

APPROX SCALE 1/2m



Road
River
Track
Ward boundary
EA Boundary

Settlement Cluster
Scattered Settlement
Village chairman's house
Mosque
Starting Point.

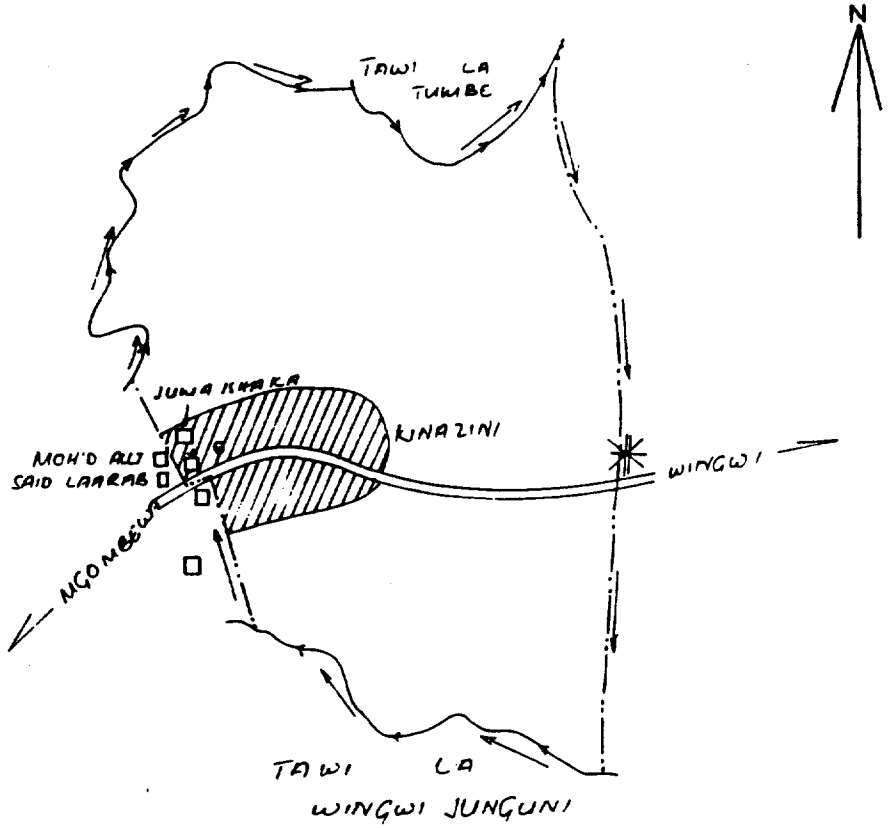
REGION	DISTRICT	BRANCH	EA Nº	0	0	2
KASKAZINI	MICHEWENI	WINGWI	EST EA POP	395		
5 4	2	0 9 1				

E NAME KINAZINI

CENSUS VILL Nº

OF EA 1 / 10000
REFERENCE 10 / 8541

APPROX SCALE 0 400 800



ROAD
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EA BOUNDARY
DISTRICT BOUNDARY

SETTLEMENT CLUSTER
SCATTERED SETTLEMENT
VILL CHAIRMANS HOUSE
MOSQUE
STARTING POINT.