

## 6. TRAFFIC SURVEY

### 6.1 Objective of Survey

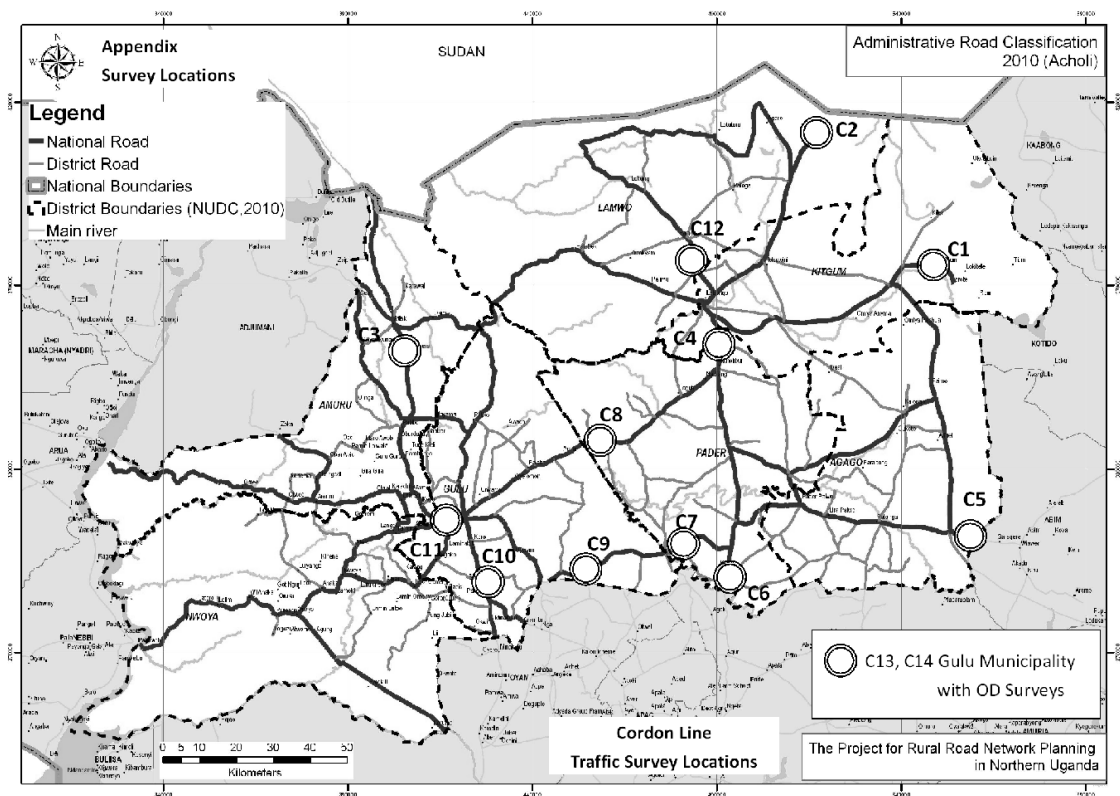
The objective of the survey is to confirm existing traffic volumes and variations at the boundary of each district on national roads (Cordon Line Survey). The result of the survey would be developed for the traffic demand forecast as well.

### 6.2 Scope of Surveys

#### 6.2.1 Cordon-line Traffic Survey

##### 6.2.1.1 Survey Locations and Methodology

Cordon-line Traffic Surveys were conducted at 14 locations (mainly located along the national roads at district boundaries). The following map shows the survey locations.



Source: JICA Study Team

Figure 6.2-1 Cordon-line (Traffic Count) Survey Locations

The surveys were performed for two consecutive days on working days. Time of the survey is 12 hours (from 7:00 a.m. to 7:00 p.m.) for each survey location. The counting was carried out by direction and by type of vehicle as shown below. The counting was recorded every 30 minutes.

#### Vehicle Type

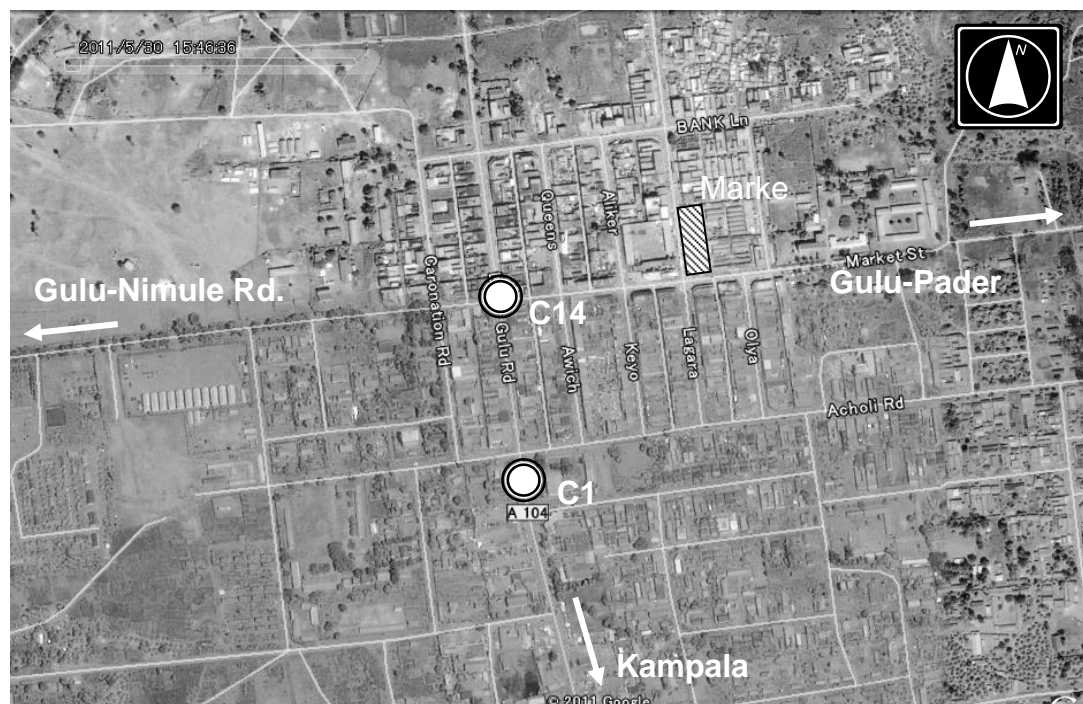
- Saloon cars and taxis
- Light goods (Vans, Pickups and 4WDs)
- Small buses (Matatus)
- Medium buses
- Large size bus (Inter-r region)
- Light single unit truck (2 axle)
- Medium - large single unit truck (3 axle)
- Truck Trailer and semi trailer
- Motorcycle
- Bicycles
- Pedestrians

### 6.2.2 Traffic Count Survey and Roadside OD Interview Survey in Gulu Township

The survey was performed for two consecutive days on working days for 25% of all vehicles at the two locations shown below. Time of the survey was 12 hours (from 7:00 a.m. to 7:00 p.m.) and the following items were surveyed.

- Origin and destination (address/date/time)
- Number of passengers
- Type of Commodity (only for trucks/trailers)
- Tonnage of commodity (only for trucks/trailers)

At the same time, traffic count surveys were conducted according to the survey methodology as described above.



Source: JICA Study Team

**Figure 6.2-2 Survey Locations in Gulu Township**

### **6.2.3 Home Interview Survey**

A Home Interview Survey was conducted with approximately 671 individual households selected from Sub-counties in Gulu, Kitugum, Lamwo, Pader, and Agago Districts. These surveyed households were randomly selected.

The survey method was home interview, interviewing the head of the household and family members. Survey items are listed below:

- Address of the household
- Family attributes (number of family members, monthly income, car ownership)
- Personal attributes (employment, monthly income and car ownership)
- Trip information (frequency, trip purpose, travel time and distance, mode of transport)

### **6.2.4 Bus/Boda Boda Users Interview Survey**

A Bus/Boda Boda survey was conducted in Gulu, Kitugum and Pader at Bus Terminals and major Boda Boda parking points. The survey was carried out by interviews with passengers and/or the drivers.

The survey forms comprised the following major interview items.

- Basic Information (sex, age, occupation, monthly wage)
- Trip Purpose
- Origin and Destination
- Usage Frequency
- Fare
- Satisfaction Level with current Service

## **6.3 Survey Consultant**

The survey consultant for the field works was employed by the Study Team. The selection method was the shortlisting among qualified consultants and price competitions by them which was in accordance with JICA's Guideline for Procurement of Sub (Local)-consultants. As a result, the following Ugandan consulting firm was selected.

Kkatt Consult Engineering Consultant

Plot 260, Nalinya Mpologoma Road, Block 262, Makindye , P.O. Box 25999, Kampala  
Uganda

## **6.4 Survey Results**

### **6.4.1 Cordon-line Traffic Survey**

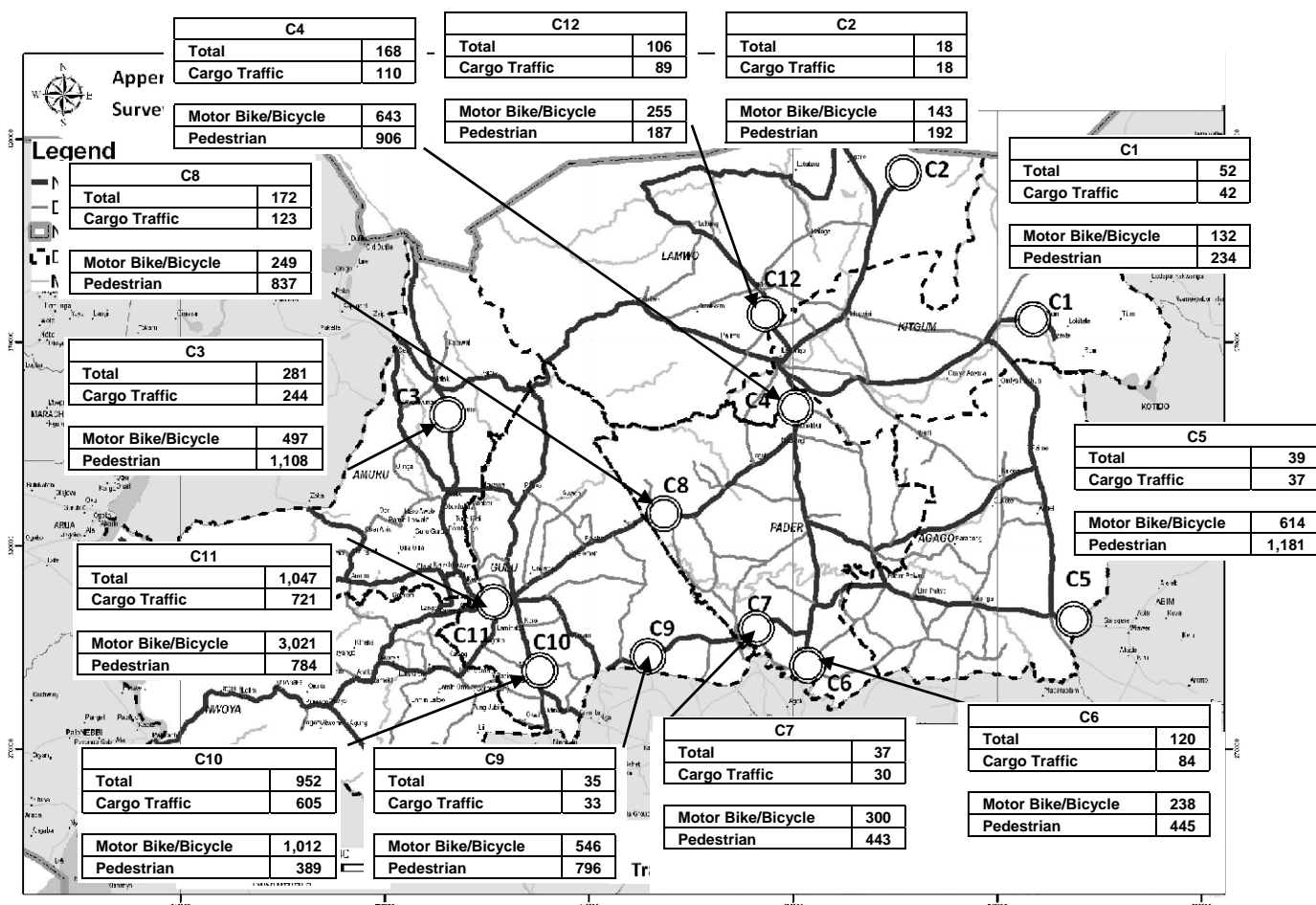
#### **(1) Traffic Count Results**

Average daily traffic count results at the survey stations are shown in the following table and figure.

**Table 6.4-1 Traffic Count Results**

Category/Stations	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Saloon cars, & Taxis	2	-	13	18	2	14	3	34	1	239	187	17
Light goods (vans, pickups & 4WD)	26	5	56	61	25	51	16	80	24	310	460	66
Small bus (minibuses and matatus)	3	1	3	24	-	13	3	2	1	51	106	-
Medium bus (Coaster)	6	-	1	5	-	3	1	-	-	8	14	-
Large bus (inter-region bus)	-	-	21	12	-	8	1	13	-	50	20	-
Light single unit truck (2 axle)	13	6	68	33	12	19	12	31	8	88	109	13
Medium - large single unit truck (3 axle)	4	7	32	11	-	10	2	10	1	95	69	10
Truck Trailer and semi trailer	-	-	88	6	-	4	-	3	1	112	83	1
<b>Total</b>	<b>52</b>	<b>18</b>	<b>281</b>	<b>168</b>	<b>39</b>	<b>120</b>	<b>37</b>	<b>172</b>	<b>35</b>	<b>952</b>	<b>1,047</b>	<b>106</b>
Motor-Bike	34	21	84	155	140	82	58	60	170	510	2,418	115
Bicycle/Cart	99	122	414	488	475	157	242	189	376	532	604	140
Pedestrian	234	192	1,108	906	1,181	445	443	837	796	389	784	187

Source: JICA Study Team



Source: JICA Study Team

**Figure 6.4-1 Traffic Count Results**

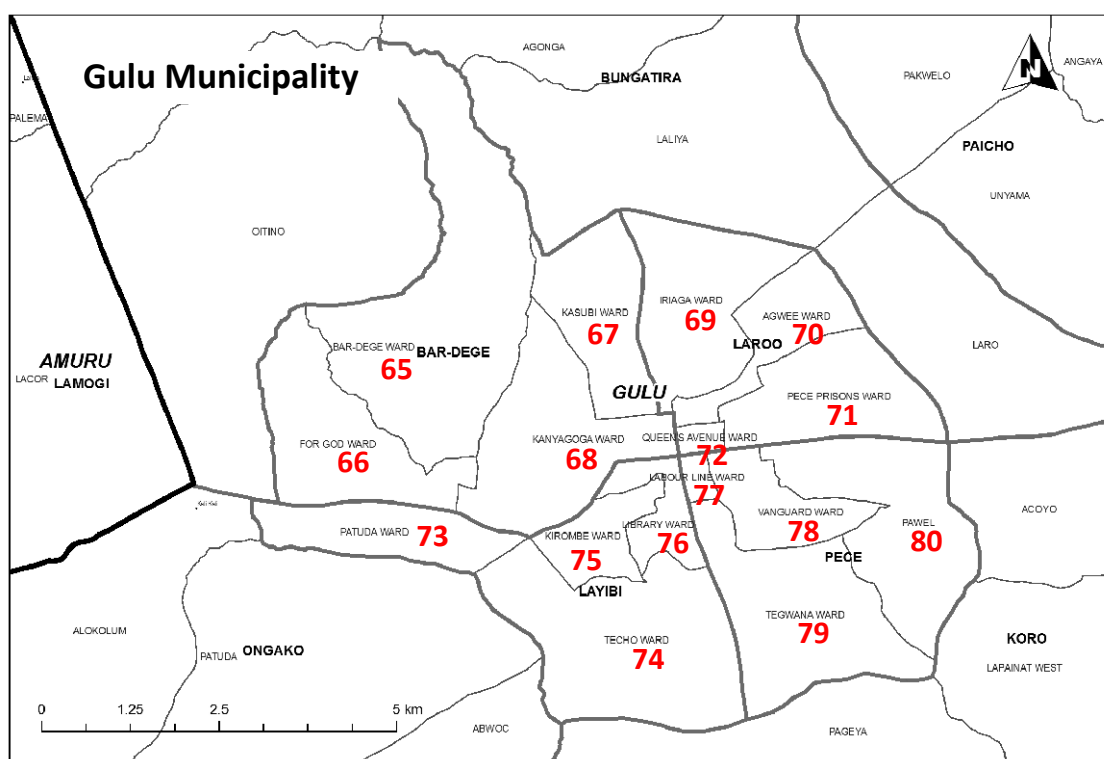
As the results show, the existing traffic volumes are relatively small and the cargo traffic is the majority of traffic for the entire network. The busiest road in the area is Gulu-Atiak-Nimule road which reaches Juba eventually and its majority traffic is also cargo. The number of passenger vehicles is very limited and that is one indicator of the low living standard in the area.

### 6.4.2 Traffic Count Survey and Roadside OD Interview Survey in Gulu City

In addition to the cordon-line traffic surveys, OD and traffic count surveys were conducted in Gulu City.

The objective of the survey is to capture the existing traffic problems in Gulu City, particularly since the City is considered as a regional centre in the Study area that would have both negative and positive impacts in the Study Area.

As for the OD survey the following zoning was applied and the zoning corresponded with wards in Gulu Municipality.



Source: JICA Study Team

**Figure 6.4-2 Zoning Map of Gulu Township**

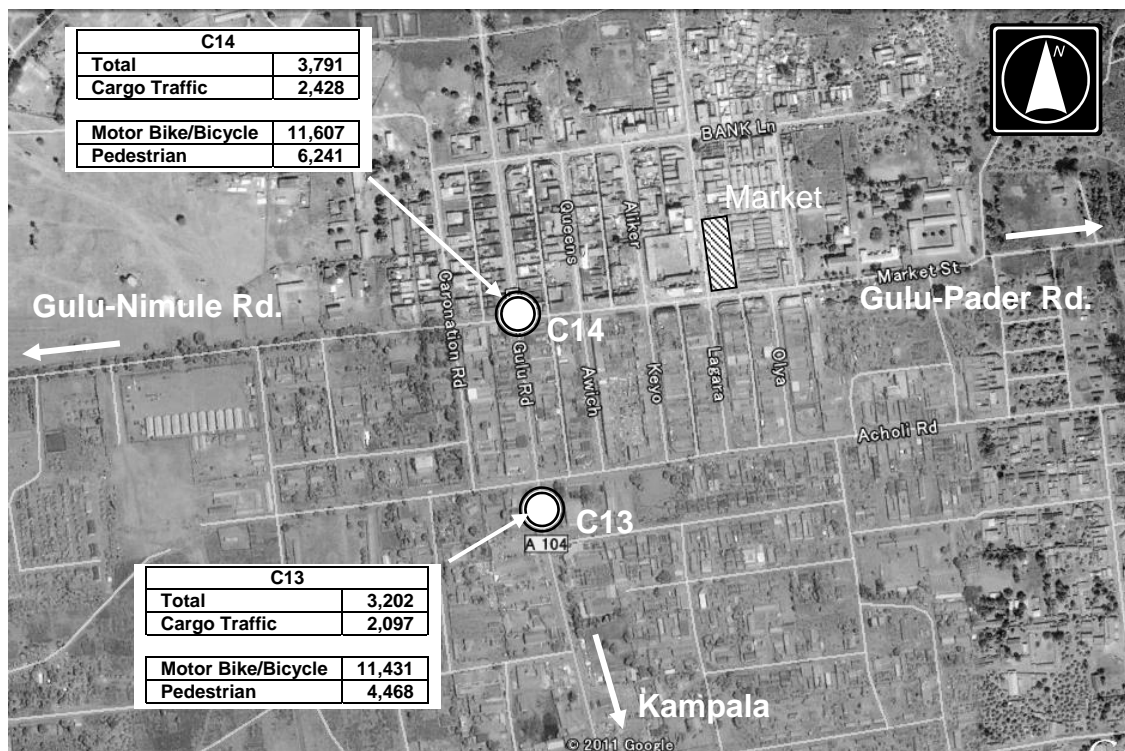
#### (1) Traffic Count Result

Average daily traffic count results at the survey stations are shown in the following table and figure.

**Table 6.4-2 Traffic Count Results in Gulu Township**

Category/Stations	C13	C14
Saloon cars, &Taxis	982	1,065
Light goods (vans, pickups & 4WD)	1,764	1,714
Small bus (minibuses and matatus)	105	227
Medium bus (Coaster)	6	13
Large bus (inter-region bus)	13	60
Light single unit truck (2 axle)	147	635
Medium - large single unit truck (3 axle)	154	48
Truck Trailer and semi trailer	33	32
<b>Total</b>	<b>3,202</b>	<b>3,791</b>
Motor-Bike	9,132	8,006
Bicycle/Cart	2,299	3,601
Pedestrian	4,468	6,241

Source: JICA Study Team

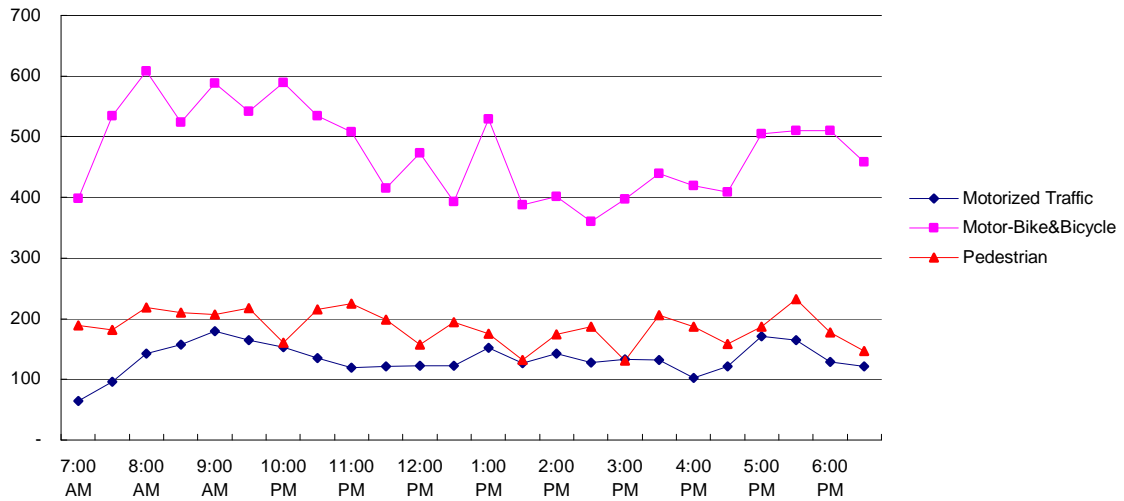


Source: JICA Study Team

**Figure 6.4-3 Traffic Count Results in Gulu Township**

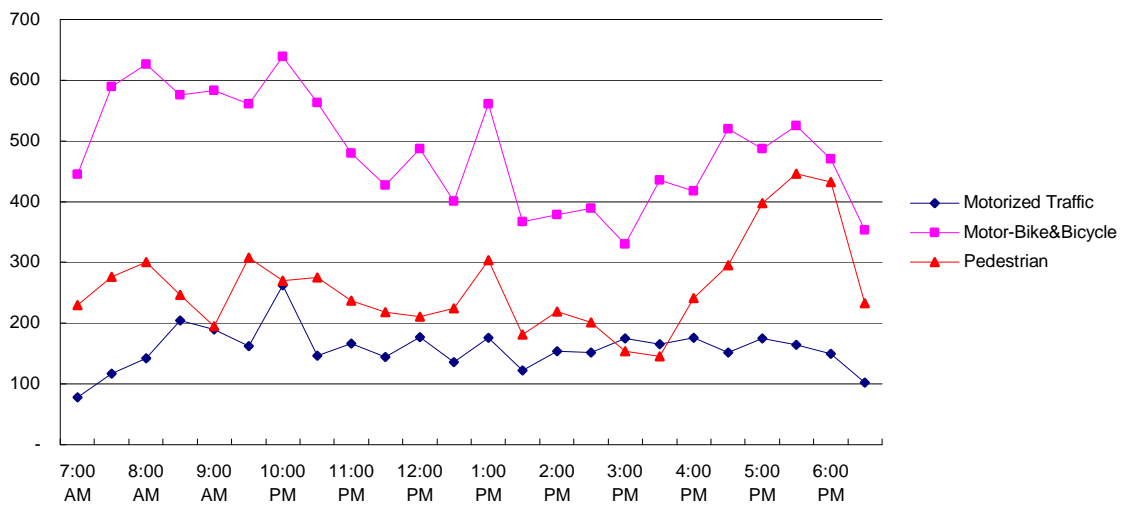
The following graphs (figures) show the hourly variation of the traffic. The peak hour in the A.M. is 7:30 – 10:00 and that of P.M. is 16:30- 19:00 which is a common pattern in urban and semi-urban areas.

An interesting finding was that volume of the motorized traffic was almost constant throughout the day which suggested that the motorized traffic is not being used for commuting, commonly. Motor-bikes and bicycles are identified as principal traffic modes for commuting from the result of the survey.



Source: JICA Study Team

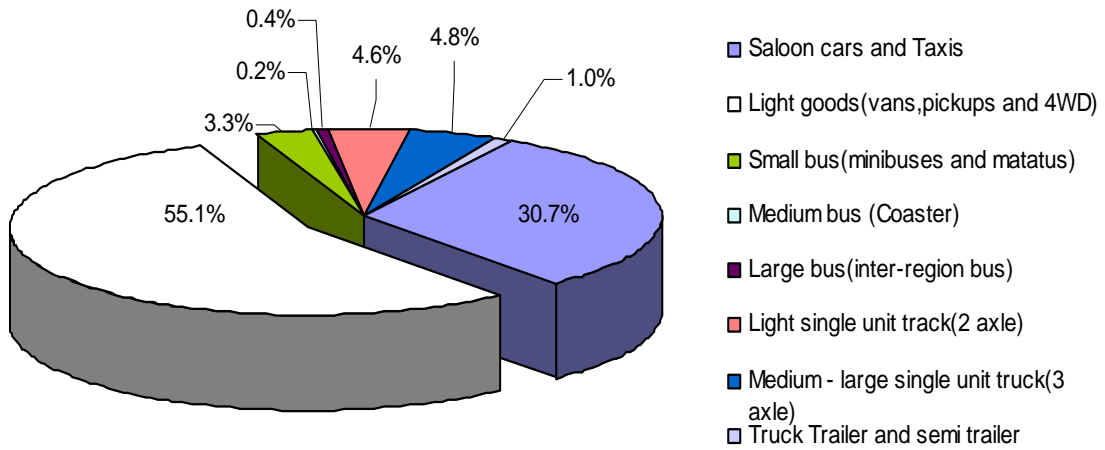
**Figure 6.4-4 Hourly Traffic Variation at C13**



Source: JICA Study Team

**Figure 6.4-5 Hourly Traffic Variation at C14**

Traffic composition at C13 shows that Vans, Pick-ups and 4WDs occupied half of all the traffic.

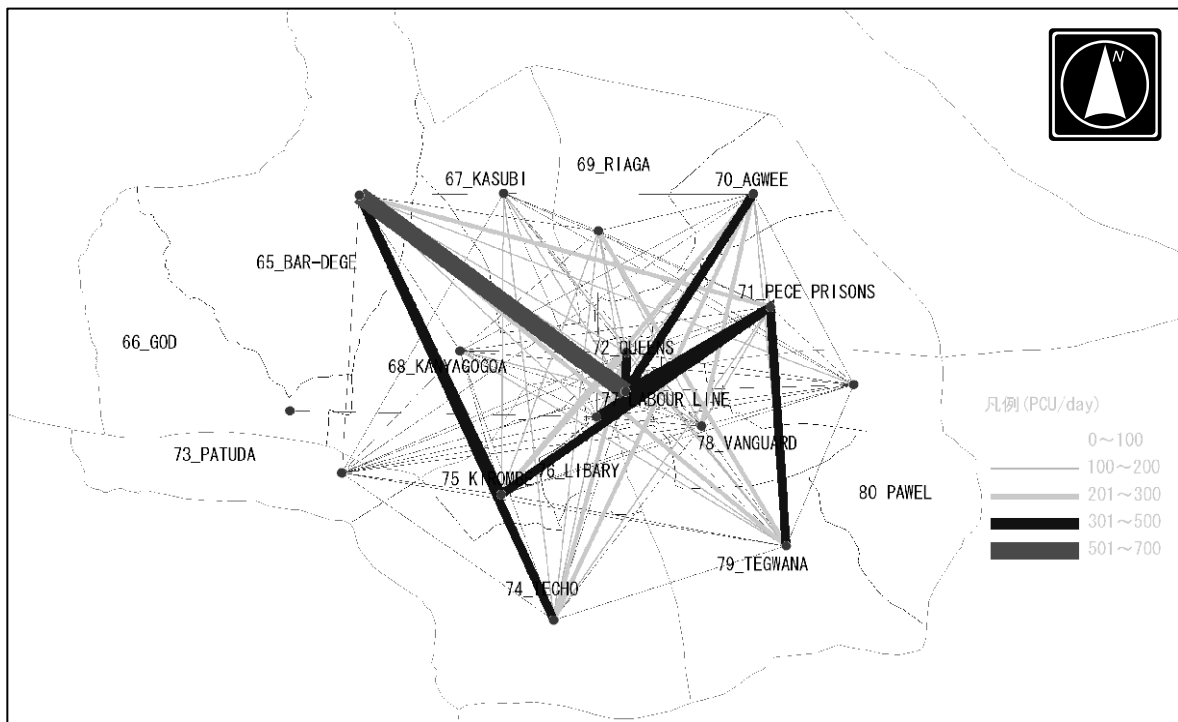


Source: JICA Study Team

**Figure 6.4-6 Traffic Composition at C13**

**(2) OD Survey Result**

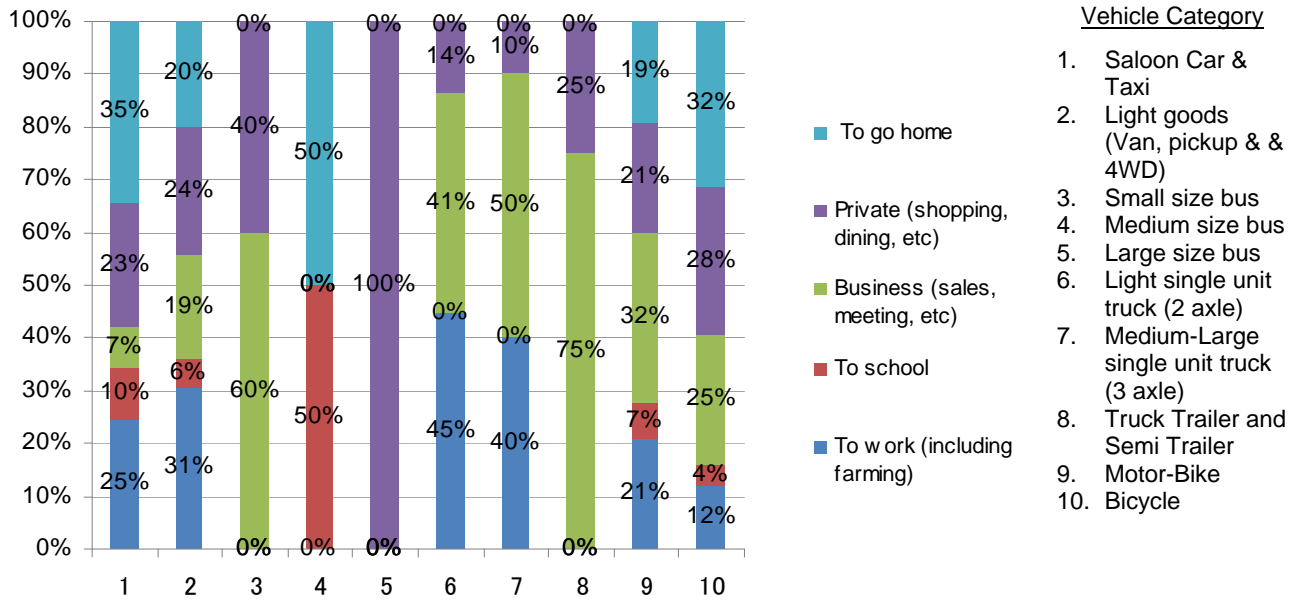
The survey result is illustrated with desire lines which indicate traffic movement in the Gulu Township. It is realized that there is a great deal of traffic movement to the northern area and it also suggests that the residential area is being developed in the northern area of the town. The development direction is toward the north.



Source: JICA Study Team

**Figure 6.4-7 Desire Lines**





Source: JICA Study Team

**Figure 6.4-8 Travel Purposes by Vehicle Category**

### 6.4.3 Home Interview Survey

A home interview survey was conducted, the households were randomly selected. The results were compiled in the tables and following graphs.

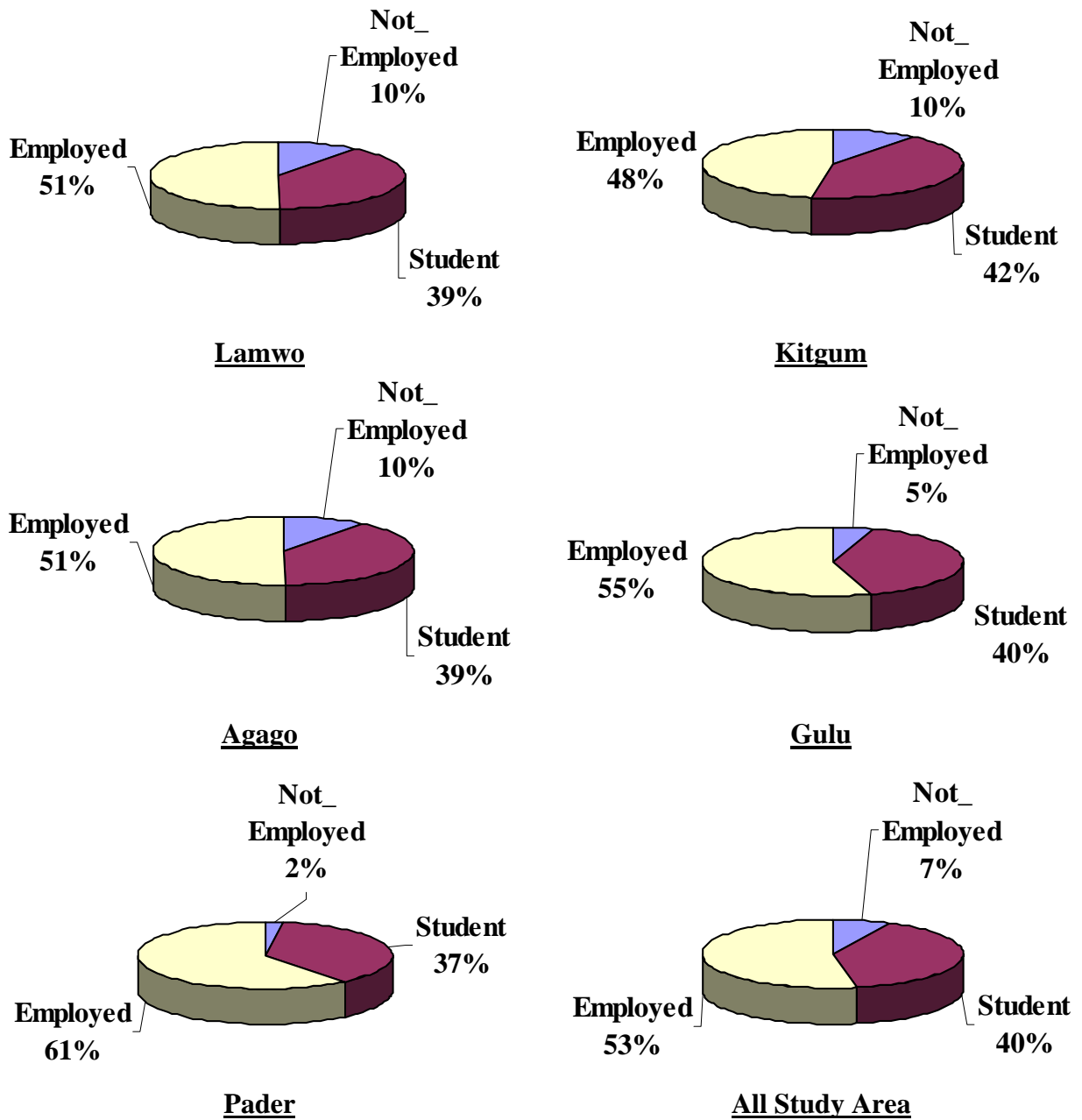
#### (1) Nos. of Residents in a Household

**Table 6.4-3 Number of Residents in a Household**

	Average Nos. of Resident				
	Male Over Age 5	Male Age 0-4	Female Over Age 5	Female Age 0-4	Total
Lamwo	1.4	1.2	1.3	1.4	5.3
Kitgum	1.6	1.2	1.5	1.3	5.6
Agago	1.6	1.0	1.5	1.0	5.1
Gulu	1.8	1.0	1.8	0.9	5.5
Pader	1.8	0.9	1.6	0.7	5.1
Average	1.7	1.0	1.6	1.0	5.3

Source: JICA Study Team

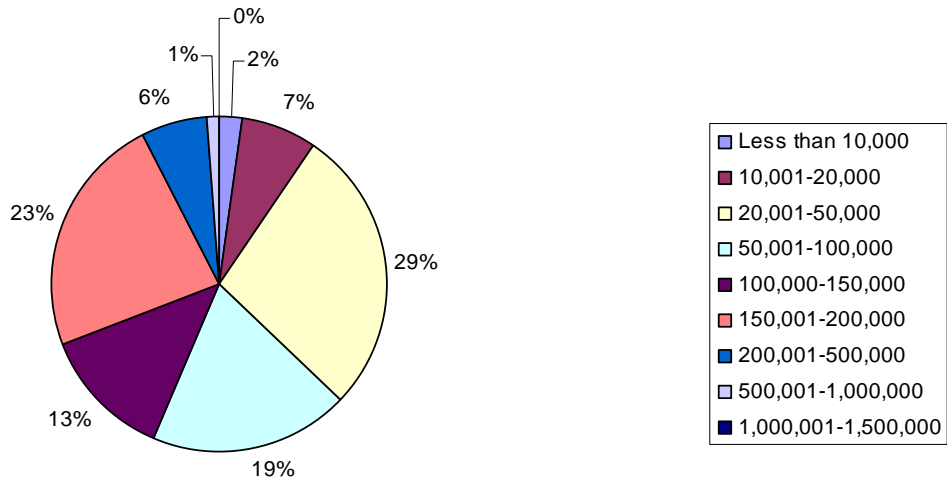
(2) Employment Status



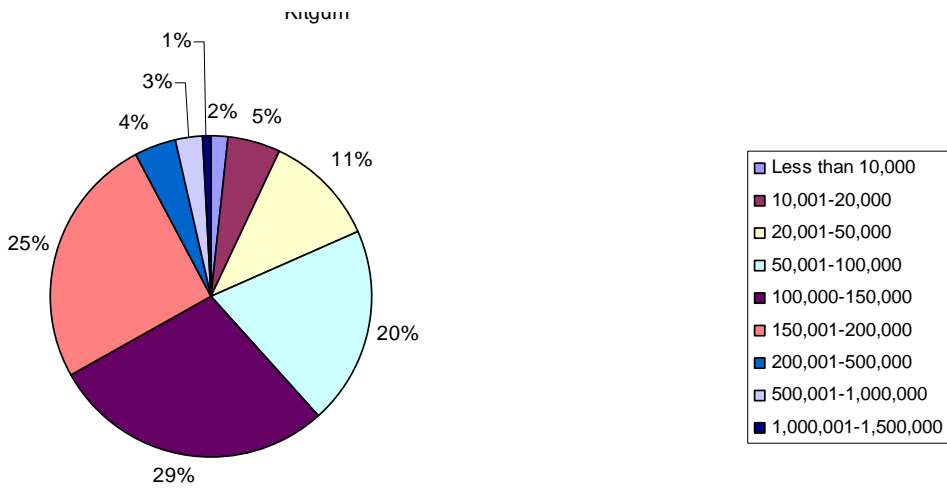
Source: JICA Study Team

Figure 6.4-9 Employment Status

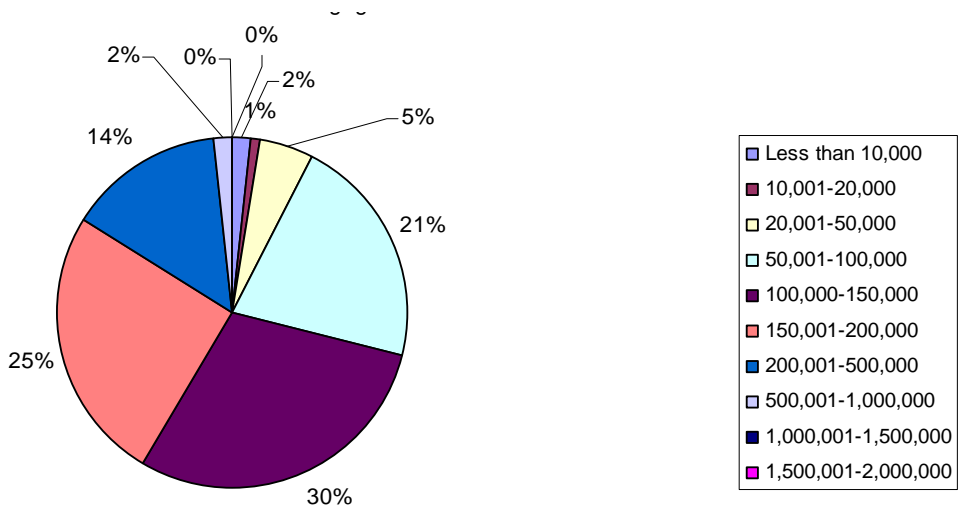
**(3) Monthly Income**



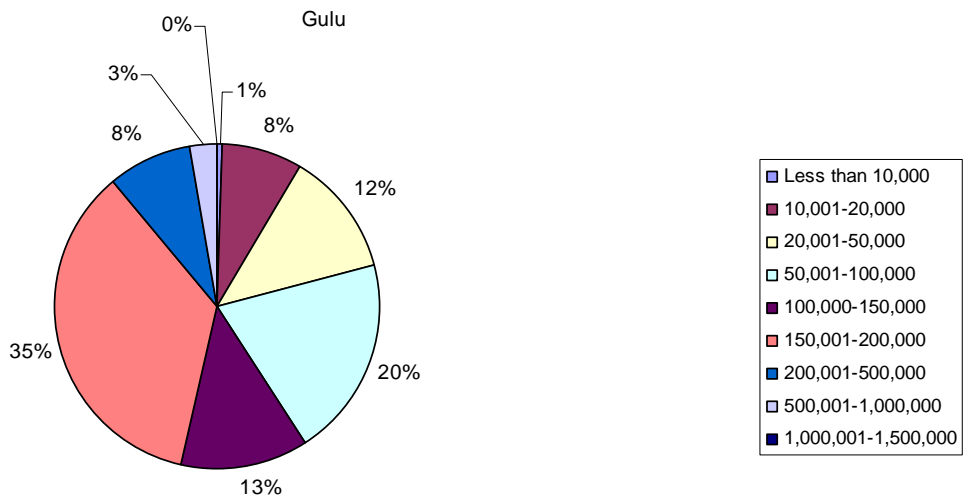
Lamwo



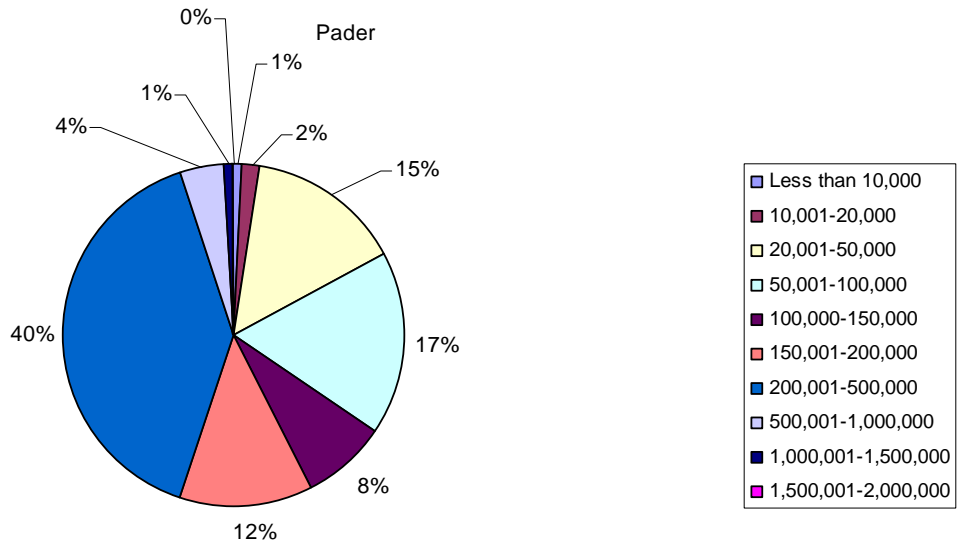
Kitgum



Agago



Gulu



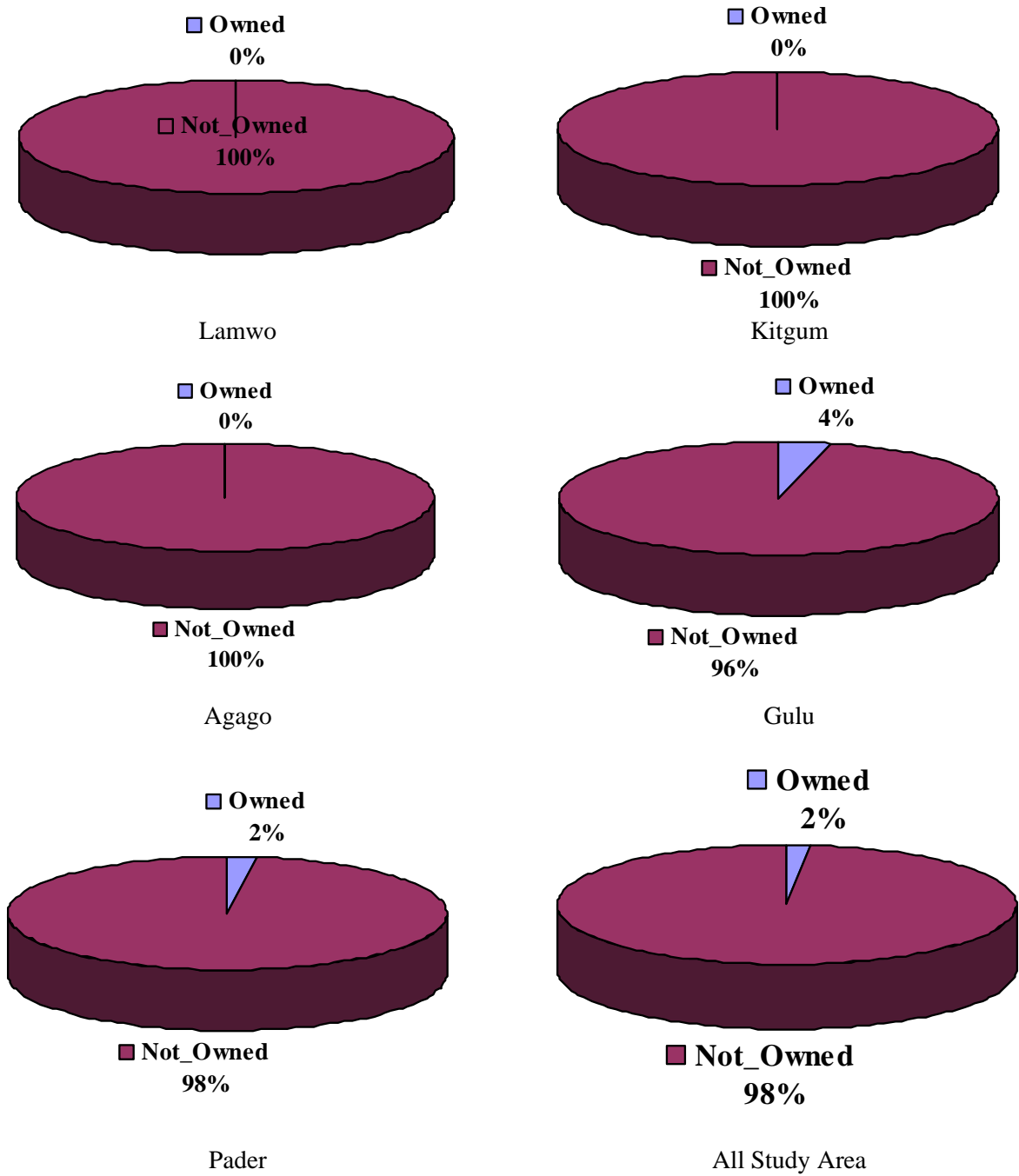
Pader

Source: JICA Study Team

**Figure 6.4-10 Monthly Income**

(4) Vehicle Ownership

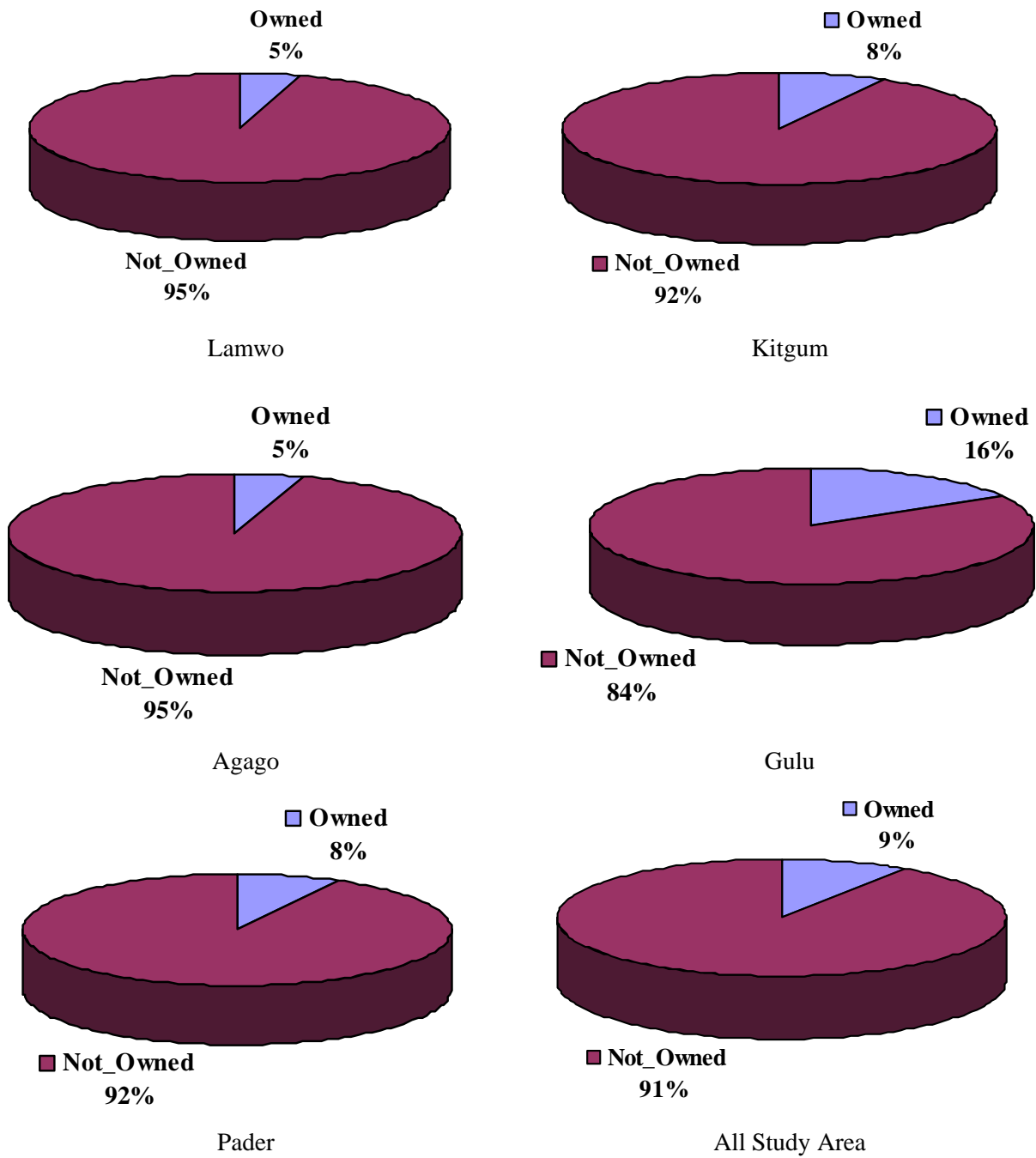
1) Vehicle



Source: JICA Study Team

Figure 6.4-11 Vehicle Ownership (Vehicle)

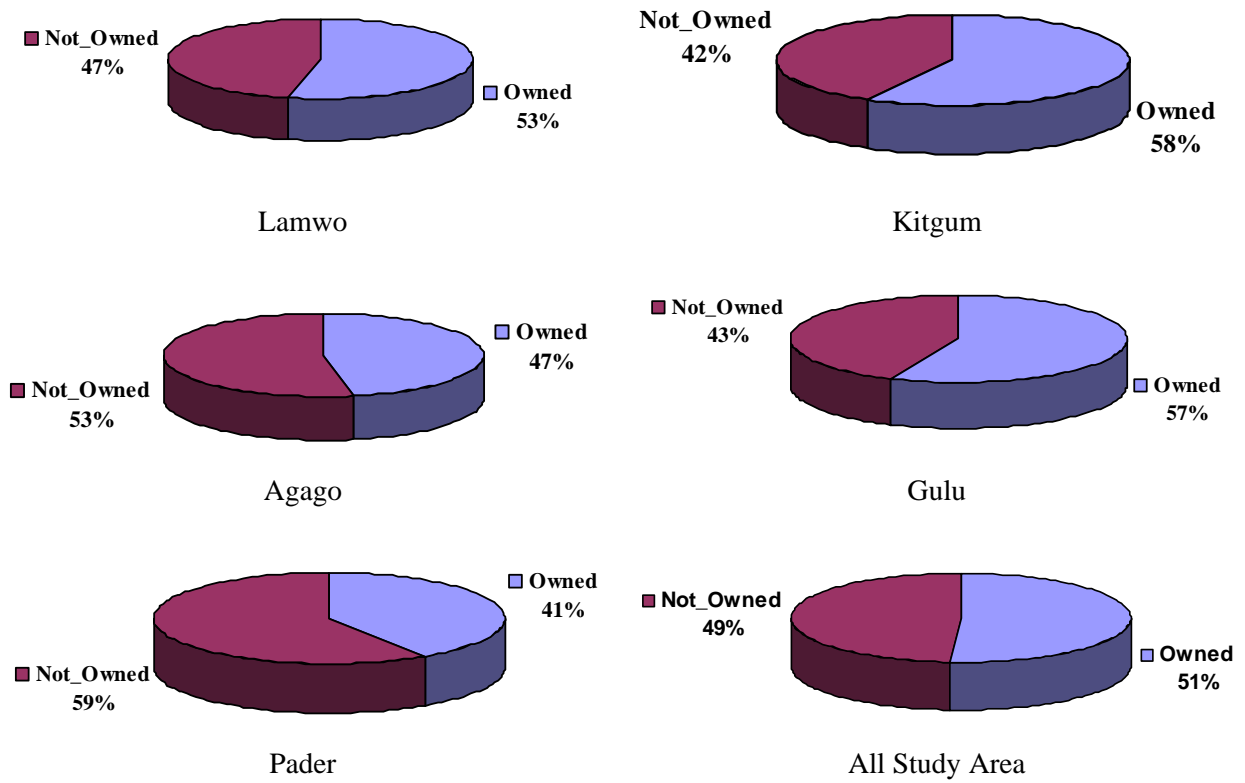
2) Motor-Bike



Source: JICA Study Team

Figure 6.4-12 Vehicle Ownership (Motor-Bike)

3) Bicycle



Source: JICA Study Team

Figure 6.4-13 Vehicle Ownership (Bicycle)

## 7. SOCIO ECONOMIC FRAMEWORK IN THE STUDY AREA

### 7.1 Introduction

This chapter aims at preparing a socio-economic framework and projecting future population in five Districts, namely, Gulu, Kitgum, Lamwo, Pader and Agago. This socio-economic framework will indicate demographic characteristics of these five Districts in the next decades. It will also provide essential inputs to determine the priority of road improvement projects in the study area and to test the economic viability of these priority projects, which are separately discussed in this report.

Future population in Acholi sub-region and future economic growth rate in Uganda and neighbouring countries are separately projected for discussion of the traffic demand forecast, as explored in Chapter 10. The intermediate year and target year are set as Year 2018 and 2030, respectively.

### 7.2 Literature Review

#### (1) UBOS

In 2007, the Uganda Bureau of Statistics (UBOS) disclosed population projections up to 2017. This population projection was made using the 2002 population census as the baseline data. UBOS also produced detailed projections broken down to district and sub-county levels. Considering the impact caused by HIV/AIDS, two population projection scenarios have been made including high variant and low variant scenarios. In the high variant scenario, the population of Uganda was estimated to increase from 30.2 million in 2007 to 43.7 million in 2017 with the annual growth rate of 3.7% p.a. While, in the low variant projections, it was estimated at 28.6 million in 2007 and 40.6 million in 2017 with the annual growth rate of 3.6% p.a.

**Table 7.2-1 2002-2017 Population Projection by UBOS**

Scenario	2002 (million)	2007 (million)	Growth Rate (2007/02)	2017 (million)	Growth Rate (2017/07)
Low variant	24.1	28.6	3.5%	40.6	3.6%
High variant	24.1	30.2	4.6%	43.4	3.7%

Source: UBOS (2007) Projections of Demographic Trends in Uganda 2007-2017

Gulu is the largest district in the Study Area in terms of population size (374,900 in 2010 and 451,800 in 2017). Lamwo is the smallest district and the population of Lamwo District is



projected to be 158,100 in 2010 and 206,400 in 2017 with a population growth rate of 3.9% per annum.

**Table 7.2-2 2002-2017 Population Projection in the Study Area by UBOS**

District	2002	2010	Growth Rate (2010/02)	2017	Growth Rate (2017/10)
Gulu	298,527	374,900	2.9%	451,800	2.7%
Kitgum	167,030	228,900	4.0%	298,800	3.9%
Lamwo	115,345	158,100	4.0%	206,400	3.9%
Pader	142,320	210,100	5.0%	293,300	4.9%
Agago	184,018	271,700	5.0%	379,000	4.9%

Source: UBOS (2007) Projections of Demographic Trends in Uganda 2007-2017

**(2) UN**

UN Population Division produces long-term population projections for each individual country in the world. As for Uganda, the current population is estimated at 33.8 million in 2010 and is projected to increase to 60.8 million over the next two decades. The population growth rate in the recent years is relatively high and is estimated to be 3.3% p.a. between 2010 and 2015; gradually decreasing to 2.6% p.a. between 2025 and 2030.

**Table 7.2-3 1990-2030 Population Projection by UN**

Year	Population ('000)	Annual growth
1990	17,731	3.40%
1995	20,954	3.12%
2000	24,433	3.27%
2005	28,699	3.32%
2010	33,796	3.28%
2015	39,710	3.13%
2020	46,319	2.89%
2025	53,406	2.63%
2030	60,819	-

Source: UN (2008) World Population Prospects: The 2008 Revision Population Database

**(3) UNHCR**

UNHCR itself does not provide population projections; however, it regularly updates the village-wise population in northern Uganda for monitoring the return process of the IDPs. From UNHCR monitored figures, approximately 95 % of IDPs have already returned. According to UNHCR, all of the camps in Acholi Sub-region will be closed by the end of 2011. Some people are expected to remain at transit sites. Transit sites tend to be located between camps and original villages so that people who stay at the transit sites can access camps to obtain services such as water and medical care and access original villages to cultivate their own land. When these camps close and terminate such services, the people are expected to move to their original villages.

**Table 7.2-4 Populations by District in Acholi Sub-region**

District	2005		2010				Return Ratio	
	Number of Camps	Estimated Population in Camps	Number of Camps	Estimated Population in Camps	Number of Transit Sites	Estimated Population in Transit Sites		Estimated Population in Camps and Transit Sites
Amuru/Nwoya	34	257,000	0	-	50	11,268	11,268	95.6%
Gulu	31	204,000	1	366	13	1,963	2,329	98.9%
Kitgum/Lamwo	25	310,000	8	3,236	65	6,582	9,818	96.8%
Pader/Agago	31	339,000	4	2,062	154	32,546	34,608	89.8%
Acholi Sub-region	121	1,110,000	13	5,664	282	52,359	58,023	94.8%

Source: UNHCR

## 7.3 Population Projection in Acholi Sub-region

### 7.3.1 Preconditions

The following bullet points are set as preconditions for the population projections in Acholi Sub-region.

- The baseline population applied to this study is the sub-county-wise population, prepared by UBOS.
- The intermediate population growth rate between 2017 and 2018 is estimated, applying the same growth rate projected by UBOS. The long-term population growth rate between 2018 and 2030 is prepared, referring to the growth rate projected by the UN.

### 7.3.2 Summary of Results of Population Projection

The following table tabulates the population projections in Acholi Sub-region. In Amuru District, the largest population is projected in Lamogi Sub-county in all projection years (76,000 in 2018 and 101,000 in 2030), followed by Amuru, Pabbo and Atiak Sub-counties. In Nwoya District, the population size is projected as relatively smaller than that in Amuru District. The largest population in Nwoya District can be seen in Alero Sub-county (34,000 in 2018 and 45,000 in 2030). The total population size in both Amuru and Nwoya Districts is estimated to increase to 352,000 in 2018 and 468,000 in 2030.

**Table 7.3-1 Summary of Results of Population Projection in the Study Area**

District / Sub-county	2010	2018	2030	Growth Rate (2010/18)	Growth Rate (2018/30)
Gulu District	374,900	462,700	619,900	2.7%	2.5%
Awach	14,100	17,400	23,600	2.7%	2.6%
Bar-dege	46,000	56,900	76,400	2.7%	2.5%
Bobi	20,900	26,000	35,000	2.8%	2.5%
Bungatira	28,800	35,500	47,400	2.6%	2.4%
Koro	22,800	28,200	38,000	2.7%	2.5%
Lakwana	16,800	20,900	28,300	2.8%	2.6%
Lalogi	23,000	28,300	37,800	2.6%	2.4%
Laroo	26,700	32,800	43,800	2.6%	2.4%
Layibi	32,000	39,400	52,600	2.6%	2.4%
Odek	30,500	37,600	50,500	2.7%	2.5%
Ongako	18,000	22,200	29,600	2.7%	2.4%
Paicho	31,200	38,400	51,100	2.6%	2.4%

District / Sub-county	2010	2018	2030	Growth Rate (2010/18)	Growth Rate (2018/30)
Palaro	8,300	10,200	13,400	2.6%	2.3%
Patiko	10,500	12,800	16,900	2.5%	2.3%
Pece	45,300	56,100	75,500	2.7%	2.5%
<b>Kitgum District</b>	<b>228,900</b>	<b>309,600</b>	<b>475,300</b>	<b>3.8%</b>	<b>3.6%</b>
Kitgum T.c.	57,300	77,400	118,900	3.8%	3.6%
Kitgum Matidi	16,000	21,600	33,100	3.8%	3.6%
Labongo Akwang	17,700	24,000	37,000	3.9%	3.7%
Labongo Amida	14,600	19,800	30,400	3.9%	3.6%
Labongo Layamo	12,100	16,200	24,600	3.7%	3.5%
Lagoro	17,800	24,100	36,800	3.9%	3.6%
Mucwini	20,600	27,800	42,400	3.8%	3.6%
Namokora	19,300	26,100	40,100	3.8%	3.6%
Omiya Anyima	22,700	30,800	47,600	3.9%	3.7%
Orom	30,800	41,800	64,400	3.9%	3.7%
<b>Lamwo District</b>	<b>158,100</b>	<b>213,500</b>	<b>328,000</b>	<b>3.8%</b>	<b>3.6%</b>
Agoro	22,700	30,600	46,800	3.8%	3.6%
Lokung	27,500	37,100	56,900	3.8%	3.6%
Madi Opei	14,100	19,000	29,000	3.8%	3.6%
Padibe East	17,400	23,300	35,700	3.7%	3.6%
Padibe West	16,300	21,900	33,300	3.8%	3.6%
Palabek Gem	17,300	23,600	36,700	4.0%	3.7%
Palabek Kal	17,500	23,700	36,500	3.9%	3.7%
Paloga	13,600	18,400	28,400	3.9%	3.7%
Parabek Ogili	11,700	15,900	24,700	3.9%	3.7%
<b>Pader District</b>	<b>210,100</b>	<b>306,900</b>	<b>529,900</b>	<b>4.9%</b>	<b>4.7%</b>
Acholibur	13,200	19,300	33,100	4.9%	4.6%
Angagura	14,800	21,600	37,000	4.8%	4.6%
Atanga	17,500	25,600	44,400	4.9%	4.7%
Awer	28,400	41,600	72,200	4.9%	4.7%
Kilak	7,100	10,500	18,500	5.0%	4.8%
Laguti	14,100	20,600	35,500	4.9%	4.6%
Lapul	23,500	34,400	59,700	4.9%	4.7%
Latanya	15,600	22,700	39,200	4.8%	4.7%
Ogom	10,800	15,500	26,100	4.6%	4.4%
Pader T.c.	12,800	18,700	32,500	4.9%	4.7%
Pajule	31,100	45,300	78,100	4.8%	4.6%
Puranga	21,200	31,100	53,600	4.9%	4.6%
<b>Agago District</b>	<b>271,700</b>	<b>396,900</b>	<b>685,300</b>	<b>4.9%</b>	<b>4.7%</b>
Adilang	27,500	40,300	69,800	4.9%	4.7%
Kalongo T.c.	14,400	20,600	35,100	4.6%	4.5%
Lapono	20,600	30,100	52,100	4.9%	4.7%
Lira Palwo	39,200	57,200	98,600	4.8%	4.6%
Lukole	22,200	32,400	56,000	4.8%	4.7%
Omot	25,600	37,400	64,600	4.9%	4.7%
Paimol	30,800	44,900	77,200	4.8%	4.6%
Parabongo	18,000	26,500	45,900	5.0%	4.7%
Patongo	44,000	64,400	111,400	4.9%	4.7%
Wol	29,400	43,100	74,600	4.9%	4.7%
<b>Study Area</b>	<b>1,243,700</b>	<b>1,689,600</b>	<b>2,638,400</b>	<b>3.9%</b>	<b>3.8%</b>

Source: JICA Study Team

## 8. REGIONAL DEVELOPMENT ISSUES IN THE STUDY AREA

### 8.1 Land Development Issues

#### 8.1.1 Introduction

From the land development perspectives, several issues in the study area can be pointed out as follows. These issues are divided into two categories: one is related to the regional economy, the other is relevant issues of the living environment. Major issues found based on the field surveys, interviews and development plan of each district are described in the following section.

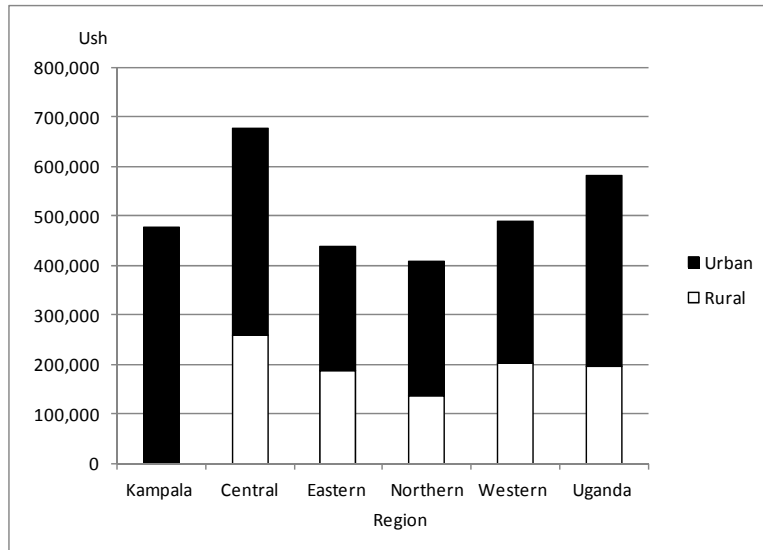
**Table 8.1-1 Land Development Issues in the Study Area**

Poverty / Regional Economy	Social Service
<p><u>Agricultural Industry</u></p> <ul style="list-style-type: none"> <li>• Subsistence agriculture and limited household income</li> <li>• Low production volume</li> <li>• Disorganized marketing system</li> <li>• Inefficient trading</li> </ul> <p><u>Non-farm industries</u></p> <ul style="list-style-type: none"> <li>• Inadequate non-farm industries</li> <li>• Job accessibility</li> </ul>	<p><u>Education</u></p> <ul style="list-style-type: none"> <li>• Inadequate educational service</li> <li>• Access to schools</li> </ul> <p><u>Health</u></p> <ul style="list-style-type: none"> <li>• Inadequate health service</li> <li>• Access to hospitals and health clinics</li> </ul> <p><u>Water</u></p> <ul style="list-style-type: none"> <li>• Inadequate water points and water supply</li> <li>• Access to water points</li> </ul>

Source: JICA Study Team

#### 8.1.2 Perspective of Regional Economy

Overall, poverty in Uganda has been falling in recent years. However, in the northern region, including the study area, it is estimated that 46.7% is categorized as living in poverty according to the analysis of UBOS. In addition, in terms of the average household expenditure, the northern area is the lowest in Uganda as shown in Figure 8.1-1. There is a large difference between the central and northern regions. One of the major contributors to cause poverty is considered to be the weak regional economy.



Source: UBOS compiled by JICA Study Team

**Figure 8.1-1 Monthly Consumption Expenditure per Household 2009/10 (2005/06 price)**

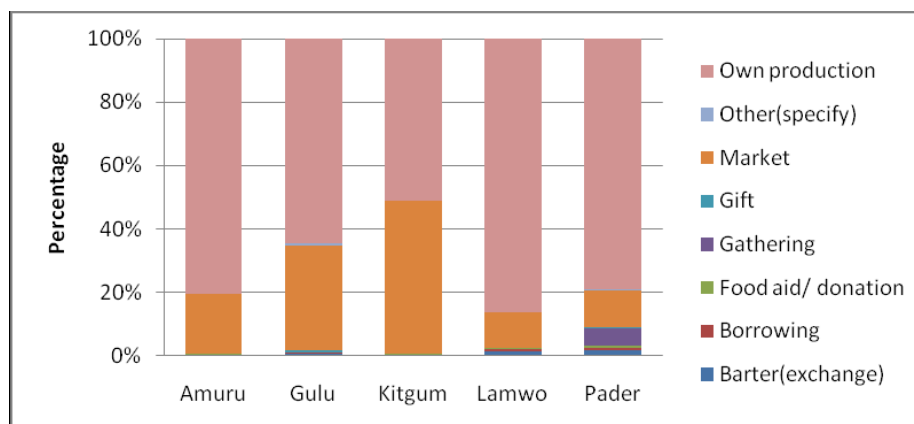
The issues of the regional economy are analysed as mainly: 1) inexperience regarding the agricultural industry and its system, and 2) limited variety of other industries.

### 8.1.2.1 Inexperience regarding Agricultural Industry and its System

Agriculture is the backbone of the regional economy in the study area. In other words, improvement of the agricultural industry shall be efficient to boost the regional economy in the study area. The major issues of the agricultural system are considered to be as follows.

#### (1) Subsistence Agriculture

At this moment, subsistence agriculture is still dominant in the study area. More than 50% of the total food comes from the farmers' own products as shown in Figure 8.1-2. Shortage of cash income and dependence on subsistence agriculture causes a negative spiral. To shift from subsistence to commercial agriculture could contribute to increase their livelihood. Information distribution and technical training regarding commercial agriculture have been enhancing by local governments, donors and NGOs. Further efforts are necessary to disseminate the information.



Note: Pader district includes Agago district.

Source: Nutrition Surveillance Acholi Region Uganda Round 1 March/April 2011, UNICEF and ACF

**Figure 8.1-2 Household Main Food Source**

**(2) Productivity**

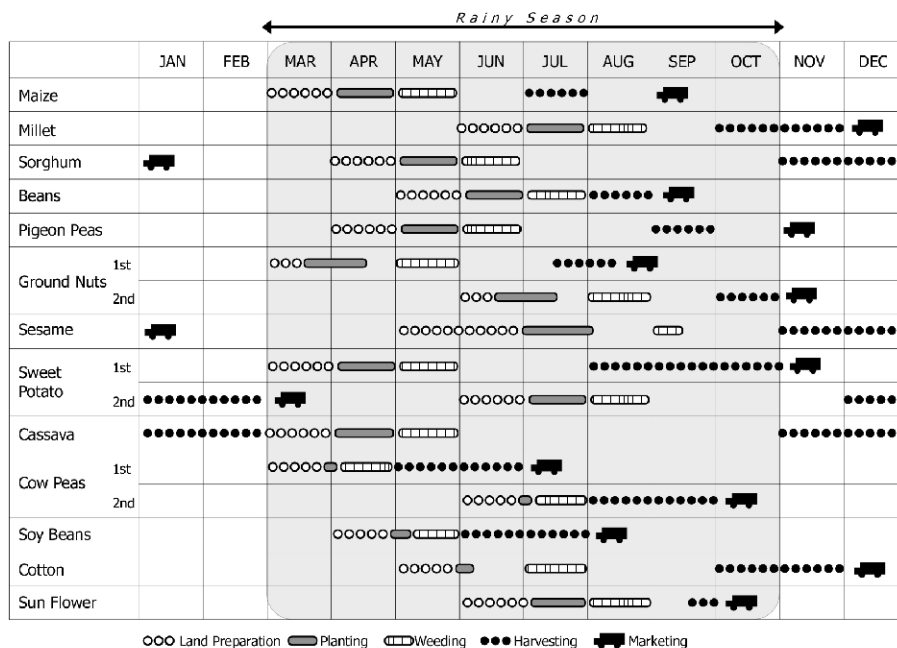
Issues of agricultural productivity are pointed out as well. Firstly, hand-ploughing is still the main method of land cultivation. The difference in cultivation capacity between hand-ploughing and ox-ploughing is considered to be a factor of ten. If the farmers shift to mechanized cultivation such as ox-ploughing and tractors, the productivity is expected to increase drastically. Secondly, the agricultural productivity is limited in the dry season due to farmers being completely dependent upon rain-fed cultivation at this moment. In the study area, only a limited area is irrigated even though many water sources are available such as rivers and swamps. Thirdly, agricultural techniques need to be updated. Basically, the farmers do not use fertilizer, agrochemicals or improved seeds because they can't afford to buy them. Micro finance has been enhanced by commercial banks and donors. Continuously encouraging the farmers to use these services for improving the productivity is needed. Finally, land accessibility needs to be improved by awareness-building. The land distribution is generally dependant upon the rules of each community. Woman-headed households tend to find it difficult to obtain land from the community.

**(3) Trading System**

Export of agricultural products to other regions including Kampala and South Sudan is important to achieve growth in the regional economy of the study area. The system of trading needs to improve significantly.

1) Distribution System

Distribution of agricultural products is one of the issues for improvement of trading. Many agricultural products, especially cash crops, are harvested in the rainy season due to dependence upon rain-fed cultivation. Figure 8.1-3 illustrates the cropping calendar of major products. However the transportation cost in the rainy season is higher than that in the dry season since the roads in the study area become muddy. Sometimes trucks are stuck in the middle of the road due to the mud. Improvement of the roads is vital for encouraging the distribution system.



Source: Production office of Pader district, compiled by the JICA Study Team

**Figure 8.1-3 Cropping Calendar**

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In addition, post harvest loss is also likely to be caused due to limited storage facilities. In Uganda, roughly 5 to 15% of cereal and legumes, 20 to 25% of other crops and over 35% of fruit and vegetables are estimated to be lost according to the research of the National Agricultural Research Organisation (NARO). Appropriate warehouses and facilities in which to keep the agricultural products are necessary. At least every trading centre should have facilities such as multi-crop storage, heaters for drying, and so on.

## 2) Marketing

The marketing system is also inefficient. Major issues of this are: a lack of farmer's associations and the other is selling agricultural products in their raw form. Firstly the farmers are likely to sell their products individually to middlemen from other regions at low prices due to lack of information about fair prices. Establishment of farmer's associations could help sharing information and selling at reasonable prices. Secondly the products in raw form tend to be sold at low prices, and then they are processed in Kampala or the importing countries. To add value to agricultural products is one of the measures for selling at better prices and enhancement of income for farmers. Processing facilities, and sufficient electricity and water need to be introduced at trading centres.

### 8.1.2.2 Inadequate Non-farm Industries

In the dry season, the farmers tend to stop producing due to having neither rain nor irrigation systems. As a consequence, the cash income of the farmers decreases during the dry season. Accordingly, the farmers try to sell charcoal in order to earn their livelihood instead of non-farm employment. However, producing charcoal is not a sustainable industry from the environmental viewpoint despite the planting of trees that is being done by the government. Not only growing cash crops but also other industries such as agro-industries and commercial industries are essential in order to increase cash income for the farmers.

In addition, the population of the study area is expected to be approximately 2.5 million in 2030 according to the population forecast done by the study team. This number is almost double the existing population in 2010. For taking account of the population growth, industries to provide job opportunities are necessary, even though most of the people in the study area are engaged in agriculture.

#### (1) Inadequate non-farm industries

To attract industries mentioned above, basic infrastructure is definitely required such as water supply, sewage systems and electricity. In particular, a stable supply of water and electricity is vital for development of industry. The large-size towns such as Gulu and Kitgum are appropriate to accommodate industries since infrastructure has already been partially developed. Well maintained roads connecting between cities are also needed to deliver the products safely and quickly.

#### (2) Job opportunities

If industry is developed in the study area, other issues still remain. It is expected that the people in the study area will not be able to take advantage of the new job opportunities in the study area due to their illiteracy and lack of education since northern Uganda has the worst illiteracy rate in Uganda. Basic education is necessary to participate in the economic activities, especially literacy. To offer the farmers to non-farm businesses, the education system also needs to be enhanced as is referred to in the following section. Besides, transportation for commuting to office places needs to be improved.

### 8.1.3 Perspective of Living Environment

Walking and bicycling are dominant for people’s mobilisation, particularly in rural areas since public transportation is limited in the study area. Accordingly, lack of transportation reduces the size of the living sphere and limits access to social services such as schools, health facilities, water points, and trading centres. Additionally, the number of social services is insufficient. The following sections attempt to describe the issues of the social services.

#### 8.1.3.1 Water

There are several challenges to provide sufficient water to the people. The number of water points still inadequate. The number of water points required is calculated based on population. Compared to the national standard, the number of water points in the study area is considerably low.

**Table 8.1-2 Required and Current Numbers of Water Points in the Study Area**

	Borehole	Motorized well	Shallow well	Spring
National Standard	4,146	1,244	4,146	6,219
Study Area	1,739	20	203	165
Coverage Ratio	42%	2%	5%	3%

Source: UNOCH, DWO and Clustre Partners, compiled by the JICA Study Team

As described in Chapter 3, the access to safe water is not at the national level. The condition of water points is also poor. Many water points have been abandoned for a long time during the conflict and need to be maintained or repaired so as to work properly. However, there aren’t sufficient funds to do so. Even when there are funds available, other problems still remain. Some of water points do not have proper access roads. Drilling of boreholes requires heavy equipment. Therefore, if water points are to be newly opened, access roads are required to reach the points. Also, there are sometimes land disputes around the water points.

Secondly, operation and maintenance of existing water points has not been done satisfactorily. As described above, water points should be managed by water and sanitation committees consisting of community people. However, they must have proper knowledge and techniques to maintain the water points. Information distribution and training are necessary to manage them.

In addition, the district offices are under-staffed. Because some of the positions are vacant, current staff should cover tasks of other positions. Under-staffing also makes it difficult to reach and check all water points frequently and provide necessary support to hand pump mechanics and water and sanitation committees.

Finally, district offices in the study area do not have proper data for planning, such as underwater potentials based upon a comprehensive hydro-geological survey and exact population.

#### 8.1.3.2 Health

There are various challenges facing the health sector in the study area. First of all, the number of health units is not at the level of the national standard. In terms of number, "hospital" is above the national standard, however, the other health clinics are below the standard. Inadequate health facilities may cause problems.



**Table 8.1-3 Required and Current Numbers of Health Facilities in the Study Area**

District	Hospital	HC IV	HC III	HC II
National Standard	2	12	62	249
Study Area	7	6	46	91
Coverage Ratio	350%	50%	74%	37%

Source: UNOCHA and WHO compiled by the JICA Study Team

For example, in terms of infant and child mortality, the sub-regions of Northern Uganda scored worse than the average of national and rural areas in 2006.

**Table 8.1-4 Comparative Mortality Figure in 2006**

Indicator	National average	Rural areas average	North Region
Infant mortality per 1,000 births	76	88	106
Under 5 mortality rate, per 1,000 births	137	153	177

Source: Uganda Demographic and Health Survey (UDHS)

Furthermore, health units are currently located only along the major roads. Accessibility to existing health units is also a problem. Some roads are in bad condition and are not passable, especially during the rainy season.

It cannot be said that existing health units have sufficient facilities. Rather, most of them are still incomplete in that regard. Particularly, the number of staff houses is very limited compared to the number of staff that needs accommodation. It is necessary to provide fences around health units to protect them from animals and other intruders.

In terms of human resources in the health sector, there are not enough staff members for these health units; which is another issue. Current staffing level is not sufficient compared to the required number of staff. Besides, in some remote areas, there are no applicants for the existing vacant positions, since living conditions, including the security situation, are not considered to be appropriate. As a matter of fact, many of the current staff members commute from town or large-size villages due to lack of staff houses. As a consequence, these staff members come to health units late and leave early, which causes shorter opening hours and less service. Some required services are missing and some services are covered by existing personnel who do not have the exact expertise necessary to provide the services. It is also said that salary payments to staff members are delayed, which is also partly to blame for the understaffing.

The knowledge level of existing staff, especially for nurses and nursing assistants, is also not high enough, which necessitates further capacity building.

Many development partners pointed out the problem of lack of drug stocks. The district office also recognises that there aren't sufficient medicines. This causes insufficient clinical services at health units. Patients are forced to go to drug stores to purchase necessary drugs, which could be a burden to the poor.

### 8.1.3.3 Education

In the study area, the education level remains low compared to the national average. Illiteracy rate of the northern region was 59% in 2005/06<sup>1</sup>, which was the worst rate in Uganda. The

<sup>1</sup> HEALTH SECTOR STRATEGIC PLAN III, 2010/11 – 2014/15, Ministry of Health

lowest literacy rate seems to be linked with the low enrolment rate in primary schools. Table 8.1-5 indicates the enrolment rate by district in 2009. Gross enrolment rate (GER) of the study area was 20% in 2009 which did not achieve at the national average. Notably, Pader and Agago districts had the lowest rate in the study area and their gender parity index implied the worst.

**Table 8.1-5 Primary School Enrolment Ratio in 2009**

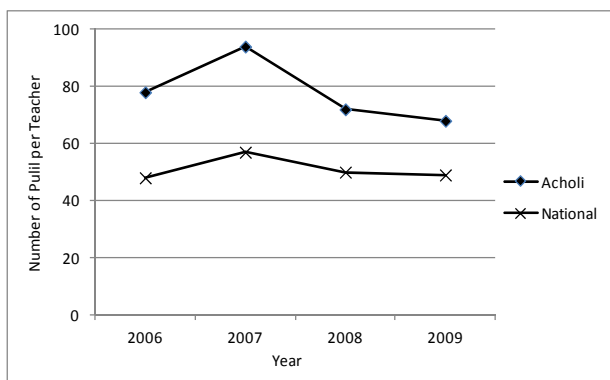
District	Gross Enrolment Rate				Net Enrolment Ratio			
	Male	Female	Total	Gender Parity Index	Male	Female	Total	Gender Parity Index
Gulu	42%	24%	33%	1.7	32%	20%	26%	1.6
Kitgum & Lamwo	25%	15%	20%	1.7	19%	13%	16%	1.5
Pader & Agago	15%	6%	10%	2.4	12%	5%	9%	2.2
National	31%	25%	28%	1.2	25%	23%	24%	1.1

Source: Ministry of Education and Sport

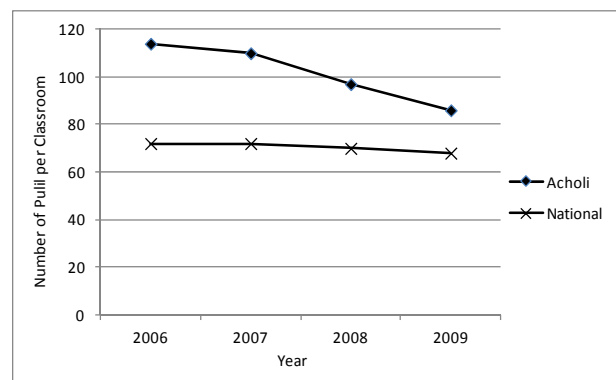
The number of schools is still inadequate. Considering the aspect of accessibility to existing schools, more schools should be constructed, especially in home villages. However, lack of funding makes it difficult to build new schools. Furthermore, some locations suffer from land disputes.

Existing schools do not have adequate facilities such as classrooms, furniture, sanitation facilities, and playgrounds. Also, some of the existing classrooms are temporary structures that are easily affected by the weather.

High teacher-pupil ratios show that there are not enough teachers in schools as shown in Figure 8.1-4. Because there isn't enough accommodation for teachers at schools, vacancies for teaching positions exist all the time, especially in remote areas of the study area. Besides, delays in salary payments cause low motivation among teachers and high rate of staff turnover for teachers. Teacher-pupil ratio and classroom-pupil ratio have become better since 2006, however, there was still a disparity between Acholi sub-region and the national average.



**Number of Pupils per Teacher**



**Number of Pupils per Classroom**

Source: Uganda Bureau of Statistics Website, 2010

**Figure 8.1-4 Number of Pupils per Teacher and Classroom, 2006 to 2009**

Poor working conditions for teachers also cause irregular attendance and high rate of absenteeism by teachers. Since teacher accommodation is lacking, many teachers are forced to commute from large towns such as Gulu. Teachers who commute sometimes come to

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schools late and leave schools earlier: this creates shorter contact time between teachers and students. Delays in salary payments de-motivate teachers and sometimes force them to take on second jobs to better their living conditions, and this accelerates absenteeism.

Irregular attendance and absenteeism among children is also a challenge. This can be attributed to several reasons: for example, children take a long time commuting to school, and children sometimes need to do domestic chores such as water fetching and firewood collection instead of going to school. Also, the fact that schools do not provide lunches affects children's attendance and causes absenteeism. The absence of school lunches makes many pupils less enthusiastic about going to school. The absence of school lunches also makes it hard for pupils who attend school to concentrate properly during lessons. The government encourages parents to prepare packed lunches for pupils, but, it is not functioning well so far.

Children's irregular attendance and absenteeism are partly because of lack of parents' interest in sending their children to school. Parents who do not have understanding and appreciation towards education tend to sometimes ask their children to do domestic chores instead of sending them to school. Also, schooling is expensive for some parents. Although school fees have been wiped away by Universal Primary Education (UPE) and Universal Secondary Education (USE) programs, parents are required to pay for various items when they send children to school; such as school uniforms, stationery, exercise books, etc. Furthermore, some parents consider that it is not necessary for girls to get an education. The parents' understanding and cooperation is a pre-requisite for expansion of education.

## **8.2 Transportation Issue**

### **8.2.1 Road Network**

The Road Network in the Study area has been developed centred on Gulu and Kitgum and the network is formed as a radial pattern in the area. The Kampala – Gulu – Atiak – Nimule Road and the Lira – Kitgum – Musingo are the two main axes of the road network which have been identified as important roads in Northern Uganda and therefore, their upgrade feasibility studies and detailed engineering designs have been conducted and completed by the UNRA.

No bottle necks in terms of road capacity were found during the traffic analysis in the area; the road network will still be adequate for the traffic demands in the future.

As the road density indicates, the liner length of the road network is also sufficient in the Study area.

### **8.2.2 Road Structures**

The one of physical bottle necks is insufficient road width which does not comply with the standard cross section. Particularly, shoulders at trunk roads are heavily damaged due to erosion. The erosion is caused by un-maintained grass aside of the shoulders. The grass blocks the storm water flow from the carriageway and that makes the shoulder eroded. Pot holes are being developed during the rainy season in the entire network. Such problems are related with inadequate Road O&M work that is discussed further in 13. Present Road Maintenance and Operation System in Study Area.

The other physical bottlenecks identified in the Study are insufficient road structures such as the drainage systems. Most of the road cross culverts are 600 mm in diameter although the Ugandan Road Standards recommends and regulates minimum size of 900mm because 600mm is difficult to maintain.

### 8.2.3 City Road Network

As explained above, the network is developed centred around Gulu and Kitgum, the traffic is being generated and concentrated in the cities. In particular, two busy trunk roads (i.e. Kampala – Gulu – Atiak – Nimure Rd. Olwiyo-Gulu-Kitgum Rd.) pass through Gulu city, therefore passengers and cargo traffic is being mixed on the city roads and that creates serious chaos. In order to remove heavy through traffic from the city, the Gulu –Atiak –Nimule road project introduces and will construct a bypass, however no plan is yet prepared for through traffic on the Olwiyo-Gulu – Kitgum Road.

The city road network in Gulu has been formed with a frame pattern. The road width varies from 13-16m and no walkways and no parking spaces are provided next to the carriageway. The carriageway is heavily damaged due to the inadequate capacity of the drainage system and improper maintenance and that produces low road performance. The structural improvement of the city roads is essential for further development.

In Kitgum, a trunk road also passes through the city. Since the traffic volume is still low, no congestion is being observed. However, traffic congestion and problems may be expected as the city develops.

The roads in Kitgum and Pader city had been paved, however, the paving no longer exists due to deterioration. The road environment in the city is inferior.

### 8.2.4 Public Transport

There is no reliable public transport system in the Study Area. The only scheduled commercial public transport system is the long distance bus connecting to Kampala and/or Juba.

The Boda Boda (Bike Taxi) is the primary public transport mode in the city and village centres. In Gulu city, the Boda Boda represents more than 70% of all traffic and the driving behaviour is uncontrolled and that sometimes creates traffic congestion in the city.

Gulu has two long distance bus terminals in busy areas although the city is not big enough to require two terminals. Furthermore, there is a mini bus (matatu) terminal along Kampala – Gulu Road. The facilities of these terminals are observed as poor. The terminals are being operated by the private sector and no integration plan considering the effectiveness and convenience for the passenger has been introduced by transport operators or governmental organizations.

In rural areas, sharing pick-up trucks operated by individuals is the only transport mode and its operation is done on a demand and request basis. The public has few job opportunities or business chances because of no scheduled transport system. The public, therefore, need to prepare their own transport system although they have little income.

### 8.2.5 Other Public Transport Modes

There are airfields in Gulu, Kitgum and Pader. There were scheduled flights between Entebbe, Gulu, and Pader in the past but there are no scheduled flights currently because there is no longer a demand for air transport in the areas. One of the reasons for the termination of the scheduled flights is the improvement work done on the Kampala- Gulu Road. The serious traffic bottlenecks have been removed from the road and that results in time saving. The air transport is no longer competitive against the road transport.

Railway tracks had been constructed along Pacwach-Gulu-Lira-Mbale, however, they have not been used for a long time. The damage to the tracks is serious and some track has been removed by vandalism. The NTMP identified the route as the number 4 priority and its

renovation estimation was 280 Million USD. It seems to be unfeasible which suggests that the road will be the only transport mode in the area, even in the future.

### 8.3 Social/Natural Environmental Issues

#### 8.3.1 Urban Areas and Human Settlements

Population growth pressure with higher annual population growth rate at 3.8%<sup>2</sup> in the average of Sub-region without job/business opportunities except subsistence farming and proper social services is one of the major reasons for the poverty and it tends to affect the regional environment. In the urban areas of district centres and trading centres, economic activities are more intense and social services are better than in the rural areas. However, they have higher population density with insufficient infrastructure systems and this causes poor conditions of hygiene and sanitation, especially due to lack of solid and liquid waste management and infrastructure.

Gulu town has a lower annual growth rate (2.8%), however, many South Sudan shoppers and traders recently visit Gulu Town from the Nimule border and economic activities are stimulated in Gulu. Kitgum Town, the second largest service centre in the Sub-region, has a higher annual growth rate (4.0%) and the built-up area is expanding. If their economic activities are accelerated without attention to the other areas, migration toward them can increase. Consequently, it will accelerate deterioration of hygiene and sanitation if there are no measures for infrastructure improvement.

**Table 8.3-1 Environmental Problems in Urban Areas**

Problems	Consequences	Development Issues
<ul style="list-style-type: none"> <li>Waste water discharge without treatment</li> <li>Litter (polythene bags, pet bottles, papers)</li> <li>Burning of solid waste in town</li> <li>Poor waste management</li> <li>Lack of waste disposal sites</li> <li>Lack of knowledge to reduce waste</li> </ul>	<ul style="list-style-type: none"> <li>Offensive odours</li> <li>Poor condition of hygiene and sanitation</li> <li>Obstruction of drainage and over flow of rain water</li> <li>Deteriorated landscape</li> <li>Worsen intestinal worm disease and diarrhoea</li> </ul>	<ul style="list-style-type: none"> <li>Develop sewage and drainage system</li> <li>Develop solid waste management system (transportation system, dumping sites)</li> <li>Provide discharging guidelines, distribution and promotion</li> <li>Facilitate community participation for cleaning public spaces</li> <li>Promote awareness on solid waste management and the environment</li> <li>Facilitate women's involvement in solid waste management</li> </ul>

Source: Five Year District Development Plans (FY 2011/12-2015/16) of 5 districts, JICA Study Team

#### 8.3.2 Socio-economics

As mentioned in the socio-economic activities above, subsistence agriculture dominates the regional economy. There are small-scale agro processing industries, grinding mills, yogurt making and rice hullers, which are the major manufacturing industries. Service industries are growing, especially in Gulu and Kitgum towns. There are no large-scale economic activities that affect the regional environment.

In the subsistence economic activities, the situations of household income and expenditure reveal that the local households are still in the poorest level in the country. Housing conditions are also poor and they consume firewood for cooking fuel with primitive three stone kitchen

<sup>2</sup> Annual growth rate 2001 – 2010 (UBOS)

ranges. Charcoal is also commonly used, especially in urban areas, which is an immediate cash source for the households because they can produce it quickly without skill.

This situation causes a great consumption of trees in the Sub-region and it is leading to deforestation and loss of vegetation. Charcoal is in high demand, especially for urban households and service sectors, and consumption even in South Sudan. The firewood is also consumed to produce fuel for burning. This poses a great threat to the natural environment and causes deforestation and loss of vegetation leading to soil erosion, reduction of soil fertility and land degradation.

The agricultural productivity level is still low because of the high cost of inputs for farming and inaccessibility to modern farming technologies. Current practices cannot maintain soil fertility and productivity. Meanwhile, the farmers are out of marketing measures. Market information and storage are not available and the farmers produce mostly the same crops in the same season. Besides, the farmers are depending on middlemen for selling the products. Low quality products and high competition without the marketing measures reduce the product prices. The entire situation worsens the income level of the local households and it also accelerates felling trees and producing charcoal.

With the current road conditions, national and district roads have low reliability and poor drainage facilities structures. Community access roads are also not maintained well. This degrades the mobility of the farmers and merchants to markets.

**Table 8.3-2 Environmental Socio-economic Issues**

Problems	Consequences	Development Issues
<ul style="list-style-type: none"> <li>• Primitive traditional farming methods</li> <li>• Produce same crops at the same season</li> <li>• Lack of marketing for agricultural products</li> <li>• High dependence on middlemen dealing</li> <li>• Poor physical accessibility to local markets</li> <li>• High dependence on extraction of forest products for fuel wood and charcoal</li> </ul>	<ul style="list-style-type: none"> <li>• Low price of agricultural products and low income for farmers</li> <li>• Low productivity</li> <li>• Deforestation</li> <li>• Loss of vegetation cover</li> <li>• Reduce soil fertility</li> </ul>	<ul style="list-style-type: none"> <li>• Diversification of agricultural products</li> <li>• Develop agro-processing products</li> <li>• Improve farming technologies</li> <li>• Improve, maintain and rehabilitate the roads with the drainage structures to the markets (trading centres)</li> <li>• Develop/improve cooperative systems to obtain fair market information and management systems for shipping and storing products</li> <li>• Develop storage facilities to minimize post harvest losses and ensure household food security</li> <li>• Develop irrigation systems to ensure whole-year production</li> <li>• Improve micro finance systems</li> </ul>
<ul style="list-style-type: none"> <li>• Land degradation</li> <li>• Soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce soil fertility</li> <li>• Deterioration of agricultural productivity</li> </ul>	
<ul style="list-style-type: none"> <li>• Deforestation</li> </ul>	<ul style="list-style-type: none"> <li>• Destruction of suitable habitat for beekeeping</li> </ul>	
<ul style="list-style-type: none"> <li>• Drying of boreholes and rivers</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of clean water</li> </ul>	<ul style="list-style-type: none"> <li>• Develop water sources</li> </ul>
<ul style="list-style-type: none"> <li>• Lack of latrines in households, schools and public places</li> <li>• Lack of medical services and drugs</li> </ul>	<ul style="list-style-type: none"> <li>• Poor condition of hygiene and sanitation</li> <li>• Deteriorate health conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Facilitate latrine construction</li> <li>• Improve medical services in equipment, facilities and human resources</li> </ul>

Source: Five Year District Development Plans (FY 2011/12-2015/16) of 5 districts, JICA Study Team

### 8.3.3 Natural Environment

Natural resources around the former IDPs have especially been over-exploited due to increased demand for fuel wood and charcoal, for both domestic and commercial purposes. Also due to the nature of residential houses in the former camps, the trees, grass and soil have been greatly used as construction materials. In addition, due to limited sources of revenue for the

community, many more fragile ecosystems around the wetlands and riverbanks, among others, have been encroached on and degraded.

The IDPs depleted trees in forest reserves for firewood and charcoal which they sold to earn income in the course of struggling for survival. The percentage change in tree cover in forest reserves that were replanted by the NFA on average stands at 60%.

The main source of safe drinking water in the District is underground water obtained through drilling of boreholes, shallow wells and spring protection.

According to district health offices, Malaria is the most common disease for both out patients under five years old and five years old/above. ARI (acute respiratory illness) follows it and other diseases are Intestinal Worms, Skin diseases, Diarrhoea, Eye infections, Trauma (mental illness), and ENT conditions (ear, nose and throat). The most common cause of mortality is HIV/AIDS for all persons. Dust and water pollution can exacerbate respiratory diseases and water-related diseases.

**Table 8.3-3 Environmental Issues in Nature**

Problems	Consequences	Development Issues
<ul style="list-style-type: none"> <li>• Indiscriminate tree cutting</li> <li>• Collection of fuel wood</li> <li>• Collection of wood for production of charcoal and building materials (timbers)</li> <li>• Bush clearing for cultivation</li> <li>• Farmers encroaching on forest reserves</li> </ul>	<ul style="list-style-type: none"> <li>• Deforestation</li> <li>• Loss of vegetation cover</li> </ul>	<ul style="list-style-type: none"> <li>• Diversification of agricultural products</li> <li>• Improve farming technologies</li> <li>• Develop alternative economic activities</li> <li>• Promote re-plantation programs</li> <li>• Sensitization for communities</li> <li>• Dissemination of the guidelines for the communities</li> </ul>
Wetlands reduction and degradation by: <ul style="list-style-type: none"> <li>• Cultivation</li> <li>• Settlement construction</li> <li>• Waste dumping</li> <li>• Siltation</li> <li>• Bush burning in dry season</li> <li>• Grazing</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced aquatic resources and products for the local people (mudfish, edible rats)</li> <li>• Reduced flora, fauna and biodiversity</li> <li>• Deteriorated natural drainage systems, flood protection and purification of wastewater</li> </ul>	
<ul style="list-style-type: none"> <li>• Population pressure for cultivation (crop harvest for example, millet, maize, sorghum, cassava)</li> <li>• Brick production</li> <li>• Overstocking and over grazing of livestock</li> <li>• Bush burning</li> </ul>	<ul style="list-style-type: none"> <li>• Land degradation</li> <li>• Reduced soil fertility and productivity</li> </ul>	
Decrease of fishes in rivers, streams, and wetlands by: <ul style="list-style-type: none"> <li>• Wetland reclamation</li> <li>• Water siltation</li> <li>• Poisoning fishing method with herbs</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of livelihood</li> <li>• Devastated biodiversity</li> </ul>	
<ul style="list-style-type: none"> <li>• Wetland degradation</li> <li>• Poor sanitation (construction of temporary latrines)</li> <li>• Poor waste management around the water sources</li> <li>• Poor maintenance of the existing water points</li> <li>• Grazing of animals around water sources</li> <li>• Poor drainage from and to the water sources</li> <li>• Lack of cooperation among the community and their leaders</li> </ul>	<ul style="list-style-type: none"> <li>• Water pollution</li> <li>• Worsen water-related diseases (diarrhoea)</li> <li>• Congestion around limited safe water resources</li> </ul>	

Problems	Consequences	Development Issues
<ul style="list-style-type: none"> <li>• Climatic change</li> <li>• Deforestation</li> <li>• Wetland reclamation</li> <li>• Soil moisture lost</li> </ul>	<ul style="list-style-type: none"> <li>• Drought</li> </ul>	
<ul style="list-style-type: none"> <li>• Land degradation</li> <li>• Lack of agricultural technique</li> <li>• Loss of vegetation cover</li> <li>• Lack of maintenance of earth roads</li> <li>• Abandoned borrow pits</li> </ul>	<ul style="list-style-type: none"> <li>• Soil erosion</li> <li>• Water siltation</li> </ul>	<ul style="list-style-type: none"> <li>• Road improvement and maintenance</li> </ul>
<ul style="list-style-type: none"> <li>• Dust from earth roads and abandoned borrow pits</li> </ul>	<ul style="list-style-type: none"> <li>• Air pollution</li> <li>• Worsen respiratory diseases</li> </ul>	
<ul style="list-style-type: none"> <li>• Direct discharge of domestic waste water, night soil</li> <li>• Livestock excretion</li> <li>• Siltation</li> <li>• Flood</li> </ul>	<ul style="list-style-type: none"> <li>• Surface water and ground water contamination</li> </ul>	<ul style="list-style-type: none"> <li>• Develop sewage and drainage systems</li> </ul>

Source: Five Year District Development Plans (FY 2011/12-2015/16) of 5 districts, JICA Study Team



## **9. REGIONAL DEVELOPMENT PLAN**

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### **9.1 Introduction**

The returning process of the IDPs is almost completed in Acholi Sub-region as described in the previous chapter. This region now takes the next step toward sustainable development based upon ensuring a safe and peaceful living environment and reconstruction of the regional economy. Comprehensive regional development contributes to these dynamics of Acholi Sub-region. Furthermore, the road network development needs to connect with the idea of the regional development. This chapter attempts to describe a proposed regional development plan in Acholi Sub-region based upon broader perspectives.

### **9.2 Spatial Structure**

#### **(1) National Spatial Structure**

Acholi sub-region lies in the northern part of Uganda. The region is bordered by South Sudan in the North, Karamoja Sub-region in the East, Lango Sub-region in the South and West Nile Sub-region in the West. In terms of linkage to major cities, Gulu Town, which is the largest service centre of Acholi Sub-region, connects to Kampala in the south and the capital city of South Sudan, Juba, in the north. The distance between Gulu and Kampala is approximately 350km, and between Gulu and Juba is approximately 295km.

The mutual relationship between South Sudan and Acholi Sub-region is close in terms of not only geographical proximity but also social habits and customs. Notably, the southern part of South Sudan and Acholi Sub-region have the same ethnic group called “Acholi” and speak the same Acholi language.

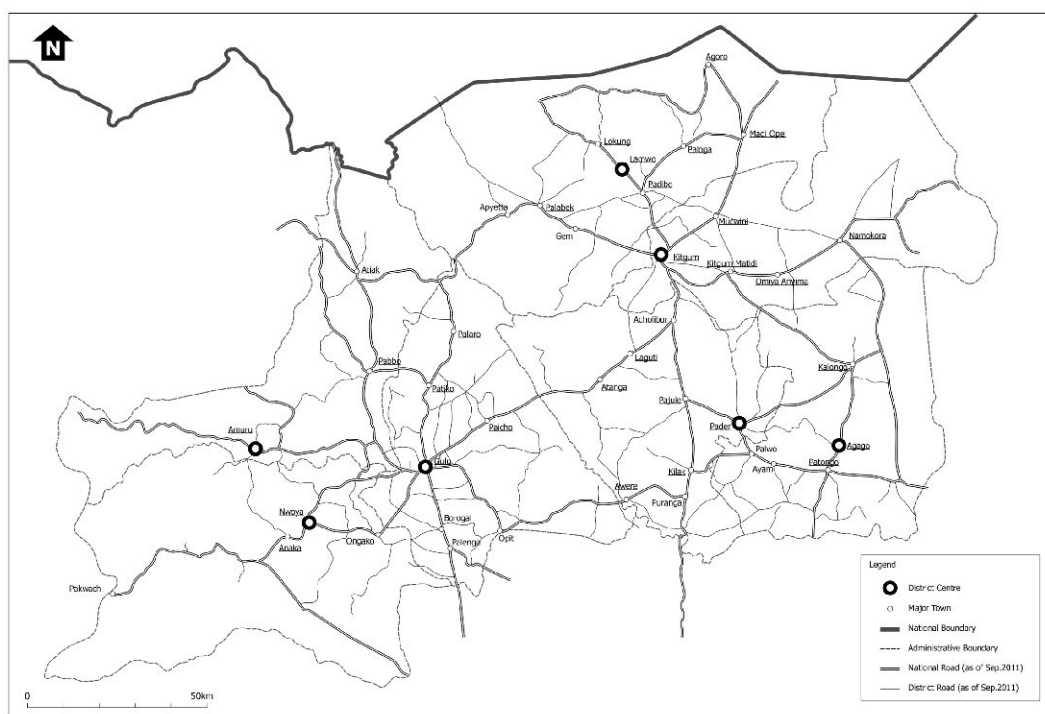
#### **(2) Regional Spatial Structure**

Acholi Sub-region stretches about 150 km from north to south, 270 km from east to west and the area of land comprises approximately 28,278 sq.km<sup>1</sup> which accounts for 11.7% of the total land of Uganda.

National roads connect between major service centres which provide public administration, education, medical care and commercial functions. District roads connect either service centres or national roads. There are neither air nor railway transportation services at this moment. Therefore, in this region, people’s mobilization, logistics and economic activities completely rely on road transportation.

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<sup>1</sup> Data is in 1995, from Statistical Abstract 2011, UBOS



Source: JICA Study Team

**Figure 9.2-1 Map of Acholi Sub-region**

### 9.3 Potential of Acholi Sub-region

#### 9.3.1 Potential of Agricultural Development

The Acholi Sub-region has rich resources for the agricultural industry including favourable climate and water, and vast land and human resources.

The average temperature of Acholi Sub-region tends to be constant throughout the year. During the rainy season, it has enough rainfall to grow a variety of agricultural products. In which some products can have two harvests in a year such as ground nuts, sweet potato, cow peas and upland rice. The land is well watered and fertile thanks to rivers such as Achwa River and Agago River. In addition, the land is generally flat. Looking at these land features, Acholi Sub-region is suitable for the agricultural industry.

A variety of agricultural products is cultivated throughout the year such as cereals, vegetables, root tubers cash crops and oil crops. In terms of the variety of agricultural products, there is no clear difference among the seven districts in Acholi Sub-region.

**Table 9.3-1 Major Agricultural Products in Acholi Sub-region**

Type	Products
Food Crop	Finger millet, Sorghum, Rice, Maize, Sweet Potato, Cassava, Beans, Sesame, Pigeon peas, Cow peas, Soya beans, Tomatoes, Cabbages, Onions, Okra, Eggplant
Cash Crop	Rice, Cotton, Maize, Finger millet, Sorghum, Sesame, Pigeon peas, Beans
Oil Crop	Sunflower, Soya beans, Ground nuts

Source: DDP compiled by JICA Study Team

In order to grasp the agricultural potential in Acholi sub-region, the productivity is analysed based upon the data of agricultural production by sub-county in 2008. Each sub-county was

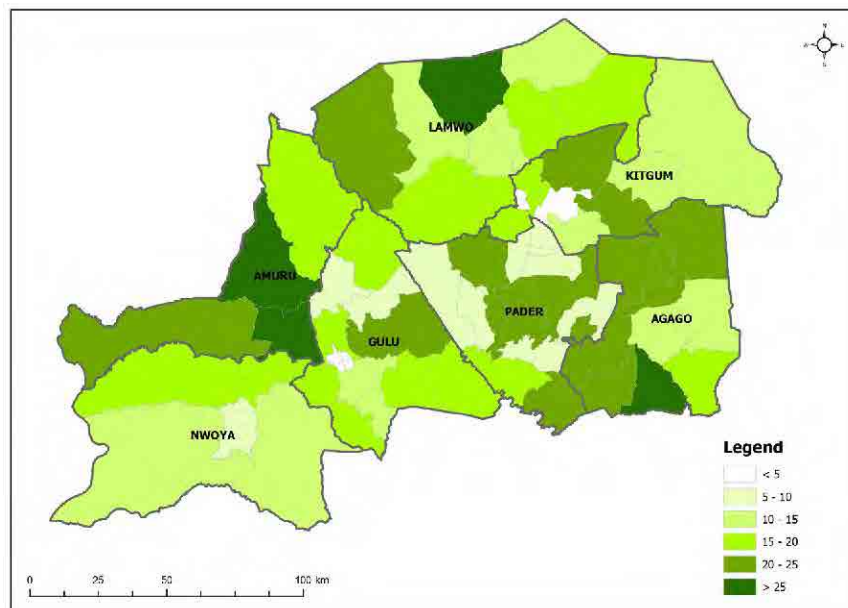
graded upon the volume of major agricultural production: maize, sorghum, millet, beans, sesame, peas and cotton. The grade was decided upon the relative comparison of the data in Acholi sub-region. The grade and base data are shown in Table 9.3-2.

**Table 9.3-2 Score for the Agricultural Potential Analysis**

Grade	Maize (ton)	Sorghum (ton)	Millet (ton)	Beans (ton)	Sesame (ton)	Peas (ton)	Cotton (ton)
0	0	0	0	0	0	0	0
1	1 – 100	1-500	1 – 150	1 – 100	1 – 200	1 – 50	1 – 50
2	101 – 300	501 -1,000	151 – 300	101 – 200	201 – 400	51 – 100	51 – 100
3	301 - 500	1,001 – 1,500	301 – 450	201 – 300	401 – 600	101 – 150	101 – 150
4	501 – 700	1,501 – 2,000	451 – 600	301 – 400	601 – 800	151 - 200	151 - 200
5	Above 700	Above 2,000	Above 600	Above 400	Above 800	Above 200	Above 200

Source: DED-Refugee/IDP Programme (2009), Second Season 2008 Land Use and Crop Yield Assessment Report Acholi Sub-region, and compiled by the JICA Study Team

Figure 9.3-1 illustrates the result of the analysis, the intensity of the colour indicates the degree of productivity. Looking at the map, some sub-counties are coloured with dark green, which have a high rate of production such as Lokung sub-county in Lamwo and Patongo sub-county in Agago district.



Source: DED-Refugee/IDP Programme (2009), Second Season 2008 Land Use and Crop Yield Assessment Report Acholi Sub-region, and compiled by JICA Study Team

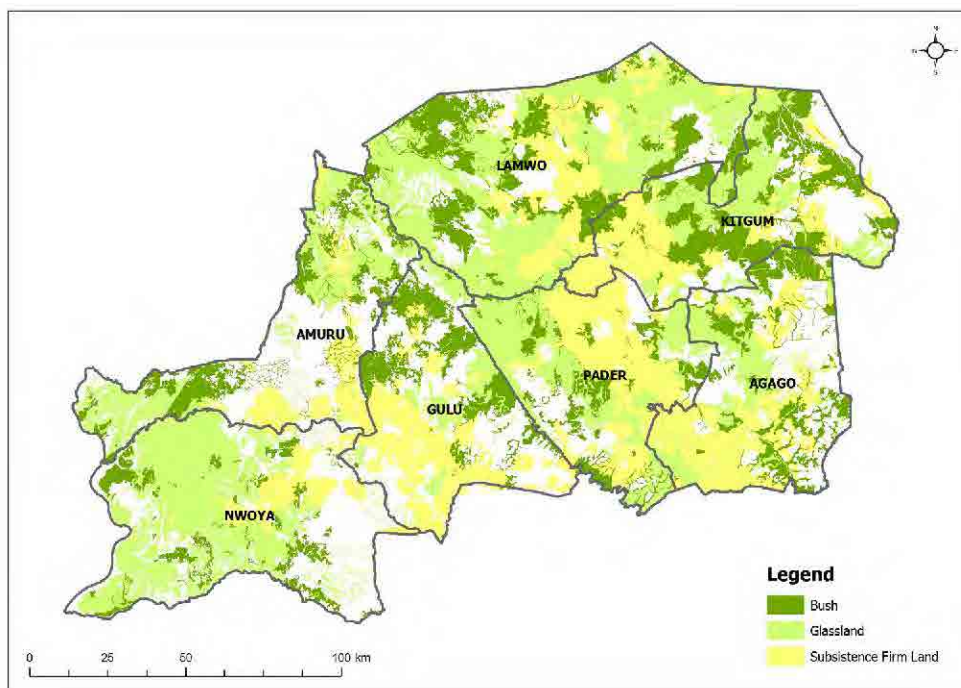
**Figure 9.3-1 Grade of Integrated Agricultural Productivity by Sub-county 2008**

In terms of land use, only 6,400 km<sup>2</sup> was used for farm land in 2005. The area of grass land and bush could be utilized for agricultural land. Thus, the land availability for agriculture is estimated at roughly 13,700 km<sup>2</sup>. If the agricultural system is improved by means of shifting from hand-ploughing to ox-ploughing or tractors, the agricultural productivity will be increased drastically.

**Table 9.3-3 Area of Farm Land, Grass Land and Bush by District 2005**

District	Farm Land (km <sup>2</sup> )	Grass Land (km <sup>2</sup> )	Bush (km <sup>2</sup> )
Gulu	1,077.7	369.6	672.4
Kitgum	984.1	810.4	1,091.4
Lamwo	1,033.2	2,548.7	1,187.3
Agago	1,057.7	651.1	642.2
Pader	1,197.6	1,117.3	438.2
Amuru	559.3	968.1	601.0
Nwoya	468.6	2,129.2	415.4
Total	6,378.1	8,594.4	5,047.8

Source: NFA 2005 compiled by JICA Study Team



Source: NFA 2005 compiled by JICA Study Team

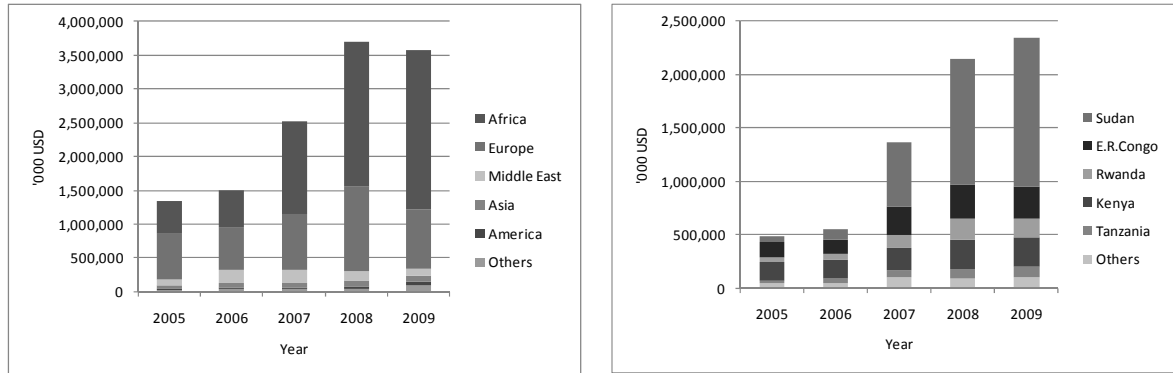
**Figure 9.3-2 Area of Area of Farm Land, Grass Land and Bush in Acholi Sub-region 2005**

On the other hand, Acholi Sub-region accommodated a population of 1,464,000 in 2010 which comprises 4.6% of the total population in Uganda. More than 80 % of households are estimated to be engaged in agriculture. In addition, the population is expected to double by 2030 according to the estimation of the study team. The human resources are also sufficient for agricultural development.

### 9.3.2 Potential of Trading

Uganda heavily depends upon imports such as commodities, construction material, and oil-based products. Meanwhile the export is mainly agricultural products such as tea, coffee, and cotton. The imports exceeded exports by approximately 2.6 billion USD in 2010. Major destinations of exports were African countries, in particular Sudan. Since 2007, the exports have increased sharply as shown in Figure 9.3-3.

Regarding food self-sufficiency in Uganda, the volume of agricultural production is not enough even though 87% of the total population engages in the agricultural industry. In Uganda, vegetable and sugar partly relied on imports and its import value was 300 million USD in 2010. To address this situation and future population growth, it will be necessary to increase the production of northern Uganda, since this area has limited agricultural production so far due to the long absence of agricultural activities.



**Export by Region**

**Export by Country in African Region**

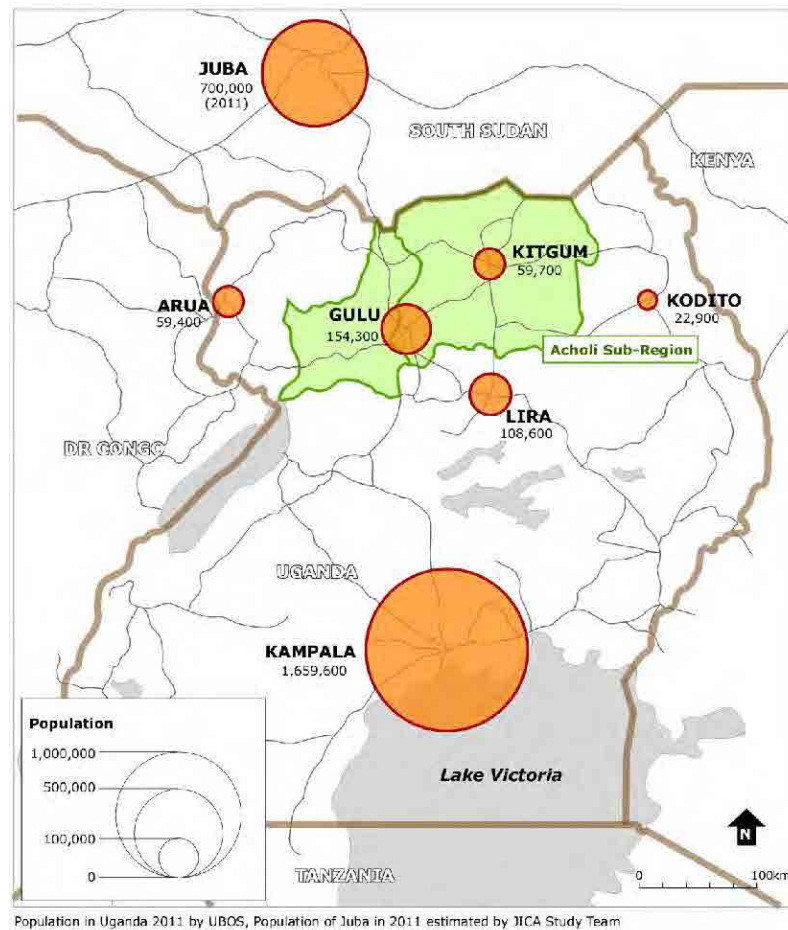
Source: UBOS compiled by JICA Study Team

**Figure 9.3-3 Destination for Exports of Uganda 2005 - 2009**

Meanwhile, informal trade with neighbouring countries tends to be fairly active in recent years. The major contributor is South Sudan because of the rapid population increase caused by returnees from North Sudan after the independence. Besides, slowing down of trade with North Sudan leads to enhance this circumstance. On the other hand, the system of agricultural production in South Sudan has not been established yet due to decades of civil war and allocation of man power to the military service. Such condition helps to encourage the informal trading of agricultural products between South Sudan and Uganda.

Furthermore, the East African Community (EAC), which encourages regional integration among eastern African countries including Uganda, focuses upon liberalization of cross border trade between partner states. The EAC partner states are negotiating a trade agreement including the trade of agricultural products at this moment.

As mentioned above, Acholi Sub-region has a large potential for agricultural development. For taking this advantage, encouraging export of agricultural products is reasonable and able to contribute to enhancement of the regional economy. From the population agglomeration and distance viewpoints, mainly two cities can be large markets for Acholi Sub-region. One is Kampala, which accommodates a population of 1.7 million, the other is Juba which is estimated around 0.7 million.



Population in Uganda 2011 by UBOS, Population of Juba in 2011 estimated by JICA Study Team

Source: JICA Study Team based upon data of UBOS and interviews

**Figure 9.3-4 Urban Population of Uganda and Juba in 2011**

### 9.3.3 Potential of Other Industries

#### 9.3.3.1 Tourism

There are two large-size tourist destinations near Acholi Sub-region, one is Murchison Falls National Park and the other is Kidepo Valley National Park. The number of visitors to these two national parks tends to increase year by year.

The distance between Gulu and the gate of Murchison Falls National Park is approximately 70 km and its road condition has already improved. For taking advantage of the short distance, one day tours from Gulu to Murchison Falls National Park are arranged. Meanwhile, Gulu and Kitgum are the major gateways of trips to Kidepo Valley National Park. The tourists from Kampala are likely to come over and stay at either Gulu or Kitgum. Under such circumstance, it can be recognized that the study area, especially Gulu and Kitgum, have large potential for tourism development.

**Table 9.3-4 Number of Visitors to National Parks in Uganda 2006 - 2009**

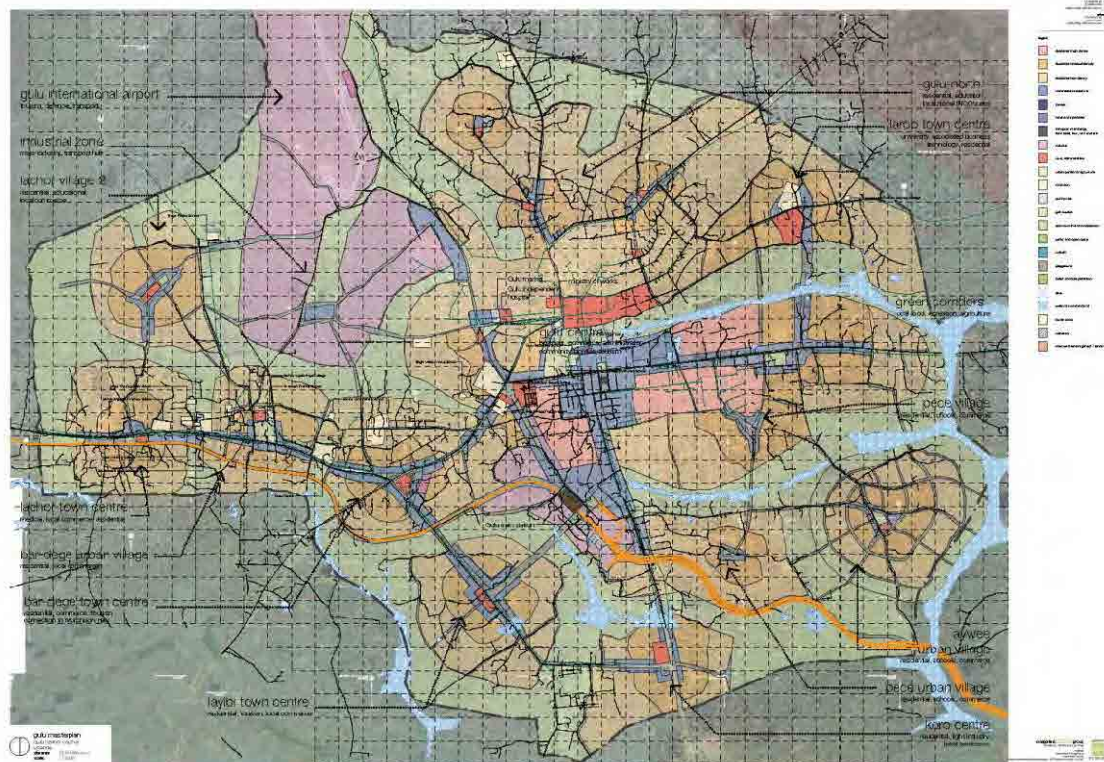
Name	2006	2007	2008	2009
Murchison Falls National Park	26,256	32,049	36,752	39,237
Queen Elizabeth National Park	43,885	51,749	53,921	62,513
Kidepo Valley National Park	959	795	1,588	2,924
Lake Mburo National Park	12,508	14,264	16,539	17,521
Bwindi Impenetrable National Park	10,176	9,585	10,128	11,806
Kibale National Park and Katonga	7,741	8,440	7,733	8,247
Others	8,567	9,671	11,643	8,811
Total	110,092	126,553	138,304	151,059

Source: UBOS

### 9.3.3.2 Other Industry

In the study area, small scale agro industries exist in major trading centres, such as packing of products, cereals grain, oil mill, and cotton ginnery. Middle scale agro industries are not in the study area. Accordingly, some products in Pader and Agago districts are brought to Lira, which has middle-sized factories for primary processing. Agro industries are expected to be attracted to Acholi Sub-region when the conditions are favourable such as sufficient volume of agricultural products, well paved roads, and improvement of basic infrastructure such as water supply and electricity.

Besides, Uganda Investment Authority has a plan to develop business-parks in 22 selected cities which shall be provided taxation incentives and reliable power supply in order to encourage economic development with investment of private partners both inside and outside Uganda. Gulu, one of the selected cities, is planned to develop “Gulu Industrial Park” of more than 400 acres. Furthermore, Gulu municipality has a future land use plan which includes large sized land for industrial development for exploiting the less frequently used airstrip as shown in Figure 9.3-5.



Source: Gulu Municipality

**Figure 9.3-5 Future Land Use Plan of Gulu Municipality**

This project is still under planning. In this regard, the economy of Uganda has enjoyed stable growth since 1987 with support of IMF and World Bank. The average growth rate of GDP was approximately 7% in the most recent five years. In which, manufacturing has been increasing and its average growth rate showed more than 8% in the most recent five years. This favourable trend may drive the industrial development in the study area if the economy can be stabilized.

### 9.3.3.3 Land Development Potential

For taking account of the future development such as industrial development explained above, the land development potential was analysed using GIS data including slope, land cover, proximity to urban centres, accessibility to social services, and protected areas. In this analysis, national parks, forest reserves, water bodies, swamps and steep slopes were categorized as unsuitable for land development from the environmental consideration perspective. The detailed categories, weights and grades which are used in the analysis are indicated in Table 9.3-5.

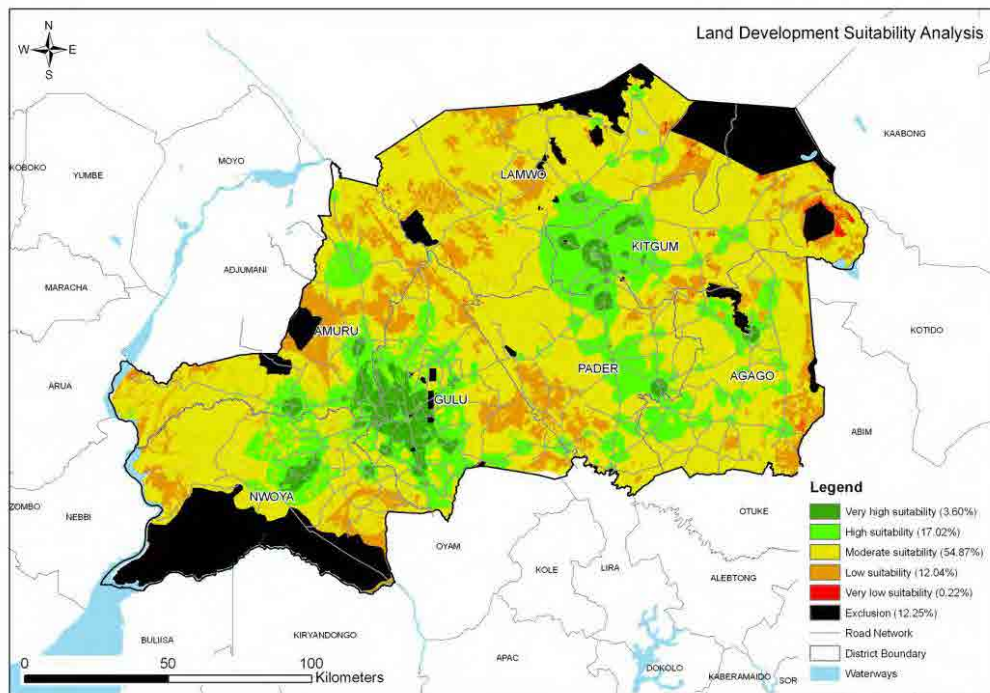
Figure 9.3-6 shows the land area suitable for development. Areas coloured with dark green are the most suitable for development while areas coloured with dark brown need to be protected from development. According to this figure, Gulu town and surrounding area have a large potential for development from the land condition view point, then Kitgum town and Pader town follow.

**Table 9.3-5 Grading for the Land Development Analysis**

Category	Factor	Weight	Description	Data Source	Suitability Grade						
Land Capability	Slope	20%		NFA	Value	Most Suitable				Least Suitable	
					Approx. Area(Ha)	2452178	321,206	45,304			
	% Analysis Area	87.00%	11.40%	1.60%							
	Grade	5	4	3	2	1					
Land Capability	Land Cover	20%	Land Cover Map of Acholi	NFA/2005	Value	Broadleaved Tree Plantations Coniferous Plantations Bush Grassland Subsistence Farmland Commercial Farmland	Depleted Tropical High Forest			Tropical High Forest Well Stocked Impediments Woodland Wetland Built up Areas	Open Water
					Approx. Area(Ha)	2,012,743	214	802,424			
	% Analysis Area	71.49%	0.01%	28.50%							
	Grade	5	4	3	2	1	Exclude				
Development Potential	Proximity to District Centers	15%	Proximity to District Centers	JST/2011	Value	<= 5km	5~10km	10~20km	20~30km	> 30km	
					OR	OR	OR	OR	OR	OR	
					Value	Short Travel Time (say <30min)	Short Travel Time (say 30min~60min)	Short Travel Time (say 60min~90min)	Short Travel Time (say 90min~120min)	Short Travel Time (say >120min)	
					Approx. Area(Ha)	31,417	94,250	374,979	546,505	1,777,651	
	% Analysis Area	1.11%	3.34%	13.27%	19.35%	62.93%					
	Grade	5	4	3	2	1					
	Accessibility to Water Sources	15%	Accessibility to Water Sources	UNOC/4/2011	Value	High Service	Medium Service		Low or No Service		
					Approx. Area(Ha)	125036	3,852,25		23812.75		
					% Analysis Area	4.42%	11.28%		84.30%		
					Grade	5	4	3	2	1	
	Accessibility to Health Services	10%	Accessibility to Health Services	UNOC/4/2011	Value	High Service	Medium Service		Low or No Service		
					Approx. Area(Ha)	292,302	675,240		1,856,650		
% Analysis Area					10.37%	23.93%		65.73%			
Grade					5	4	3	2	1		
Accessibility to Schools	15%	Accessibility to Schools	UNOC/4/2011	Value	High Service	Medium Service		Low or No Service			
				Approx. Area(Ha)	27935.5	510,099		2,286,796			
				% Analysis Area	0.99%	18.05%		80.95%			
				Grade	5	4	3	2	1		
Protection Area	National Parks	Exclude	National Parks	WCE	Value	Nil Value					
					Approx. Area(Ha)	Exclude					
	Forest Reserves	Exclude	Soil Type	NFA/WCS	Value	Nil Value					
					Approx. Area(Ha)	Exclude					
	Water Areas	Exclude	Soil Type	NFA/WCS	Value	Nil Value					
					Approx. Area(Ha)	Exclude					

Source: JICA Study Team





Source: NFA, UNOCHA and WCS analysed by the JICA Study Team

**Figure 9.3-6 Land Development Suitability Map**

## 9.4 SWOT Analyses

### 9.4.1 SWOT Analyses

Based upon the information regarding the current condition, issues referred to in Chapter 8 and potentials described in the above section, a SWOT analysis was carried out through analysing strengths, weakness, opportunities and threats in order to clarify the situation and to establish the future objectives.

#### Strengths

- Favourable climate
- Fertile and stable soil
- Sufficient man power
- Similarity with southern part of South Sudan (area of beyond the border)
- Closeness to two large national parks

#### Weaknesses

- Low cash income (high poverty rate)
- Subsistence agriculture
- Limited job opportunities
- Environmental degradation by cutting trees for making charcoal
- Low local government revenue

- Bad road condition especially in the rainy season
- Inefficient trading system
- High illiteracy rate
- Low social service delivery
- Narrow living sphere
- Poor human resources such as civil servants, teachers, medical service workers, technical workers and so on.

#### Opportunities

- Improvement of road to South Sudan
- Well paved road to Kampala
- High demand for agricultural products in South Sudan
- Betterment of trading environment by EAC
- Increasing tourists to the national parks
- Improvement of micro finance for farmers by commercial banks and donors
- Gulu is selected as one of the towns for industrial park development
- Stable growth of manufacturing industry in Uganda

#### Threats

- Increased poverty
- Enlarged regional disparity
- Continued low social service delivery and worsening illiteracy rate
- Shrinking demand for agricultural products due to development of South Sudan
- Overtaken in export of agricultural products by South Sudan
- Anticipation of soil erosion
- Rapid urban population growth seeking job opportunities and causing urban sprawl

### 9.4.2 Strategies for the Result of the SWOT Analysis

The strategies for the result of the SWOT Analysis are considered as shown in the following table.

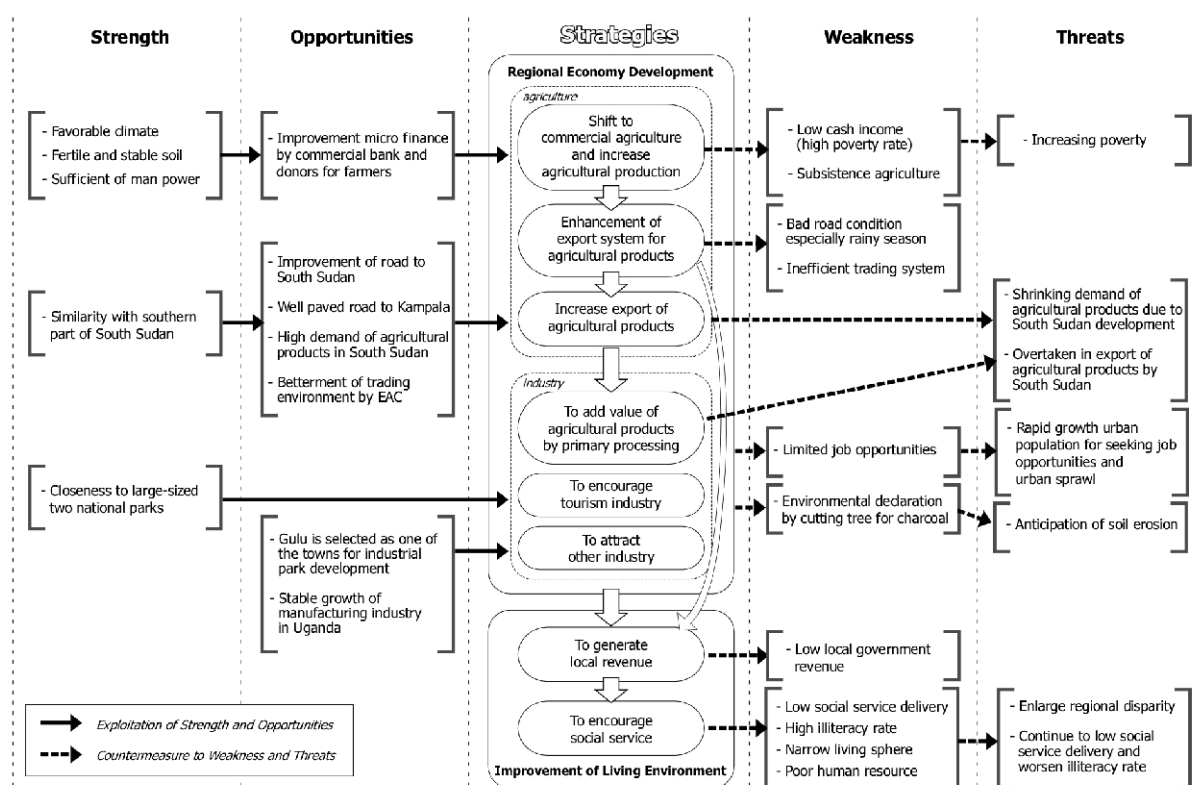
**Table 9.4-1 Results of SWOT Analysis and Strategies**

Strength	Strategies for Exploit
<ul style="list-style-type: none"> <li>• Favourable climate</li> <li>• Fertile and stable soil</li> <li>• Sufficient man power</li> </ul>	To shift from subsistence agriculture to commercial agriculture by exploiting the favourable conditions.
<ul style="list-style-type: none"> <li>• Similarity with southern part of South Sudan (area beyond the border)</li> </ul>	Demand for agricultural products is similar because of closeness of diet and living habit. To encourage the border markets and to generate local revenue
<ul style="list-style-type: none"> <li>• Closeness to large tourist destinations</li> </ul>	Murchison Fall National Park and Kidepo Valley National Park are relatively close to Acholi Sub-region. To encourage the tourism industries will generate local revenue and job opportunities

Weaknesses	Strategies for Control
<ul style="list-style-type: none"> <li>• Low cash income (high poverty rate)</li> <li>• Subsistence agriculture</li> </ul>	To shift from subsistence agriculture to commercial agriculture for improved livelihood
<ul style="list-style-type: none"> <li>• Limited job opportunities</li> <li>• Environmental degradation due to cutting trees for making charcoal</li> </ul>	To attract non-farm industries and to increase cash income instead of charcoal production
<ul style="list-style-type: none"> <li>• Low local government revenue</li> </ul>	To enhance the regional economy so as to generate local revenue
<ul style="list-style-type: none"> <li>• Bad road condition especially in the rainy season</li> <li>• Inefficient trading system</li> </ul>	To strengthen the system for trading of agricultural products based upon the road improvement and installation of required facilities
<ul style="list-style-type: none"> <li>• High illiteracy rate</li> <li>• Low social service delivery</li> <li>• Narrow living sphere</li> <li>• Poor human resources such as civil servants, teachers, medical service workers, technical workers and so on.</li> </ul>	To raise social services to the national level and to expand the coverage of service delivery in order to raise the literacy rate and develop the human resources.
Opportunities	Strategies for Exploit
<ul style="list-style-type: none"> <li>• Improvement of road to South Sudan</li> <li>• Well paved road to Kampala</li> <li>• High demand for agricultural products in South Sudan</li> <li>• Betterment of trading environment by EAC</li> </ul>	To encourage export of agricultural products to South Sudan and Kampala. Efficient trading system is also necessary.
<ul style="list-style-type: none"> <li>• Increasing tourists to the national parks</li> </ul>	To promote tourism development in Gulu and Kitgum, since the two towns are gateways to the national parks
<ul style="list-style-type: none"> <li>• Improvement of micro finance for farmers by commercial banks and donors</li> </ul>	Microfinance is one of the strategies for poverty alleviation in Uganda. There are many microfinance institutes such as the government, commercial banks, international donors and NGOs. To encourage farmers to exploit these finances agriculture mechanization.
<ul style="list-style-type: none"> <li>• Gulu is selected as one of the towns for industrial park development</li> <li>• Stable growth of manufacturing industry in Uganda</li> </ul>	To attract industries and private investors in Gulu to stimulate the industrial development. Gulu Municipality has included a certain space for industrial development in its future land use plan.
Threats	Strategies for Tackle
<ul style="list-style-type: none"> <li>• Increased poverty</li> </ul>	To encourage commercial agriculture and trading so as to gain livelihood for the farmers
<ul style="list-style-type: none"> <li>• Enlarged regional disparity</li> <li>• Continued low social service delivery and worsening illiteracy rate</li> </ul>	To raise social services to the national level and to improve the illiteracy rate.
<ul style="list-style-type: none"> <li>• Shrinking demand for agricultural products due to development of South Sudan</li> <li>• Overtaken in export of agricultural products by South Sudan</li> </ul>	To expand the agricultural production and to encourage value addition on the products in order to avoid duplication of South Sudan.
<ul style="list-style-type: none"> <li>• Anticipation of soil erosion</li> </ul>	To discourage cutting trees for charcoal production by means of providing job opportunities. To promote tree planting simultaneously
<ul style="list-style-type: none"> <li>• Rapid growth of the urban population seeking job opportunities causing urban sprawl</li> </ul>	To encourage commercial agriculture and to attract other industries for providing job opportunities in accordance with future population growth

Source: JICA Study Team

Figure 9.4-1 illustrates the relationship between results of the SWOT analysis and strategies.



Source: JICA Study Team

**Figure 9.4-1 Relation between the Result of the SWOT Analysis and Strategies**

## 9.5 Objective and Strategies of Regional Development

### 9.5.1 Objective

Taking account of the results of the SWOT Analysis, the overall objective is set targeted for the 2030 time horizon.

- Quality living standard through sustainable development in the regional economy and social services

This objective is based upon the visions of the district in the study area as well. The visions are shown in Table 9.5-1.

**Table 9.5-1 Vision of 5 Year Development Plan of each District**

District	Vision of 5 Year Development Plan
Gulu	A district with quality life, sustainable and holistic development
Kitgum	A prosperous and peaceful district with good communication links
Lamwo	A sustainably developed, prosperous and peaceful district
Pader	A Prosperous and self-sustaining local economy
Agago	A prosperous and peaceful people of Agago who are able to cope with global dynamics and can contribute towards national development

Source: 5 year district development plan Gulu, Kitgum, Lamwo, Pader and Agago

## 9.5.2 Goals and Strategies of Medium and Long Term Development

In order to achieve the overall objectives of regional development in Acholi Sub-region, a step by step approach will be effective. Hence the development goals of the medium term targeted for the 2018 time horizon and long term targeted for the 2030 time horizon are established as follows.

### 9.5.2.1 Goals of Medium Term Development (2018)

Three goals of medium term development are considered as follows.

- To increase production of commercial agriculture and to encourage inter and intra regional trade and commerce
- To promote small and medium scale industry
- To improve access to social services

#### (1) To increase productivity of commercial agriculture and to encourage inter and intra regional trade and commerce

Acholi Sub-region is endowed with the resources needed for agricultural development. However these resources have not been fully exploited yet. Encouraging the export of agricultural products could contribute to not only regional economic development but also enhancement of farmers' livelihoods. Therefore, it is necessary to increase agricultural production and to reinforce the trading system in Acholi Sub-region.

In order to increase agricultural production, a shift from subsistence agriculture to commercial agriculture is the first requirement. In parallel, to encourage mechanisation of the agricultural system is a key for achieving production. To be more precise, to advocate ox-plough farming by using microfinance is an effective method.

On the other hand, transport and function of trading centres are reinforced so as to improve the trading system. Smooth transportation links between farm lands and trading centres is fundamental. In particular, reliable transportation during the rainy season is vital for Acholi Sub-region, since the rainy season overlaps with the crop seasons of many products. A well maintained road network can contribute not only to enhance the trade but also to reduce the transportation cost and post harvest loss. It is also necessary to improve the trading centre in order to carry out appropriate trade. Establishment of warehouses at each trading centre will promote fair trade and reduce post harvest losses as well. Some simple equipment for milling and graining are also needed at major trading centres.

#### (2) To promote small and medium scale industry

In order to trade the agricultural products at appropriate price, value addition through agro-processing is promoted. There is a limited number of small and medium scale industries in the study area which collect agricultural products and processes them such as grinding grain, oil mill and cotton ginnery. Increasing the number of such industries is necessary for adding value. Implementation of basic infrastructure such as stable electricity and water supply help to attract industries and private investors. A reliable road network linking farm land and major centres is essential since the industries are likely to be located near the places where the water and electricity services exist.

#### (3) To improve accessibility to social services

As mentioned in the previous chapter, social services are still limited in Acholi Sub-region compared to the national average. At least, the number of schools, health centres and water points needs to be increased up to national level. Access to these services is another issue.

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Especially in remote area, the lack of accessibility to the services is likely to inconvenience patients and also discourage providers such as teachers, doctors and nurses. Improvement of accessibility is important.

Education is a vital role for human resources development and contributes to social and economic development. Health facilities are also important to provide safe living environments. At least, the improvement of the access to primary and secondary schools and HC-III are necessary to allow the people to participate in social and economic activities.

### **9.5.2.2 Goals of Long Term Development (2030)**

Three goals of long term development are considered as follows.

- To encourage adding value to agricultural products and to expand trade volume
- To diversify industries
- To enlarge the living sphere so as to access high level social services

#### **(1) To encourage adding value to agricultural products and to expand trade volume**

Further agricultural development and trade expansion are expected to strengthen competitiveness of the regional economy. By 2030, the agricultural situation in South Sudan is expected to be improved as well. In response to the change and expected dynamics of demand for agricultural products, the agricultural system in Acholi Sub-region needs to be upgraded to facilitate value addition.

In order to expand trade volume, agricultural production must be increased. To full mechanization is therefore needed such as using ox-ploughs, tractors, fertilizers and improved seed. Furthermore, installing small scale irrigation systems is also effective to increase productivity in order to enable farming in the dry season.

In parallel with the increase of agricultural production, the trading system also needs to be upgraded. Notably, the roads must be improved for truck transportation. Additionally, establishment of farmers associations by each community or village is favourable to trade the products at appropriate price. For establishing the farmers associations, information distribution and vocational advisers need to be provided by the local government.

#### **(2) To diversify industries**

As mentioned above, attracting agro-industry is needed to add value to agricultural products. Primary processing of agricultural products is appropriate to the study area. Influx of industries contributes not only to reducing post harvest loss but also providing job opportunities. Farming and non-farming employment are effective to increase farmers' income and reduce the poverty level. In order to attract agro-industries, reliable roads connected with major cities are vital for transportation. Additionally, a stable water supply and electricity are required for operation of these factories.

In addition that, diversifying industries in Acholi Sub-region is also necessary to drive healthy economic development and remarkably enhance commercial industries. Agriculture will always be the backbone of the regional economy in Acholi Sub-region considering the future population and land available for cultivation. However in terms of urban population, Gulu and Kitgum are estimated to accommodate 250,000 and 120,000 in 2030. Corresponding to such urban population, creation of job opportunities is one of the issues for economic development. Commercial industry has a high potential for job creation for the urban population such as tourism businesses, retail, wholesale, banking, and restaurants. These businesses also require basic infrastructure as well.

**(3) To enlarge the living sphere so as to access high level social services**

To enlarge the living sphere is considered to be important for people in Acholi Sub-region. The high level social services such as general hospitals, universities and vocational schools tends to develop in populated areas since these facilities need stable electric power and water supply. In Acholi Sub-region however, population is scattered and many people live in rural areas for engaging in agricultural activities. Not only urban dwellers but also rural people need to access such higher social service equally. To encourage people to have high level education and vocational training contributes to the human resources development, which benefits the regional economy and society. In addition, providing higher medical care ensures the people's health.

In order to encourage people's mobilization, roads take a vital role. The road network must be established with an effective shape. Major roads should link to large-sized service centres and its condition should be at a tolerable level for high speed driving. The other roads need to connect such high standard roads.

## **9.6 Proposed Spatial Structure**

Looking at a future spatial structure in Acholi Sub-region for achieving the objective of regional development, it is formed in two steps.

First, the spatial structure will be considered based upon how to connect with areas outside Acholi Sub-region, such as linkage with Kampala and South Sudan. To enhance trading business with areas outside the sub-region is one of the strategies for economic development. An effective network and appropriate arrangement of regional gateways are vital to support the regional development.

Second, corresponding to the broad structure, a regional spatial structure will be considered. The structure needs to include an efficient road network and distribution of major service centres such as administrative centres and trading centres with consideration for improvement of accessibility to social services and transportation of agricultural products.

### **9.6.1 Alternatives of the Spatial Structure**

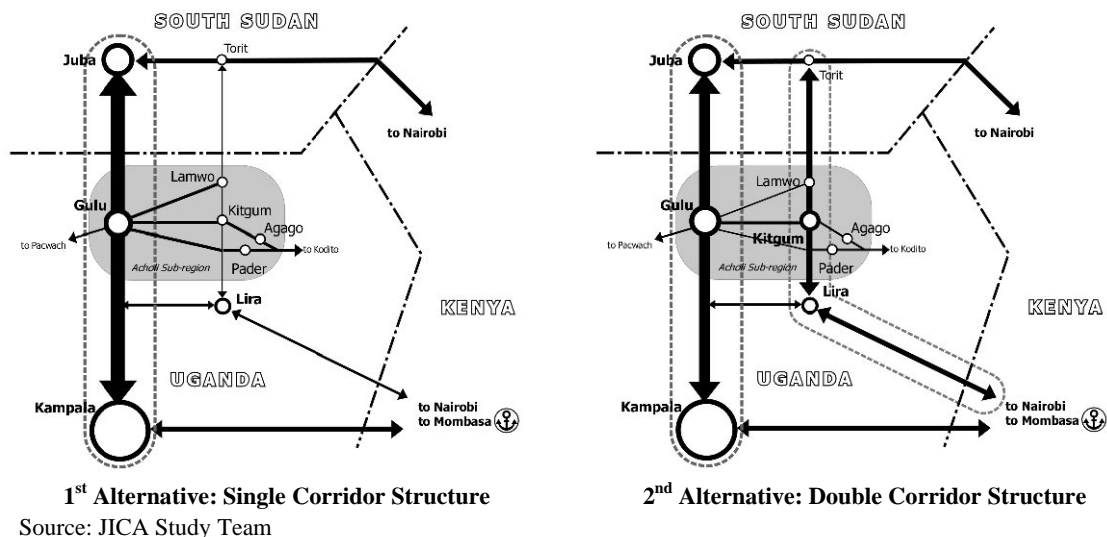
To take account of future spatial structure for connection with areas outside Acholi Sub-region, two alternatives are considered. One is a single corridor structure the other is a double corridor structure. The following sections describe these alternatives and compare them from a perspective of trade, economy, agriculture and public intervention.

#### **9.6.1.1 Alternatives**

The 1<sup>st</sup> alternative, a single corridor structure, focuses upon one route to areas outside the sub-region, given the road from Kampala to Juba via Gulu is supposed to be implemented soon. In this pattern, Gulu takes the role of regional gateway.

The 2<sup>nd</sup> alternative, a double corridor structure, focuses upon not only the road between Kampala and Juba, but also another route connecting with South Sudan and Acholi Sub-region. Beyond the border with South Sudan, there are plans to implement feeder roads linked with the border and the road to Juba. Anticipating the road development plans in South Sudan, a road linked between South Sudan and Kenya, via Kitgum and Lira is considered as an additional corridor for supporting the main corridor from Kampala to Juba.

Figure 9.6-1 illustrates a schematic image of the single corridor structure.



**Figure 9.6-1 Schematic Image of Spatial Structure Alternatives**

In this pattern, two towns, Gulu and Kitgum, become gateways of the sub-region. By 2018, Gulu is expected to be the dominant centre of Acholi Sub-region. Corresponding to progress of road implementation in South Sudan, Kitgum becomes an important secondary centre.

### 9.6.1.2 Comparison

Spatial structure influences the process of regional development. Table 9.6-1 shows positive and negative impacts of each alternative for making a comparison between the two patterns.

**Table 9.6-1 Comparison between Single and Double Corridor Development**

Perspective	Single Corridor	Double Corridor
Economy	Economic Activities tend to concentrate in Gulu and surrounding area. It may cause regional disparities within Acholi Sub-region. => <b>[Negative impact]</b>	Economic activities will be divided between Gulu and Kitgum. Balanced development is expected. Increase of Job opportunities and income generation are assumed. => <b>[Positive impact]</b>
Traffic	Concentrated on the road linked between Kampala and Juba. Traffic congestion may occur on this road. Under emergency situation, there is no security without alternative road. => <b>[Negative impact]</b>	Providing two routes may contribute to reduce traffic congestion. Under emergency situation on one road, the other road becomes an alternative route and secures continuation of economic activities and people's mobilization. => <b>[Positive impact]</b>
Service	Social services are likely to accumulate in Gulu. Accessibility from eastern areas becomes difficult. It may increase regional disparities. => <b>[Negative impact]</b>	Social services are likely to accumulate in Gulu and Kitgum. Accessibility to service centres is similar for all living in the sub-region. The services will be delivered equally. => <b>[Positive impact]</b>
Trade	Transportation cost of agricultural products in eastern areas becomes higher than in other areas. Agricultural development may be delayed in remote areas. => <b>[Negative impact]</b>	Transportation cost of agricultural products becomes similar across the sub-region. Balanced agricultural development is expected. => <b>[Positive impact]</b>
Public Intervention	Only development of Gulu is needed since the road linking between Kitgum and Juba has been implemented. => <b>[Positive impact]</b>	It is necessary to develop two centres and the road from border to Lira => <b>[Negative impact]</b>
Total Evaluation	Negative	Positive

Source: JICA Study Team



As a result of the comparison above, the double corridor structure is deemed to be appropriate for regional development in Acholi Sub-region.

## **9.6.2 Development Scenario**

The development scenario of the study area is proposed in this section on the basis of the development strategies and the spatial structure. The development scenario is proposed in a broader context at first and then narrows down to the study area.

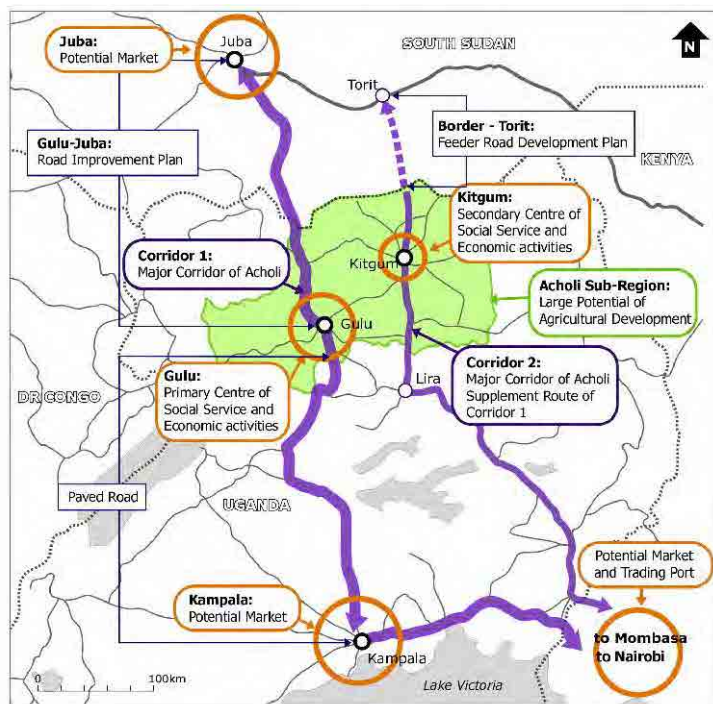
### **9.6.2.1 Broad Context**

Two main corridors connected to other regions are pillars of the spatial structure in Acholi Sub-region. To take advantage of the potentials in Acholi Sub-region, these corridors contribute to enhance the trading and commerce of agricultural products.

The road linked between Kampala and Juba via Gulu (hereafter called Corridor 1) is a predominant route which stimulates economic activities. This road connects to large potential markets, namely Kampala and Juba, in terms of demand for agricultural products. After the completion of the road improvement project from Gulu to Juba by several donors such as JICA, USAID and World Bank, this road will provide stable passage of vehicles and people all year round. In addition liberalization of cross border trade by EAC is expected to contribute to improve the trade with South Sudan. Under such condition, trading and commerce using Corridor 1 has large potential for Acholi Sub-region. Gulu is located in the middle of Corridor 1 and will be the gateway for Acholi Sub-region. Gulu needs to become a large centre of economic activities such as trading, tourism and other service industries.

On the other hand, the road linked between Lira and Torito via Kitgum (hereafter called Corridor 2) is a secondary pillar of the spatial structure. The section between Lira and the South Sudan Border has already taken the role of main corridor for the eastern side of Acholi Sub-region namely Kitgum, Lamwo, Agago and Pader districts. The rest of the section is dependant upon the policy of the South Sudan government. However, there are some implementation plans for feeder road improvement. In any case, the road is expected to come from Torito up to the border and form Corridor 2. This corridor has a large potential for enhancement of trading and commerce and becomes a supplemental route of Corridor 1 and leads to balanced development in Acholi Sub-region. Furthermore, this road would be a security road in case of emergency on Corridor 1. Kitgum is located in the middle of Corridor 2. This town is expected to be a secondary centre of Acholi Sub-region which accommodates functions for economic activities similar to Gulu.

These two corridors and two towns, Gulu and Kitgum, complement each other in terms of function and service delivery. Improvement of the roads and towns will contribute not only to stimulating trading and commerce but also to attracting other industries to Acholi Sub-region. Figure 9.6-2 illustrates the relationship between the spatial structure and the scenario for regional development.

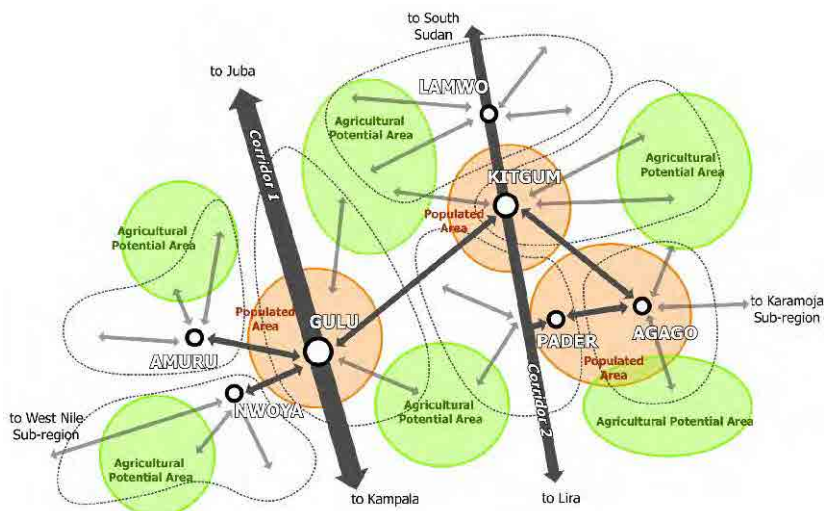


Source: JICA Study Team

**Figure 9.6-2 Spatial Structure and Development Scenario in Broad Context**

### 9.6.2.2 Detailed Context

Looking inside the Acholi Sub-region, these two main corridors will be backbones of the spatial structure. In order to form an efficient structure for the economic and social activities, the network needs to consolidate into the corridors. The linkages between district centres are also important since districts play a central role in regional development. The structure, therefore, must connect not only the corridors but also district centres. Furthermore, agriculture is the key industry for regional development as mentioned above. Agricultural potential areas and major trading centres are considered in the spatial structure so as to encourage trade in agricultural products. On the other hand, the living environment needs to be upgraded by an appropriate spatial structure. Therefore, populated areas are preferred to be covered by the network. Figure 9.6-3 illustrates a rough idea of the proposed regional spatial structure in Acholi Sub-region.



Source: JICA Study Team

**Figure 9.6-3 Rough Idea of Proposed Spatial Structure**

### 9.6.3 Proposed Regional Spatial Structure

Responding to the development scenario, a regional spatial structure will be proposed with tangible data and information in this section.

#### 9.6.3.1 Approach

The regional spatial structure needs to reflect the development scenario explained above. In order to formulate an appropriate regional spatial structure, necessary network and nodes must be selected. Spatial structure is considered for the following factors.

##### Node (service centre)

- Population distribution
- Location of high level social services: universities, tertiary schools, and hospitals
- Location of administrative centres
- Location of economic activities
- Location of trading centres
- Land development suitability

##### Network

- Population distribution
- Location of Social services: schools, health facilities, and water
- Area of high Agricultural productivity
- Agricultural land and land that could be used for agriculture

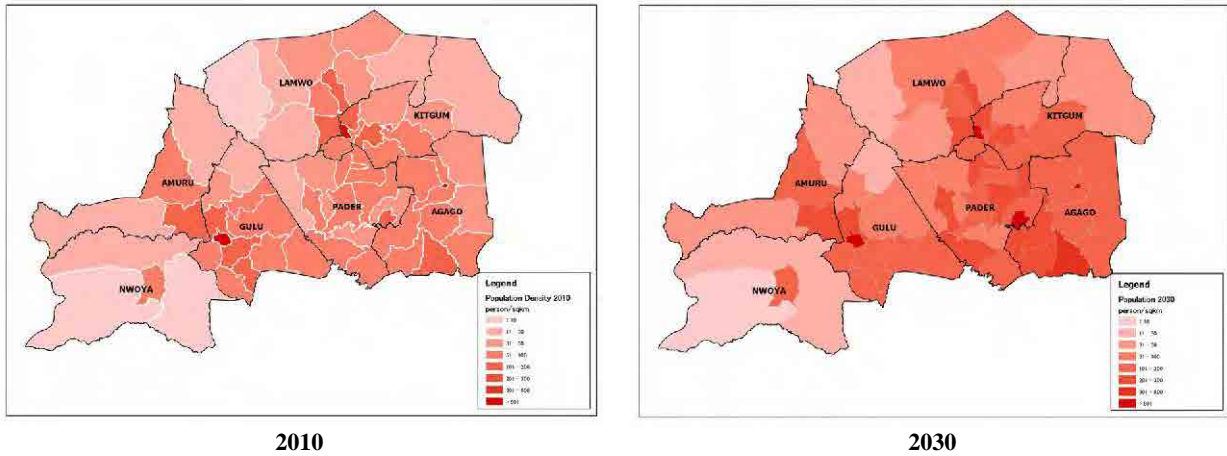
#### 9.6.3.2 Service Centres

In order to promote future regional development in Acholi Sub-region, major centres, which are expected to deliver services and functions such as administration, trading, social services, and economic activities, need to be strategically developed. Accumulation of these functions could facilitate installation of basic infrastructure such as water supply, sewage systems and electric power supply.

Gulu and Kitgum are major gateways to areas outside the sub-region. Some other towns are selected based upon the data of population, social services, administrative functions, trading and economic activities.

##### (1) Population

Based upon the estimation of the study team, population will increase at a 4% annual growth rate. Pader and Agago districts are expected to have a high population growth rate. Looking at the sub-counties, Gulu, Kitgum, Pader, Kitgum Matidi, Kalongo and Patongo are expected to accommodate higher populations in 2030. Figure 9.6-4 illustrates population density in 2010 and 2030, the darker colour indicates higher density areas.

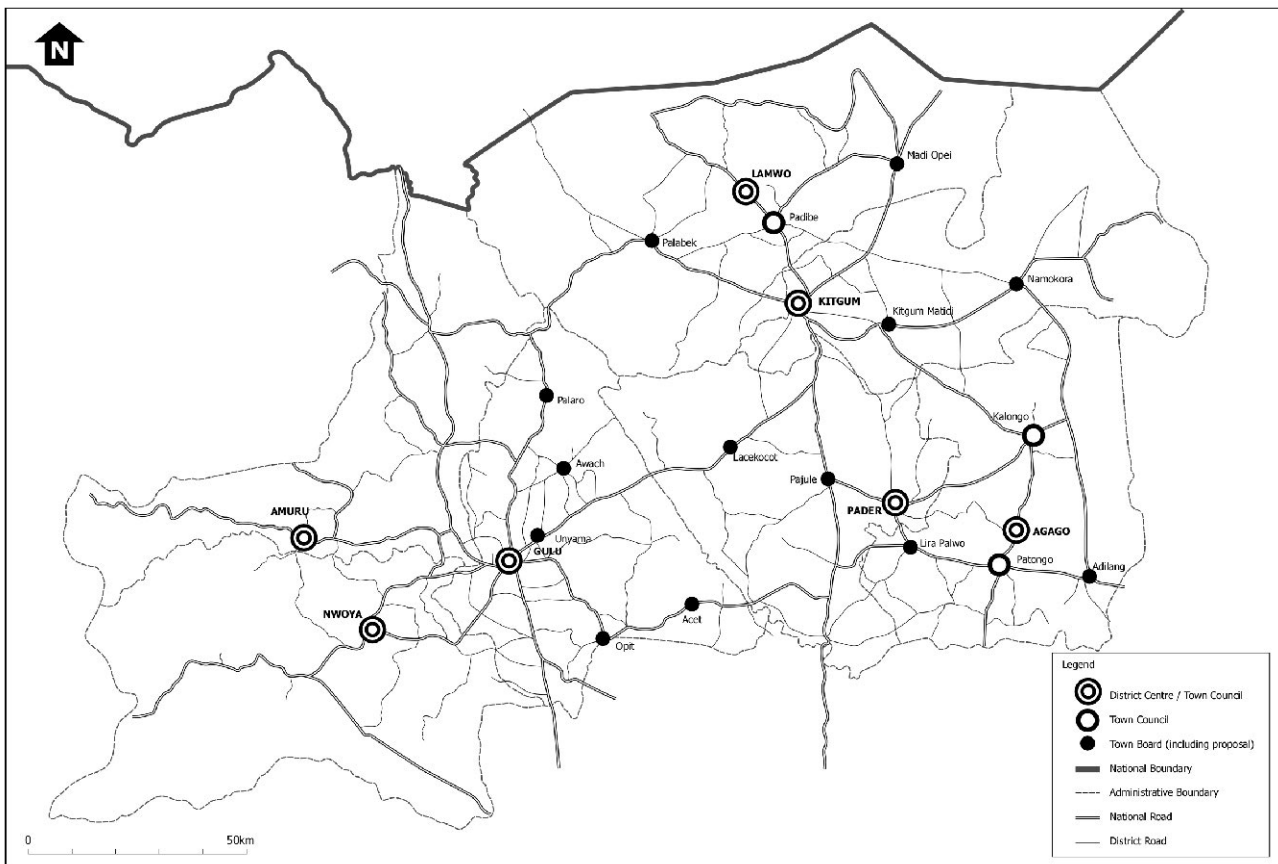


Source: UBOS compiled by the JICA Study Team

**Figure 9.6-4 Population Density in 2010 and 2030**

**(2) Administrative Centres**

Looking at administrative centres, district centres, town councils and town boards are distributed in the study area shown as Figure 9.6-5<sup>2</sup>. Under decentralization, local government needs to involve communities and local residents, this means that access to the administrative centres will become important.



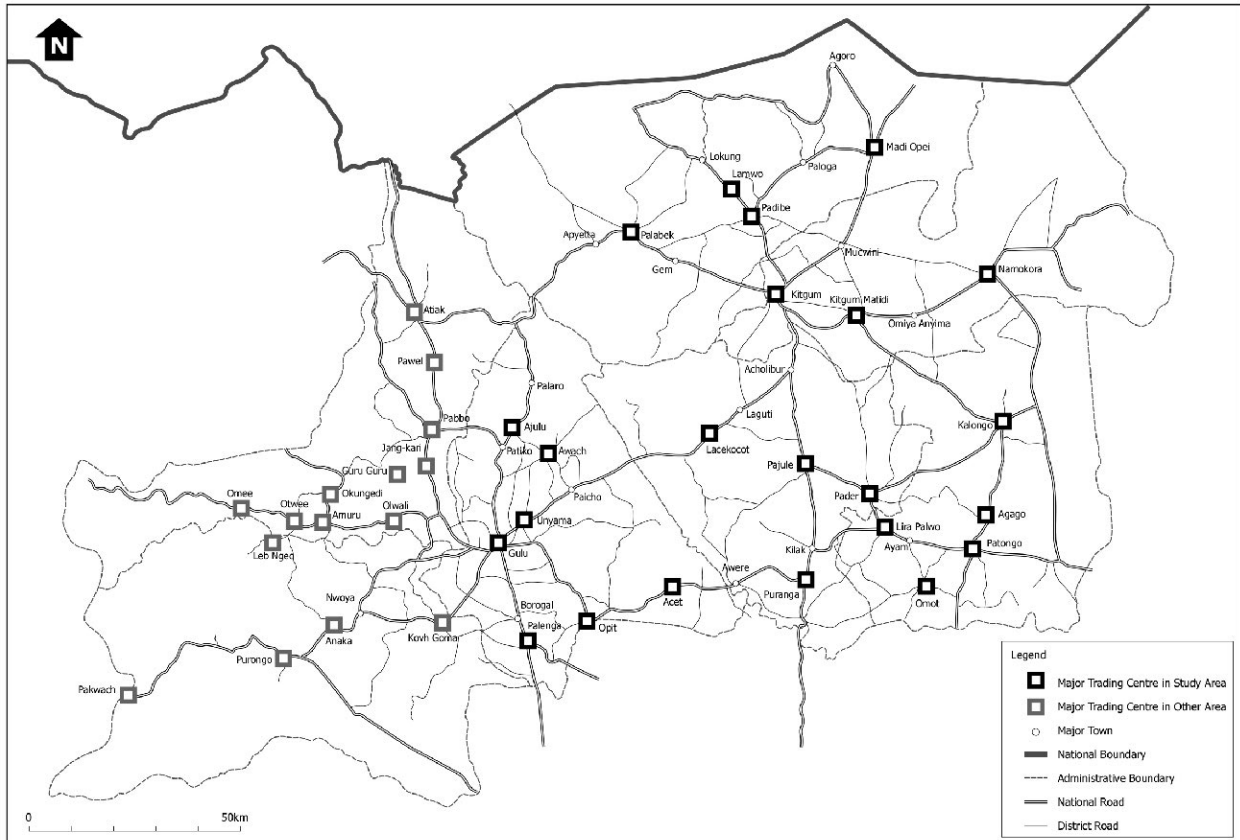
Source JICA Study Team

**Figure 9.6-5 Administrative Centres in Acholi Sub-region**

<sup>2</sup> Town boards of Gulu district are as proposed as of September, 2011

### (3) Trading Centres

Figure 9.6-6 illustrates the locations of major trading centres in Acholi Sub-region. These trading centres tend to gather in high productivity areas and along the national roads. Basically, trading centres host simple processes for agricultural products such as drying, milling, and threshing. For future development of trading, these major trading centres are important.

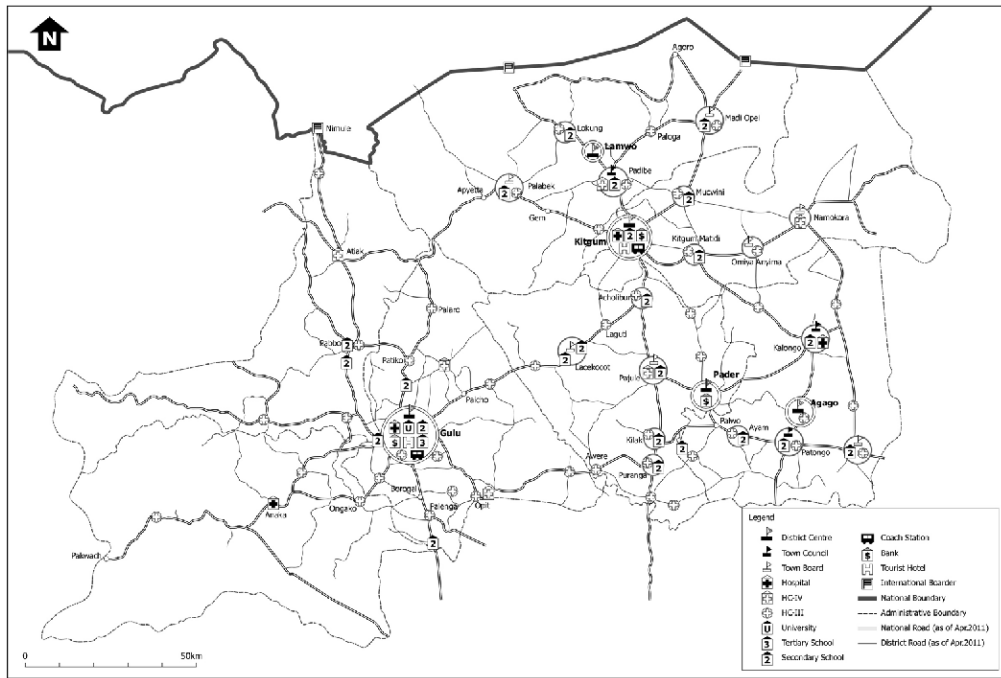


Source: JICA Study Team

**Figure 9.6-6 Major Trading Centres**

### (4) Existing Service Centres

A service centre is defined in the study as a place that has the function of providing a variety of social services and is a centre of economic activities. Gulu Town is the largest service centre in Acholi Sub-region and it accommodates higher education facilities including Gulu University and tertiary schools, a general hospital, sizable markets, tourist hotels, commercial banks and coach stations. Kitgum Town is the second largest and it accommodates a hospital, markets, tourist hotels, commercial banks and coach stations. It is necessary use the current service centres to the greatest advantage in order to further regional development. Major service centres and their function in the study area are illustrated in the following figure.

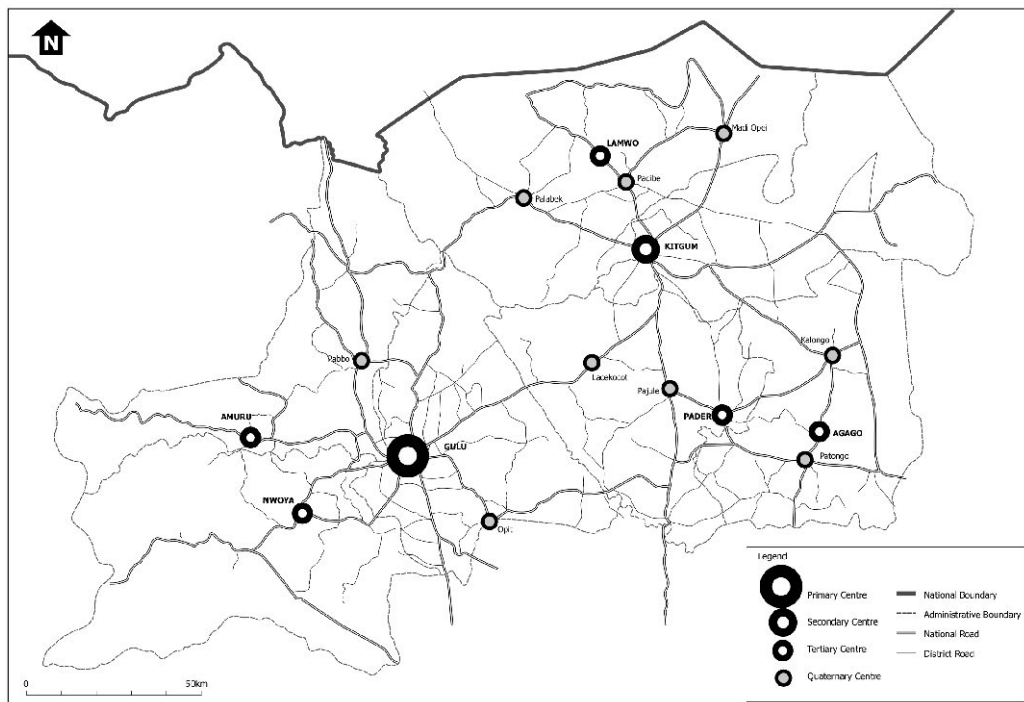


Source: JICA Study Team

**Figure 9.6-7 Major Service Centres in the Study Area**

**(5) Proposed Future Service Centres**

From the perspective of the functions and population coverage described above, future urban centres in the study area are selected in order to strategically develop them by 2030 and a hierarchy has been established as shown in Figure 9.6-8.



Source: JICA Study Team

**Figure 9.6-8 Proposed Service Centres for Strategic Development**

Each function and expected impacts are described in Table 9.6-2.

**Table 9.6-2 Major Function of Proposed Service Centres**

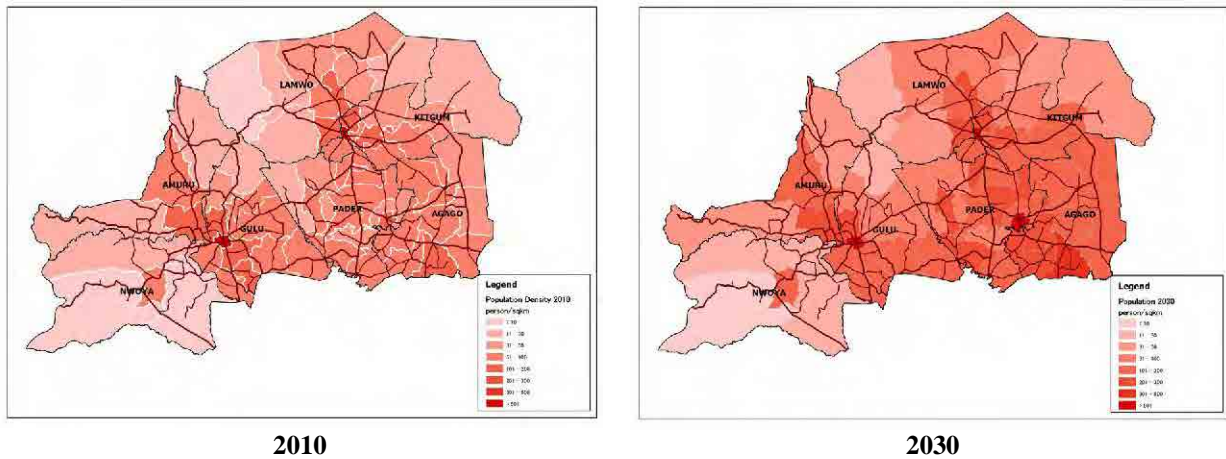
Hierarchy	Name of Town	Major Function
Primary	Gulu	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• Gateway of Acholi Sub-region</li> <li>• District Centre</li> <li>• To take a role of sizable trading centre</li> <li>• To provide high level social services including university, tertiary school and general hospital</li> <li>• To attract industries and agro industries</li> <li>• To encourage tourism development</li> <li>• To distribute information</li> <li>• To provide public transportation hub / coach station</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To promote smooth trade</li> <li>• To provide social services including high level services</li> <li>• To create job opportunities</li> <li>• To enhance mobilization</li> </ul>
Secondary	Kitgum	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• Gateway of Acholi Sub-region</li> <li>• District Centre</li> <li>• To take a role of sizable trading centre</li> <li>• To provide social services including tertiary school and general hospital</li> <li>• To attract agro industries</li> <li>• To encourage tourism development</li> <li>• To distribute information</li> <li>• To provide public transportation hub / coach station</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To promote smooth trade</li> <li>• To provide social services including high level services</li> <li>• To create job opportunities</li> <li>• To enhance people's mobilization</li> </ul>
Tertiary	Lamwo, Pader, and Agago,	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• District Centre</li> <li>• To take a role of large-size trading centre</li> <li>• To provide social services including hospital</li> <li>• To attract small and medium size agro industries</li> <li>• To distribute information</li> <li>• To provide public transportation hub / coach station</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To promote smooth trade</li> <li>• To provide social services</li> <li>• To enhance people's mobilization</li> </ul>
Quaternary	Opit, Palabek, Padibe, Madi Opei, Lagekocot, Pajule, Kalongo and Patongo	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• Administrative Centre (Town council / Town board)</li> <li>• To take a role of trading centre</li> <li>• To provide social services</li> <li>• To add value to agricultural products by means of simple processing</li> <li>• To distribute information</li> <li>• To provide a public transportation hub</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To promote smooth trade</li> <li>• To provide social services</li> <li>• To enhance people's mobilization</li> </ul>

Source: JICA Study Team

### 9.6.3.3 Network

The road network should connect with the service centres selected in the above section and run through large populations, agricultural land, and high productivity areas. The roads which accommodate many schools, health facilities and water points are selected as high priority. Hence, the following data is taken into account in formulating the preferable road network.

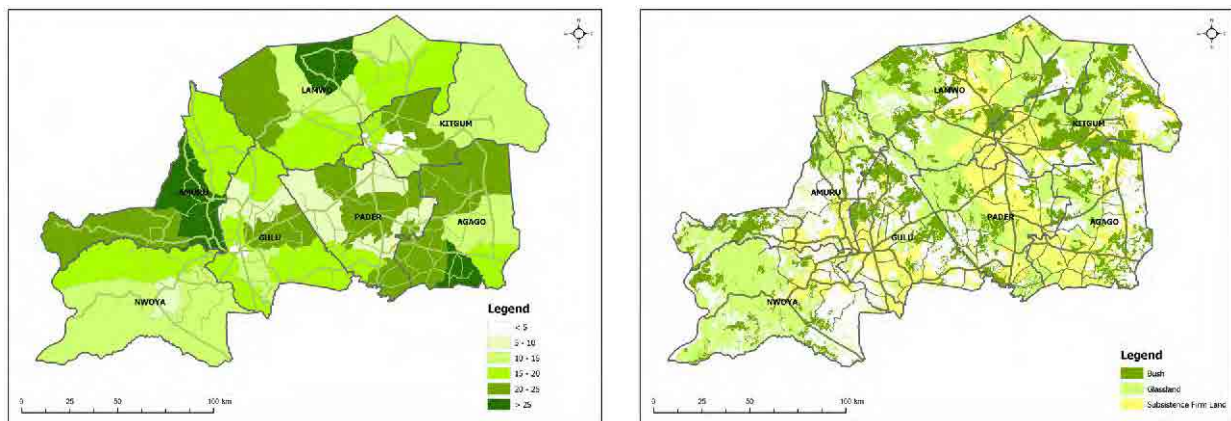
In terms of population, the routes in the areas coloured with darker red are considered as more important such as the route between Kitgum and Lira, Corner Kilak and Adilang, and Gulu and Rackoko.



Source: UBOS compiled by JICA Study Team

**Figure 9.6-9 Population Density with Road Network in 2010 and 2030**

In terms of agriculture, the productivity, farm land and expected farm land are taken into account in the route selection. Some routes run through high productivity areas and land with the potential of for development as agricultural land such as the routes between Atiak and Kitgum, and Ngomoromo.



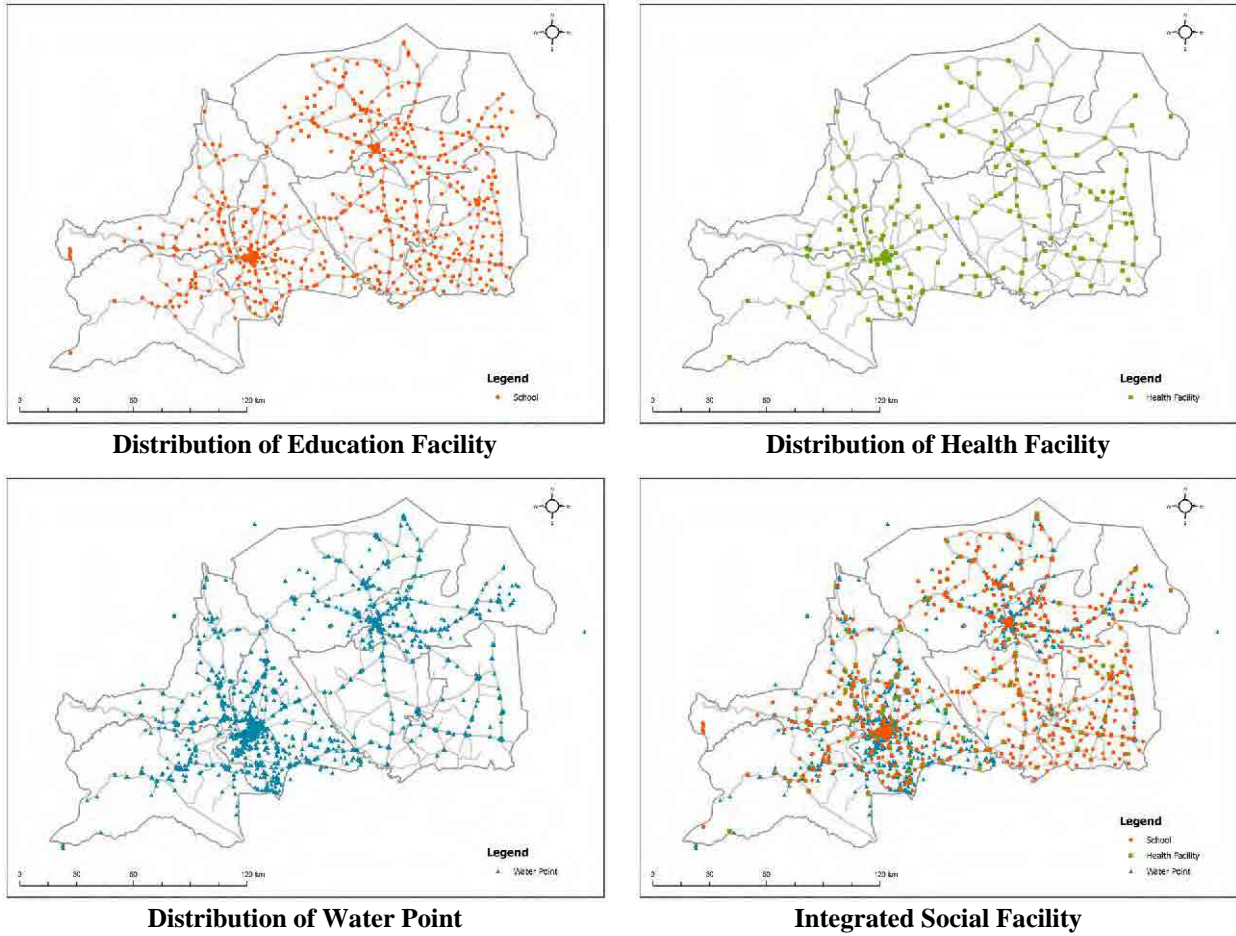
**Productivity Area (2008) with Road Network**  
Source: UBOS and NFA compiled by JICA Study Team

**Agricultural Area (2005) with Road Network**

**Figure 9.6-10 Agricultural Area with Road Network**

In terms of social services, the routes which have many facilities are prioritized such as the route between Gulu and Kitgum, and Patongo and Kitgum.

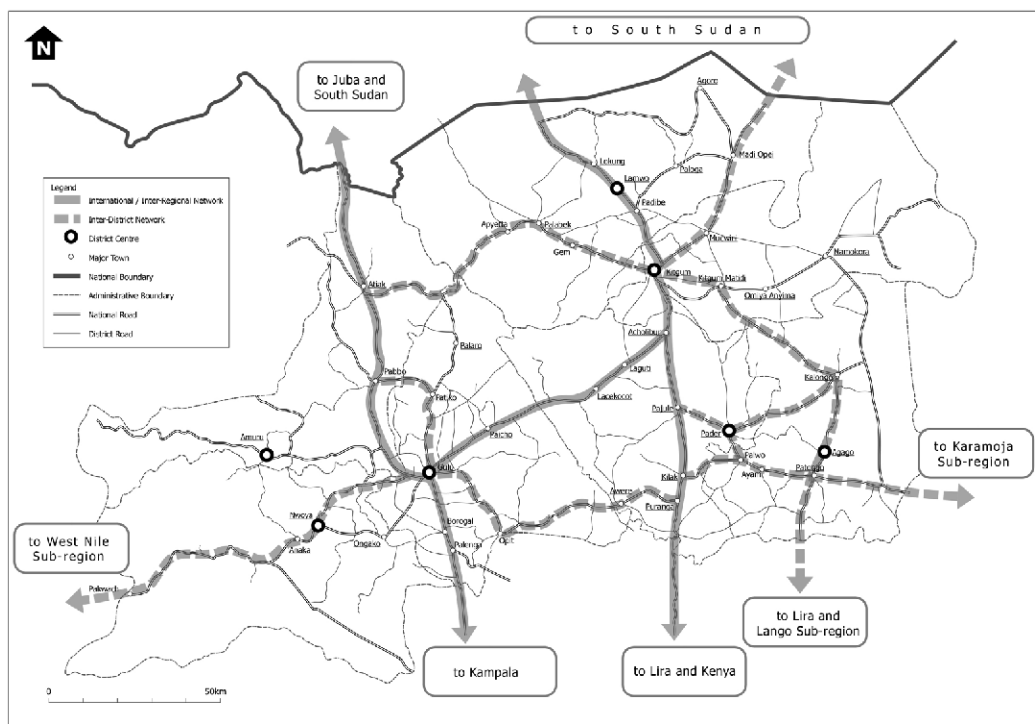




Source: UNOCHA compiled by JICA Study Team

**Figure 9.6-11 Distribution of Schools, Health Facilities and Water Points**

Based upon the data above and the location of service centres and linkage to other regions, the following network was selected as shown in Figure 9.6-12. The network is mainly categorised into two categories based on function: 1) international and inter-regional network, and 2) inter-district network.



Source: JICA Study Team

**Figure 9.6-12 Preferable Network for Regional Development**

Functions and expected impact of each route are indicated in Table 9.6-3.

**Table 9.6-3 Major Functions of Proposed Road Network**

Network	Route	Major Function and Expected Impact
International/ Inter-Regional	1. Kampala - Nimule (South Sudan Border) via Gulu	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>To ensure safe passage through the whole year</li> <li>Part of international corridor</li> <li>To access Primary Centres (Gulu)</li> <li>To access South Sudan and Kampala</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>To promote smooth trade with South Sudan and Kampala</li> <li>To enhance export of agricultural products</li> <li>To reduce transportation cost for trading</li> <li>To encourage people's mobilisation</li> <li>To attract agro-industry and tourism industry</li> </ul>
	2. Lira – Ngomoromo (South Sudan Border ) via Kitgum and Lamwo	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>To ensure safe passage through the whole year</li> <li>To access Secondary Centres, Kitgum</li> <li>To access other regions including South Sudan and Lira</li> <li>Supportive corridor for the Kampala – Juba road</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>To promote smooth trade</li> <li>To enhance export of agricultural products</li> <li>To reduce transportation cost for trading</li> <li>To encourage people's mobilisation</li> <li>To attract agro-industry and tourism industry</li> </ul>
	3. Gulu - Kitgum	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>To ensure safe passage through the whole year</li> <li>Linkage between Primary and Secondary Centres</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>To promote smooth trade</li> <li>To enhance export of agricultural products</li> <li>To encourage people's mobilisation</li> </ul>

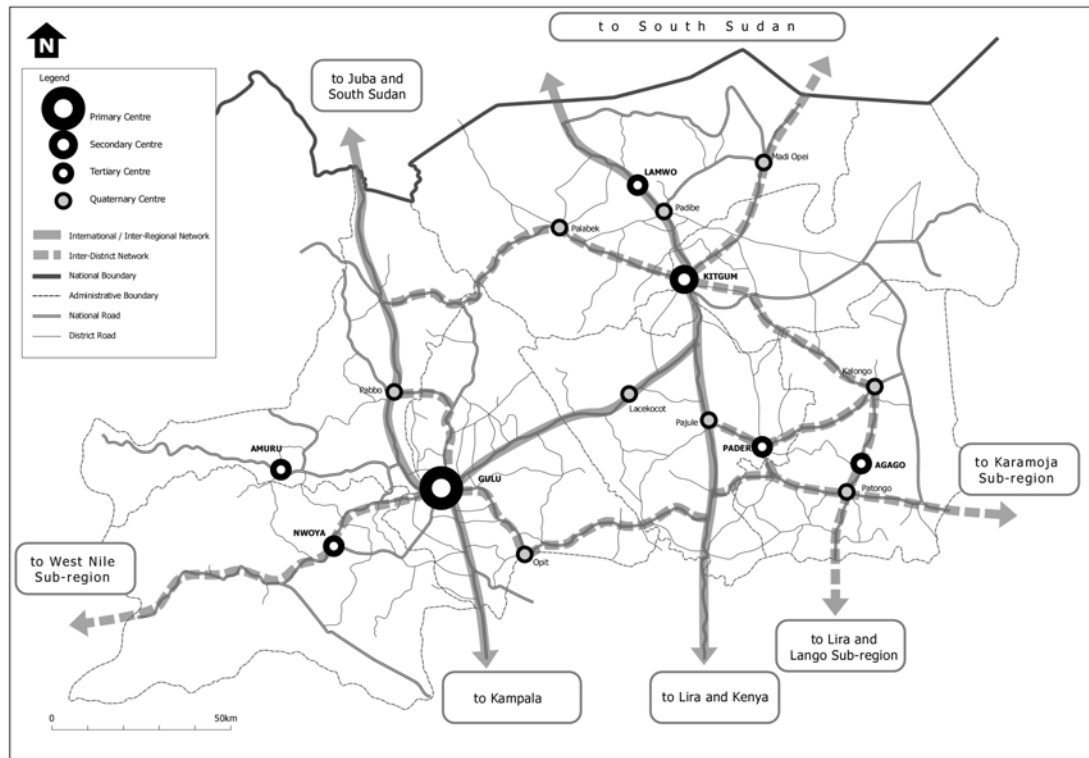
Network	Route	Major Function and Expected Impact
Inter-District	1. Kitgum – South Sudan Border via Madi Opei	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage between secondary and other centres through to border point with South Sudan</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to services, trading centres and border markets</li> <li>• To promote smooth trade</li> <li>• To encourage trade with South Sudan</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>
	2. Atiak – Kitgum via Palabek	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year, in particular in the steep slope area between Atiak and Palabek</li> <li>• Linkage between secondary and other centres</li> <li>• To connect between service centres and International/ Inter Regional roads</li> <li>• To access trading centres and high productivity areas</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To promote smooth trade</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>
	3. Gulu – Puranga via Opit	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage between primary and other centres</li> <li>• To connect between service centres and International/ Inter Regional roads</li> <li>• To access trading centres and high productivity areas</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To support trade with Karamoja Sub-region</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>
	4. Coner Kilak – Karamoja Sub-region Border via Patongo	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• To connect between service centres and International/ Inter Regional roads</li> <li>• To access Karamoja Sub-region,</li> <li>• To access trading centres and high productivity areas</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To encourage trade with Karamoja Sub-region</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>
	5. Lira Palwo – Pajule via Pader	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage between secondary and other centres</li> <li>• To connect between service centres and International/ Inter Regional roads</li> <li>• To access trading centres</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To promote smooth trade</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>

Network	Route	Major Function and Expected Impact
	6. Gulu – Pabbo via Patiko	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage between primary and other centres</li> <li>• Supportive route for part of the Kampala – Juba road</li> <li>• To connect between service centres and International/ Inter Regional roads</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To promote smooth trade</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>
	7. Kitgum – Lango Sub-region Border via Patongo Kalongo and Agago	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage among secondary, and other centres</li> <li>• To access Lango Sub-region</li> <li>• To access trading centres and high productivity areas</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To encourage trade with Lango Sub-region</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience the living environment</li> </ul>
	8. Gulu – Pakwach via Nwoya and Anaka	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage between primary and other centres</li> <li>• To connect between service centres and International/ Inter Regional roads</li> <li>• To access the West Nile Sub-region</li> <li>• To access trading centres</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To promote smooth trade</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>
	9. Pader - Kalongo	<p><u>Functions:</u></p> <ul style="list-style-type: none"> <li>• To ensure safe passage through the whole year</li> <li>• Linkage between smaller centres</li> <li>• To access to trading centres and high productivity areas</li> </ul> <p><u>Expected Impacts:</u></p> <ul style="list-style-type: none"> <li>• To improve accessibility to service and trading centres</li> <li>• To reduce transportation cost of agricultural products</li> <li>• To improve accessibility to social services</li> <li>• To enhance the convenience of the living environment</li> </ul>

Source: JICA Study Team

### 9.6.3.4 Proposed Spatial Structure

In consideration of the service centres and preferable network of Acholi Sub-region, the following spatial structure is proposed.



Source: JICA Study Team

**Figure 9.6-13 Proposed Future Spatial Structure**

### 9.6.4 Proposed Development Plan of Major Service Centres

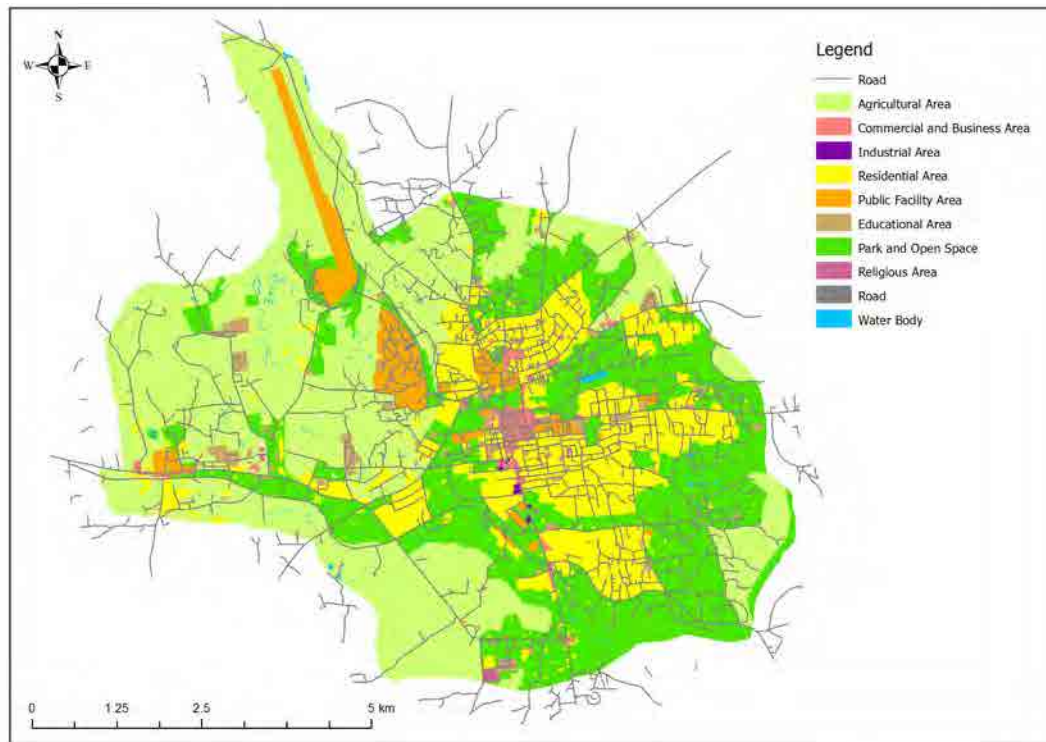
As mentioned in the above section, Gulu and Kitgum have important roles in regional development in Acholi sub-region for providing social and economic services. To do so, these towns need to attain healthy urban growth. Urbanization is expected to take place by 2030 in Acholi sub-region and likewise in other areas in Uganda and the East African countries. Urban sprawl is likely to occur without any appropriate development plan such as an urban master plan or land use plan. Urban sprawl contributes to a delay of infrastructure development degradation of the living environment. Furthermore, these major centres need to tackle the expected challenges such as increasing poverty and unemployment, and security matters in connection with urbanization.

Gulu Municipality has a future land use plan without a target year as explained in a previous section (see Figure 9.3-5). Meanwhile Kitgum has not prepared an urban plan so far. In this section, the preliminary plan for future land use for these towns is proposed. In particular, to prepare the land for industrial development is strongly proposed. Industry is important not only to increase job opportunities but also to shift from an informal economy to a formal economy.

#### 9.6.4.1 Gulu

Gulu municipality consists of four wards namely Bar-dege, Laroo, Layibi and Pece which accommodated a population of 150,000 in 2010. The eastern side of the town has developed as residences and green areas, while the western side, which is at a slightly lower attitude

compared to the eastern side, is being exploited as agricultural fields. In the middle of town there is a small river which divides the town into two areas. Government offices and the university are located on the north side of the river. Commercial activities and high density residences are mainly located in the centre of the town.



Source: Gulu Municipality compiled by JICA Study Team

**Figure 9.6-14 Existing Land Use in Gulu Municipality**

**Table 9.6-4 Area by Land Use Category in Gulu Municipality**

Category	Area (m <sup>2</sup> )	%
Agricultural Area	23,991,684	43.5%
Industrial Area	32,107	0.1%
Commercial and Business Area	687,889	1.2%
Residential Area	9,395,382	17.0%
Public Facility Area	2,323,911	4.2%
Educational Area	1,030,892	1.9%
Park and Open Space	16,061,217	29.1%
Religious Area	96,399	0.2%
Road	1,244,215	2.3%
Water body	238,111	0.4%
Other	6,323	0.0%
Total	55,108,129	100.0%

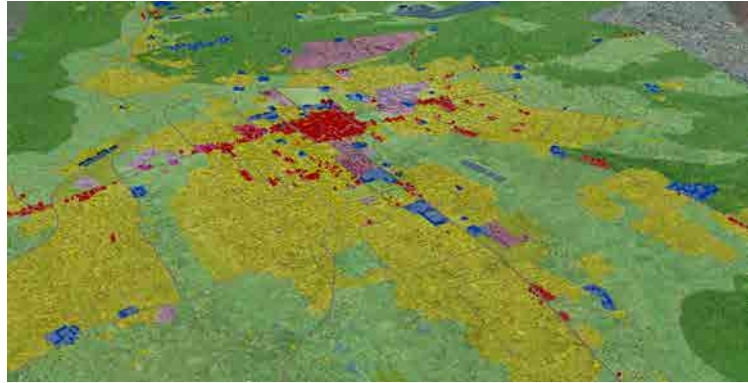
Source: Gulu Municipality compiled by JICA Study Team

The central area has a large-size market<sup>3</sup>, retail shops, restaurants, small size accommodations and commercial banks. Commercial activities are enlivened because of the opening of a foreign financed supermarket and renovation of the market complex that will accommodate

<sup>3</sup> The market is under reconstruction as of February 2012

hundreds of vendors. Many people are expected to come to Gulu to enjoy shopping from not only the surrounding areas but also South Sudan.

Heavy freight vehicles such as trucks and trailers from/to Kampala and Juba pass through the middle of town due to lack of a bypass road. Additionally, many coaches drive through the town because a coach station is also located in the town centre. Accordingly the flow of pedestrians and vehicle transportation tends to mix.



Source: JICA Study Team

**Figure 9.6-15 3D Image of Gulu Municipality based upon Existing Land Use**

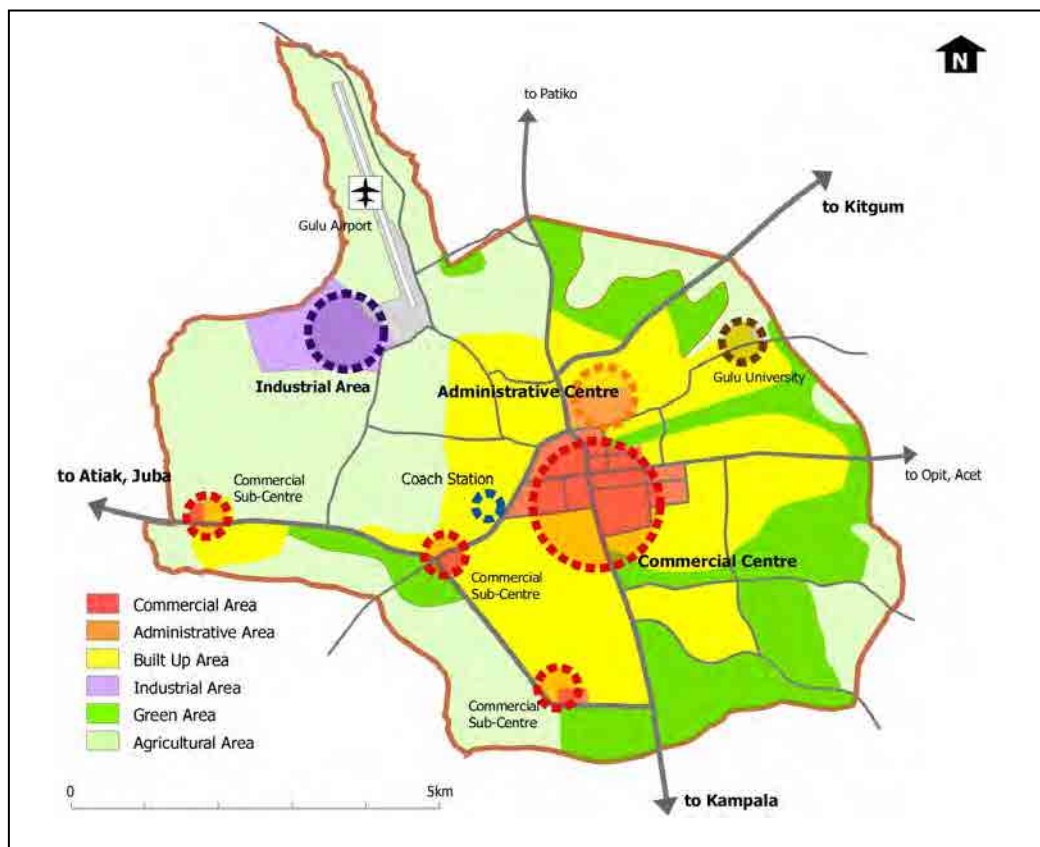
Gulu municipality is expected to be the primary service centre in Acholi sub-region. The future population is estimated at 462,700 in 2018 and 535,800 in 2030. In order to accommodate the future population, certain areas need to be prepared for residences otherwise urban sprawl will occur. In addition, it is expected to become a primary service centre with a sizable trading centre, and to provide high level social services and job opportunities. The following issues are expected to become problems in urban development in Gulu.

- The build-up area is stretching toward the north and south along the major roads so that ribbon development is occurring
- Large sized freight vehicles pass through the middle of town due to lack of a bypass road
- Coaches pass through the middle of town due to the inappropriate location of the coach station
- The river that runs through the town is likely to be flooded during the rainy season, which disturbs pedestrian and vehicular traffic

Net density of population in Gulu municipality was 399 person/ha. This is relatively high density even though most of the buildings are low-rise. The urban population density is expected to be higher since the number of middle-rise buildings, four or five stories, has been increasing in recent years. Based on this figure and future population, Gulu needs to prepare an additional 400 ha of land for residences by 2030. The future land use needs to be planned taking into account the increasing future population and required job opportunities. The following ideas are considered in the future land use plan:

- 1) To formulate a compact town in view of facilitation of urban infrastructure.  
Allocation of green areas such as parks, open spaces and agricultural land in the outskirts of the town, namely the green belt will be useful for prevention of urban sprawl.
- 2) To secure the residential land for population growth.  
There is still sufficient vacant land inside the town centre. To utilize such unused land for residential and commercial development could contribute to form a compact town.

- 3) To prepare the industrial land.  
According to the plan of the Uganda Investment Authority, 400 acres of land is required for industrial development as mentioned in the previous section. Appropriate land needs to be selected taking into account the requirements for transportation and basic infrastructure.
- 4) To develop bypasses in order to reduce through traffic of heavy vehicle in town centre  
Freight vehicles between Kampala and Juba should be induced to take a bypass and to avoid passing through the town centre in order to improve the traffic environment inside the town.
- 5) To shift the existing coach stations to an appropriate area.  
There are two coach stations in the town centre which contribute to mixing pedestrian and vehicular traffic. To combine these two stations and to allocate a location outside the centre are effective to reduce the number of large size vehicles in the town centre.



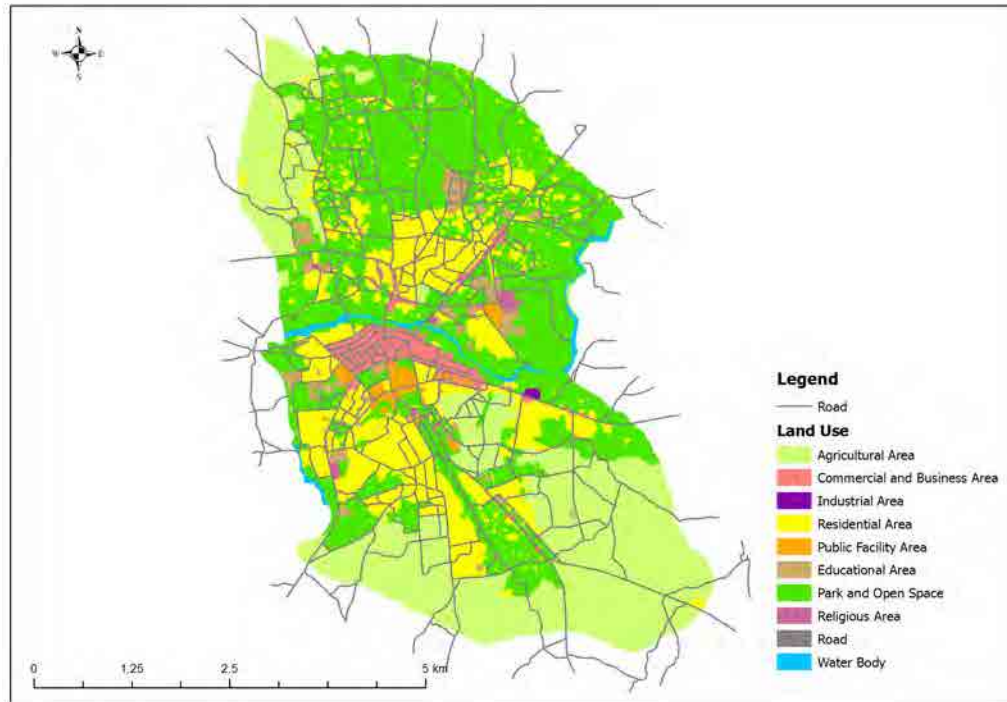
Source: JICA Study Team

**Figure 9.6-16 Concept Plan of Proposed Urban Land Use in Gulu**

#### 9.6.4.2 Kitgum

Kitgum Town accommodated a population of 57,300 in 2010. Kitgum is divided into two sections, north and south sides, by the Pager River. There is only one small bridge connecting both areas. Commercial activities are concentrated close to the river on the south side of Kitgum which accommodates a large-size market, retail shops, restaurants, small size accommodations, a coach station and commercial banks. An unused airstrip and farm land behind the residential areas are also located in the southern part of the town. The north side is mainly occupied by residences and retail shops. Existing land use of Kitgum is illustrated in the following figure.





Source: Kitgum Town Council compiled by JICA Study Team

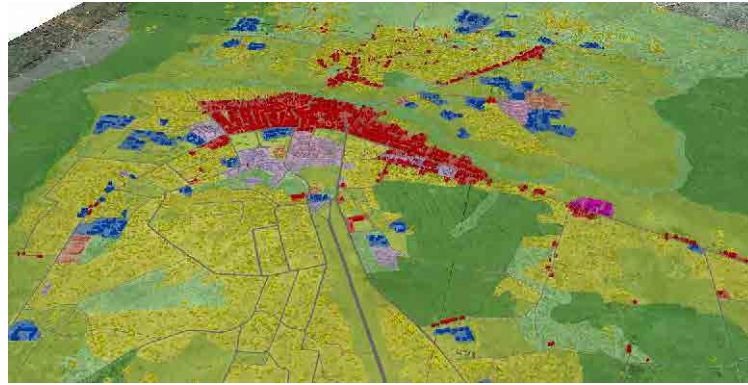
**Figure 9.6-17 Existing Land Use in Kitgum Town**

**Table 9.6-5 Area by Land Use Category in Kitgum Town**

Category	Area (m <sup>2</sup> )	%
Agricultural Area	9,324,670	30.5%
Industrial Area	24,786	0.1%
Commercial and Business Area	929,238	3.0%
Residential Area	5,803,330	19.0%
Public Facility Area	352,354	1.2%
Educational Area	777,404	2.5%
Park and Open Space	12,247,918	40.1%
Religious Area	111,993	0.4%
Road	623,900	2.0%
Water body	327,133	1.1%
Total	30,522,726	100.0%

Source: Kitgum Town Council compiled by JICA Study Team

The central commercial area is located near the small bridge. Due to lack of an alternative bridge, all traffic to/from the northern area such as Lamwo and Madi Opei pass through this area. Accordingly, the flow of pedestrian and vehicular transportation tends to mix in the town centre.



Source: JICA Study Team

**Figure 9.6-18 3D Image of Kitgum Town Council based on Existing Land Use**

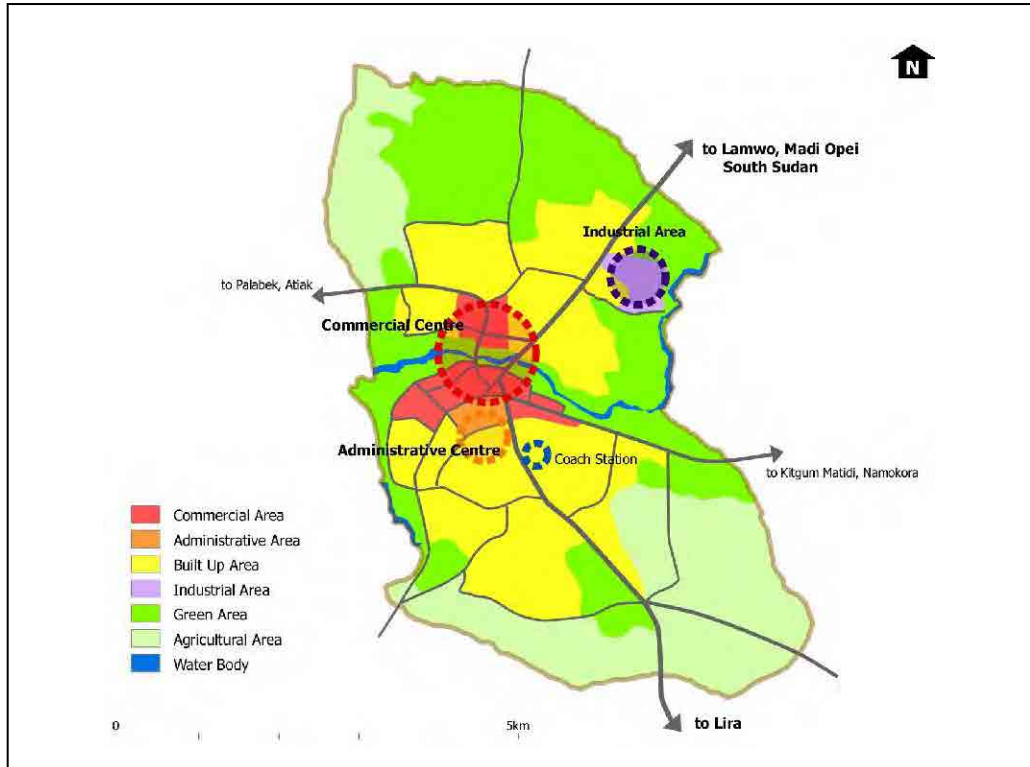
Kitgum Town is expected to be a secondary service centre in Acholi sub-region. The future population is estimated at 77,400 in 2018 and 118,900 in 2030. In order to accommodate the future population, an area needs to be prepared for residences otherwise urban sprawl will occur. In addition, its functions as a secondary service centre are expected to include a sizable trading centre, providing high level social services and providing job opportunities. The following issues are expected to become problems in urban development in Kitgum Town.

- The built-up area is expanding toward the south along the road to Lira and this means that ribbon development is occurring
- Freight vehicles to/from Lira and South Sudan are expected to pass through the middle of town due to lack of a bypass road
- An alternative bridge connecting with north and south is required for population growth and in case of emergency

Net population density in Kitgum Town was 99 person/ha in 2010. Compared to Gulu, the density was lower, however, it is expected to become higher in association with urbanization. Based upon this figure and future population, Kitgum needs to prepare at least an additional 200 ha of land for residences by 2030. The future land use needs to be well planned taking into account the increasing future population and required job opportunities. The following ideas are considered in the future land use plan.

- 1) To form a compact town in view of facilitation of urban infrastructure.  
Allocation of green areas such as parks, open spaces and agricultural land in the outskirts of the town, namely the green belt, is useful for prevention of urban sprawl.
- 2) To secure the residential land for population growth.  
There is still sufficient vacant land inside the town centre. To utilize such unused land for residential and commercial development could contribute to form a compact town.
- 3) To prepare the industrial land.  
Appropriate land needs to be selected taking into account the requirements for transportation and basic infrastructure.
- 4) To develop a bypass in order to reduce through traffic in town centre.  
Since the number of vehicles passing between Lira and the northern areas such as Lamwo, Madi Opei and South Sudan is expected to increase, it is necessary to complete a bypass by means of building a bridge at the missing link. The bypass could contribute to avoid passing through the town centre in order to improve the environment in the town.

- 5) To shift the existing coach station to an appropriate area.  
There is a coach station in the heart of the town centre which contributes to mix pedestrian and vehicular traffic. To allocate an area outside the centre would be effective to reduce the number of large size vehicles in the town centre.



Source: JICA Study Team

**Figure 9.6-19 Concept Plan of Proposed Urban Land Use in Kitgum**

## **10. TRAFFIC DEMAND FORECAST**

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### **10.1 Basic Approach for Forecast**

In the previous JICA Study in Amuru/Nwoya Districts, the traffic forecast study was carried out for the Study Area as well. Since the study was carried out recently and no major changes in the socio economic framework were recognized, the traffic demand forecast study respects and refers to this previous JICA study approach and result. In particular, the OD pattern of the previous JICA Study is applied for the demand forecast.

### **10.2 Traffic Demand Methodology**

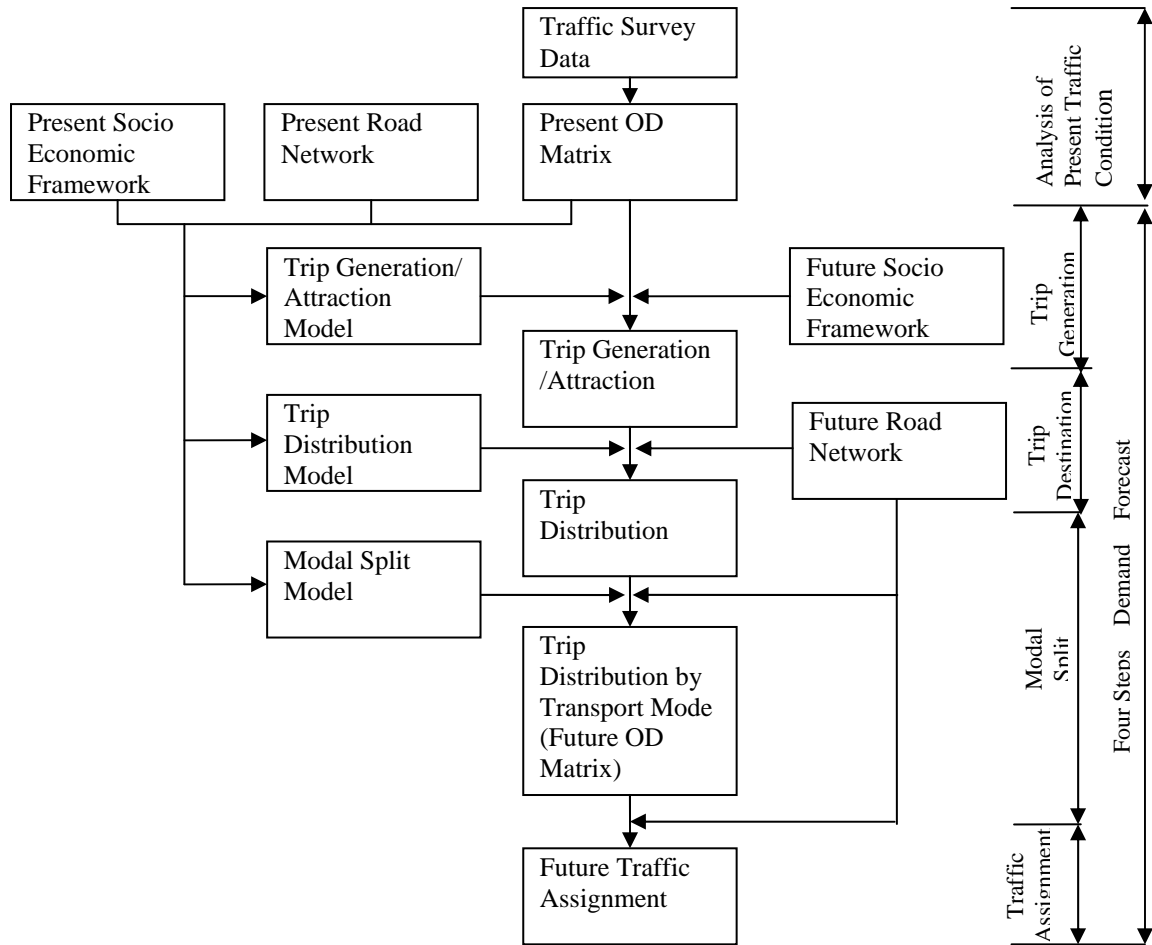
#### **10.2.1 Four Steps Approach**

The future traffic demand in Acholi sub-region is forecast based on the current traffic demand estimated by the results of the roadside traffic count and driver interview surveys conducted in the previous JICA Study and this Study and population projections prepared by UBOS and UNHCR.

The popular demand estimation approach used throughout the world includes the following basic components:

- Trip Generation/Attraction Model, the prediction of trips produced at and attracted to each zone;
- Trip Distribution Model, the prediction of origin-destination flows, represented by distribution of trip ends by trip generation;
- Modal Split Model, the estimation of percentage of trip flows made by each transport mode; and
- Traffic Assignment, assignment of trips to routes in the road net work.

The following figure shows the work flow for the traffic demand forecast in the four steps approach.



Source: JICA Study Team

**Figure 10.2-1 Flow of Traffic Demand Forecast**

### 10.3 Zoning System

Traffic zones, which are geographical units of the traffic demand analysis, were developed based on the administrative territories of the sub-county in Acholi Sub-region. The minor amendments and corrections from that of the previous JICA Study were made because of the introduction of a new administration system which is summarized in the following table.

**Table 10.3-1 Amendment of Zoning System**

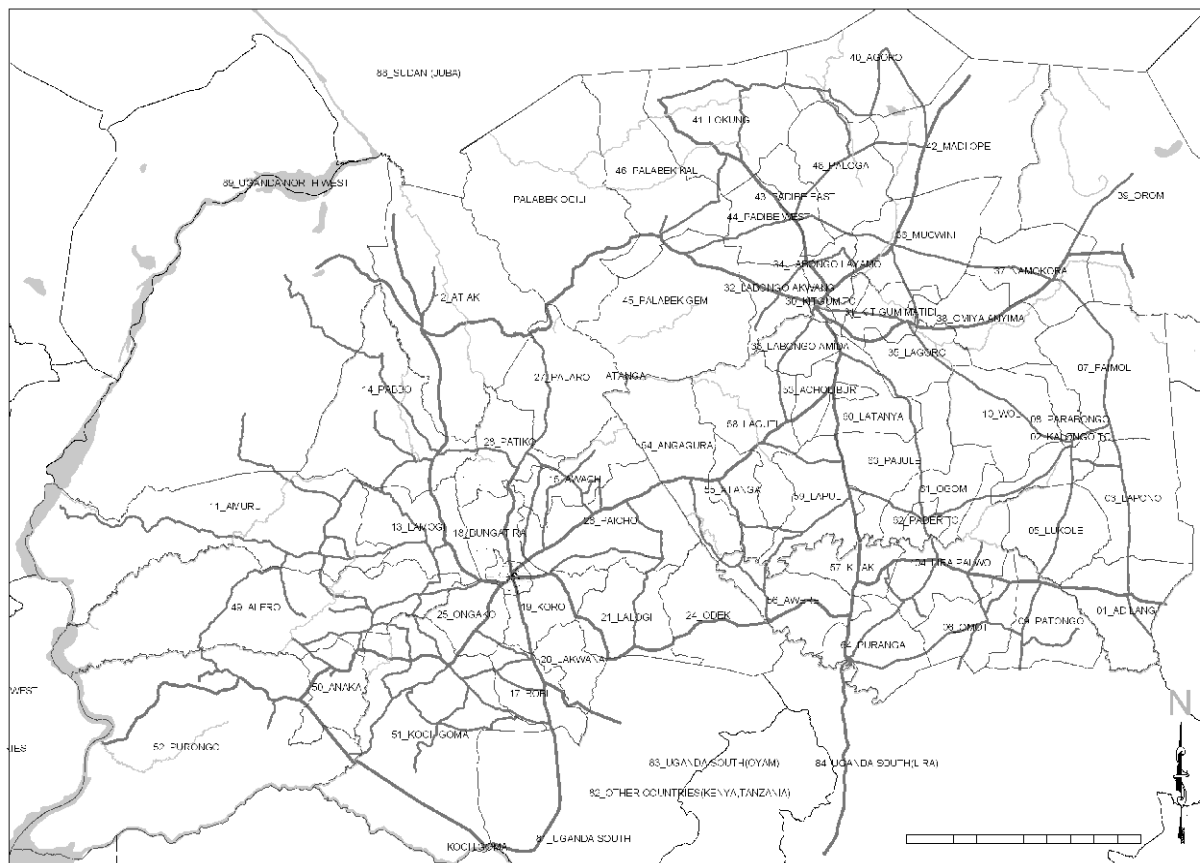
Previous Study			This Study			Previous Study			This Study		
Zone No.	Zone Name	District	Zone No.	Zone Name	District	Zone No.	Zone Name	District	Zone No.	Zone Name	District
31	Acholibur	Pader	53	ACHOLIBUR	PADER	42	Lira Palwo	Pader	4	LIRA PALWO	AGAGO
40	Adilang	Pader	1	ADILANG	AGAGO	24	Lokung	Kitugum	41	LOKUNG	LAMWO
23	Agoro	Kitugum	40	AGORO	LAMWO	43	Lukole	Pader	5	LUKOLE	AGAGO
52	Alero	Amuru	49	ALERO	NWOYA	25	Madi Opei	Kitugum	42	MADI OPEI	LAMWO
48	Amuru	Amuru	11	AMURU	AMURU	19	Mucwini	Kitugum	36	MUCWINI	KITGUM
53	Anaka	Amuru	50	ANAKA	NWOYA	20	Namokora	Kitugum	37	NAMOKORA	KITGUM
			54	ANGAGURA	PADER	11	Odek	Gulu	24	ODEK	GULU
32	Atanga	Pader	55	ATANGA	PADER				61	OGOM	PADER
49	Atiak	Amuru	12	ATIAK	AMURU	21	Omiya Anyima	Kitugum	38	OMIYA ANYIMA	KITGUM
1	Awach	Gulu	15	AWACH	GULU	44	Omot	Pader	6	OMOT	AGAGO
33	Awere	Pader	56	AWERE	PADER	12	Ongako	Gulu	25	ONGAKO	GULU
			16	BAR-DEGE	GULU	22	Orom	Kitugum	39	OROM	KITGUM
7	Bobi	Gulu	17	BOBI	GULU	51	Pabbo	Amuru	14	PABBO	AMURU
2	Bungatira	Gulu	18	BUNGATIRA	GULU	37	Pader TC	Pader	62	PADER TC	PADER
6	Gulu Municipality	Gulu				27	PadibeEast,Padibe West	Kitugum	43	PADIBE EAST	LAMWO
			2	KALONGO TC	AGAGO				44	PADIBE WEST	LAMWO
34	Kilak	Pader	57	KILAK	PADER	3	Paicho	Gulu	26	PAICHO	GULU
14	Kitgum Matidi	Kitugum				45	Paimol	Pader	7	PAIMOL	AGAGO
13	Kitgum TC	Kitugum	30	KITGUM TC	KITGUM				63	PAJULE	PADER
			31	KITIGUM MATIDI	KITGUM	28	Palabek Gem	Kitugum	45	PALABEK GEM	LAMWO
55	Koch Goma	Amuru	51	KOCH GOMA	NWOYA	29	Palabek Kal	Kitugum	46	PALABEK KAL	LAMWO
8	Koro	Gulu	19	KORO	GULU	26	Palabek Ogili	Kitugum	47	PALABEK OGILI	LAMWO
15	Labongo Akwang	Kitugum	32	LABONGO AKWANG	KITGUM	4	Palaro	Gulu	27	PALARO	GULU
16	Labongo Amida	Kitugum	33	LABONGO AMIDA	KITGUM	30	Paloga	Kitugum	48	PALOGA	LAMWO
17	Labongo Layamo	Kitugum	34	LABONGO LAYAMO	KITGUM	46	Parabongo	Pader	8	PARABONGO	AGAGO
18	Lagoro	Kitugum	35	LAGORO	KITGUM	5	Patiko	Gulu	28	PATIKO	GULU
35	Laguti	Pader	58	LAGUTI	PADER	47	Patongo	Amuru	9	PATONGO	AGAGO
9	Lakwana	Gulu	20	LAKWANA	GULU				29	PECE	GULU
10	Lalogi	Gulu	21	LALOGI	GULU	38	Puranga	Pader	64	PURANGA	PADER
50	Lamogi	Amuru	13	LAMOGI	AMURU	54	Purongo	Amuru	52	PURONGO	NWOYA
41	Lapono	Pader	3	LAPONO	AGAGO	39	Wol	Pader	10	WOL	AGAGO
36	Lapul,Pajule	Pader	59	LAPUL	PADER						
			22	LAROO	GULU						
			60	LATANYA	PADER						
			23	LAYIBI	GULU						

Source: JICA Study Team

## 10.4 Road Network

### 10.4.1 Existing Road Network

The Road Network was reviewed considering the result of the road inventory survey as shown in the following figure.



Source: JICA Study Team

**Figure 10.4-1 Existing Road Network in Study Area**

### 10.4.2 Existing Road Network Condition

For the traffic assignment, the road network condition is defined as follows. Free flow speed is defined by the road surface condition as the result of the road inventory survey.

**Table 10.4-1 Definition of Free Flow Speed in Road Network**

Pavement Type	Surface Condition	Free Flow Speed (km)
Paved	Good	80
	Fair	60
Earth	Poor	40
	Bad	20

Source: JICA Study Team

Link capacity was defined in the previous JICA Study as follows,

- Basic capacities applied to this analysis were 1,200 PCU/hour for one-lane (carriageway width less than 3.5m) and 2,500 PCU/hour for two-lanes (carriageway width 3.5m and more);

- Adjustment factors by road surface type were defined as 1.00 (paved), 0.75 (unpaved-fair), 0.5 (unpaved –poor) and 0.25 (unpaved-bad);
- A peak ratio to 24 hours was 8.4% (average of traffic count survey at 15 survey stations);
- The average heavy vehicle ratio including large bus, medium truck and trailer was about 29 percent. Adjustment factor for road capacity for heavy vehicles was 0.78 estimated by the following formula.

$$\gamma_T = 100 \times \frac{100}{(100-T)+E_t} \times T$$

Where,  $\gamma_T$ : Adjustment Factor for Heavy Vehicles

T: Ratio of Heavy Vehicles (%)

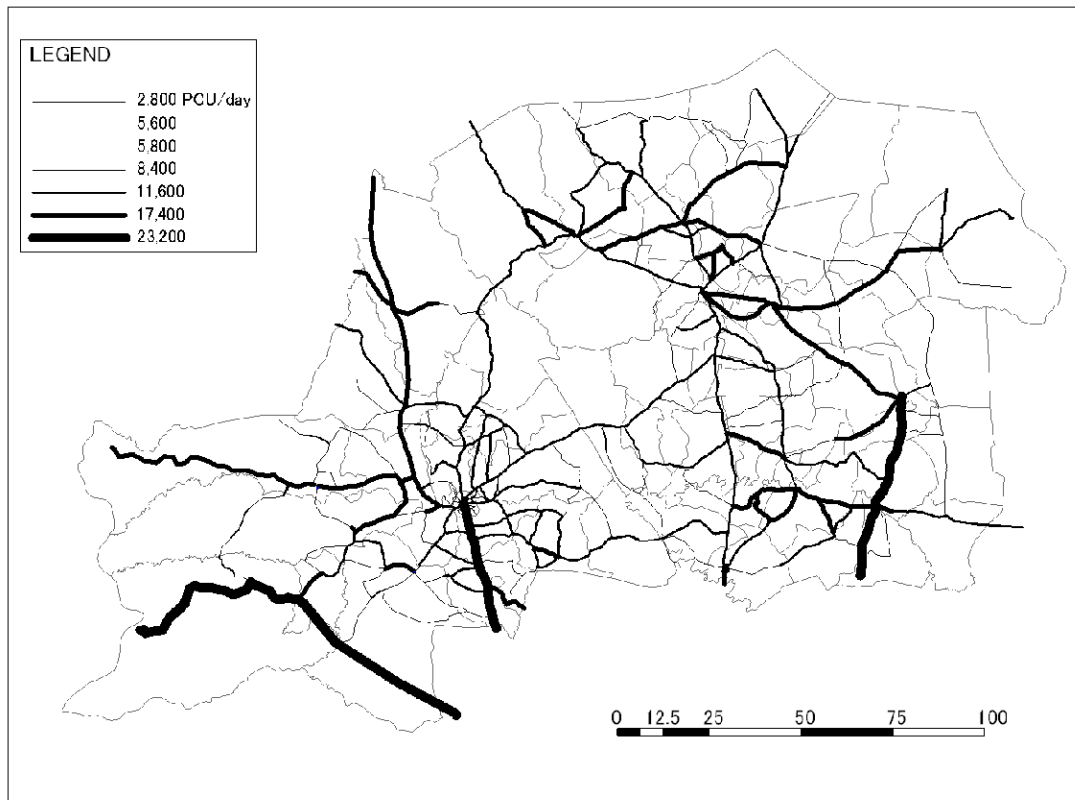
$E_t$ : Passenger Car Unit (PCU) of the Heavy Vehicles

**Table 10.4-2 Definition of Capacity (PCU/day)**

Pavement Type	Surface Condition	Carriageway Width	
		Less than 3.5m (1 Lane Road)	3.5m and more (2 Lane Road)
Paved	Good	-	23,200
Earth	Fair	8,400	17,400
	Poor	5,600	11,600
	Bad	2,800	5,800

Source: JICA Study in Amuru/Nwoya

The following figure shows defined road capacity in the Study Area.



Source: JICA Study Team

**Figure 10.4-2 Defined Road Capacity in Study Area**



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## 10.5 Current Traffic Demand Estimation

### 10.5.1 Basic Approach

The basic approach for the current traffic demand estimation is to calibrate data in the last JICA study with the latest information such as the population prediction for 2011 and traffic volume by the cordon survey in 2011. Since the new administration system has been introduced in the study area the last data was calibrated so as to meet the new system.

### 10.5.2 Trip Production Rate

The estimated gross person trip production rate in the last study is applied. The gross trip production rate by mode/employment status was estimated as shown in the following table. The table explained the higher trip frequency, which was 2.84 trips/person by the workers, was realized while that of the unemployed was 2.47 trips/ person.

**Table 10.5-1 Estimated Gross Person Trip Production Rate (Trip/ Person/Day)**

Status	Walk	Bicycle	Motor-Bike	Passenger Car	Small Bus (Matatu)	Large Bus	Truck	Total
Unemployed	2.01	0.27	0.12	0.02	0.03	0.00	0.02	2.47
Student	1.85	0.22	0.11	0.01	0.04	0.02	0.00	2.25
Worker	1.89	0.54	0.28	0.04	0.04	0.01	0.04	2.84

Source: JICA Study in Amuru/Nwoya

### 10.5.3 Trip Production by Mode

The current zonal population by district with employment status is calibrated from that of the last JICA study. The new administration system is also considered in the calibration. The population prediction data is obtained from UBOS and employment status rates in the last study are applied as well. The result is tabulated as follows.

**Table 10.5-2 Estimated Population by Employment Status in 2011**

	Less than 5 Years Old	Unemployed	Student	Worker	Total
Gulu	125,627	94,894	118,833	46,045	385,400
Kitugum	77,743	58,724	73,539	28,495	238,500
Lamwo	53,686	40,533	50,783	19,677	164,700
Pader	71,973	54,366	68,081	26,380	220,800
Agago	92,998	70,247	87,969	34,086	285,300
Amuru	56,783	42,892	53,712	20,812	174,200
Nwoya	17,081	12,902	16,157	6,260	52,400

Source: JICA Study Team

The following table shows a summary of estimated daily trip production by population and gross trip rate which is calibrated by the latest population data with the new administration system.

**Table 10.5-3 Estimated Person Trip Production in 2011**

	Total	Person Trip Production ('000 trip/day)							Total of Motorized Trips
		Walk	Bicycle	Motor-Bike	Passenger Car	Small Bus	Large Bus	Truck	
Gulu	632,533	497,605	76,629	37,5329	4,928	9,422	2,837	3,740	58,298
Kitugum	391,435	307,937	47,421	23,115	3,050	5,843	2,314	2,314	36,077
Lamwo	270,312	212,651	32,747	15,962	2,106	4,035	1,598	1,598	24,914
Pader	362,385	285,083	43,902	21,399	2,823	5,409	2,143	2,143	33,400
Agago	468,245	368,362	56,726	27,650	3,648	6,990	2,768	2,768	43,157
Amuru	285,903	224,916	34,636	16,883	2,270	4,268	1,690	1,690	26,351
Nwoya	86,001	67,656	10,419	5,078	670	1,284	508	508	7,926

Source: JICA Study Team

#### 10.5.4 Internal Trip Ratio

The internal trip ratio is applied from that of the last JICA study. It was known that 73% of motor-bike and 58% of passenger vehicle trips start and end within the same zone (sub-county).

**Table 10.5-4 Internal Trip Ratio**

Mode	Walk	Bicycle	Motor-Bike	Passenger Car	Small Bus	Large Bus	Truck
Internal Trip Ratio	95.2	84.4	73.0	58.0	88.7	19.0	5.3

Source: JICA Study in Amuru/Nwoya

#### 10.5.5 Trip Distribution Model

A trip distribution model to estimate trips in Acholi Sub-region was developed based on the following gravity model by transport mode in the last JICA study.

$$T_{ij} = K \times P_i^\alpha \times A_j^\beta \times D_{ij}^\gamma$$

Where,

$T_{ij}$ : Person or vehicle trips from zone I to zone j

$P_i$ : Person Trip Production in Zone I,

$A_j$ : Person Trip Attraction (Equal to Trip Production) in Zone j,

$D_{ij}$ : Travel Distance between Zone i-j (km),

K,  $\alpha$ ,  $\beta$ ,  $\gamma$ : Parameters

#### 10.5.6 Vehicle Occupancy Rate and PCU

Average vehicle occupancy rate including the driver was provided in the last JICA study as shown in the following table.

**Table 10.5-5 Average Vehicle Occupancy Rate and PCU**

Vehicle Type	Occupancy Rate (Person/veh.)	PCU
Passenger Car (Sedan, Pick-up, Van, 4WD)	3.79	1.0
Small Bus (less than 50 seats)	12.07	1.2
Large Bus (50 seats and more)	48.58	2.0
Light Truck (2 Axle Truck)	4.97	1.7
Heavy Truck ( 3 and more Axles, Trailer)	3.33	2.5
Motor-Bike	1.58	0.3

Source: JICA Study in Amuru/Nwoya

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## 10.5.7 Traffic Demand

Current internal trips within Acholi Sub-region were estimated by the trip production model are calibrated by the counted traffic volume at the survey stations on each district boundary. Current OD matrixes are prepared totalling calibrated OD within the Acholi Sub-region and external OD.

## 10.6 Future Traffic Demand Forecast

Based on the assignment cases prepared in last JICA study, future traffic demand forecasts are carried out.

### 10.6.1 Future Trip Production by Mode

Based on the population prediction by UBOS and the population growth rate, the populations in 2018 and 2030 are estimated as shown in the following tables.

**Table 10.6-1 Estimated Population by Employment Status in 2018**

	Less than 5 Years Old	Unemployed	Student	Worker	Total
Gulu	150,824	113,927	142,668	55,281	462,700
Kitugum	100,919	76,231	95,461	36,989	309,600
Lamwo	69,594	52,569	65,830	25,508	213,500
Pader	100,039	75,566	94,629	36,667	306,900
Agago	129,376	97,726	122,379	47,419	396,900
Amuru	67,703	51,140	64,042	24,815	207,700
Nwoya	20,601	15,561	19,487	7,551	63,200

Source: JICA Study Team

**Table 10.6-2 Estimated Population by Employment Status in 2030**

	Less than 5 Years Old	Unemployed	Student	Worker	Total
Gulu	174,652	1311,926	165,207	64,014	535,800
Kitugum	198,969	150,294	188,210	72,927	610,400
Lamwo	75,591	57,099	71,504	27,706	231,900
Pader	147,141	111,145	139,184	53,931	451,400
Agago	203,109	153,421	192,125	74,444	623,100
Amuru	103,950	78,520	98,329	38,100	318,900
Nwoya	48,504	36,638	45,881	17,778	148,800

Source: JICA Study Team

The table below shows the forecast person trips in 2018 and 2030 as estimated by applying the rate in 2011.

**Table 10.6-3 Estimated Person Trip Production in 2018**

	Total	Person Trip Production ('000 trip/day)							Total of Motorized Trips
		Walk	Bicycle	Motor-Bike	Passenger Car	Small Bus	Large Bus	Truck	
Gulu	759,400	597,410	91,999	44,843	5,916	11,336	3,406	4,490	69,991
Kitugum	508,127	399,737	61,558	30,005	3,959	7,585	2,279	3,004	46,832
Lamwo	350,404	275,658	42,450	20,692	2,730	5,231	1,572	2,072	32,832
Pader	503,696	396,250	61,021	29,744	3,924	7,519	2,259	2,978	46,424
Agago	651,407	512,453	78,916	38,466	5,075	9,724	2,922	3,851	60,038
Amuru	340,885	268,170	41,297	20,130	2,656	5,088	1,529	2,015	31,418
Nwoya	103,726	81,600	12,566	6,125	808	1,548	465	613	9,560

Source: JICA Study Team

**Table 10.6-4 Estimated Person Trip Production in 2030**

	Total	Person Trip Production ('000 trip/day)							Total of Motorized Trips
		Walk	Bicycle	Motor-Bike	Passenger Car	Small Bus	Large Bus	Truck	
Gulu	879,375	691,792	106,533	51,928	6,851	13,127	3,944	5,199	81,049
Kitugum	1,1001,811	788,111	121,366	59,158	7,805	14,954	4,493	5,923	92,334
Lamwo	380,603	299,415	46,109	22,475	2,965	5,681	1,707	2,250	35,079
Pader	740,854	582,820	89,752	43,748	5,772	11,059	3,323	4,380	68,282
Agago	1,022,655	804,509	123,891	60,389	7,967	15,265	4,587	6,046	94,255
Amuru	472,731	411,744	34,636	16,883	2,227	4,268	1,282	1,690	26,351
Nwoya	210,467	192,121	10,419	5,078	670	1,284	386	508	7,926

Source: JICA Study Team

## 10.6.2 Future External Trips

Future external trips were estimated in the last JICA study based on available data such as number of registered vehicles and GDP.

**Table 10.6-5 Number of Registered Vehicles by Type**

Type	1998	2000	2003	2005	Annual Growth Rate 1998-2005 (%)
Motor-Bike	61,044	64,305	80,088	103,205	7.8%
Passenger Car	46,930	49,016	56,837	69,807	5.8%
Utility	37,199	42,443	48,528	60,130	7.1%
Bus	666	800	846	1,021	5.8%
Mini Bus	15,143	15,523	19,726	23,833	6.7%
Truck	11,451	13,240	16,122	15,858	4.8%
Others	3,711	3,778	4,044	-	-
Total	176,164	189,105	226,191	274,174	6.5%

Source: UNRA

**Table 10.6-6 Gross Domestic Products (GDP)**

	1998	2000	2003	2005	Annual Growth rate 1998-2005
GDP (bil. Ush)	7,835.60	8,932.29	10,445.54	11,779.22	6.0%

Note: GDP is based on year 2000 constant prices

Source: World Economic Outlook Database, IMF

**Table 10.6-7 Elasticity of Vehicle Registration and GDP Growth by Mode**

	Motor-Bike	Passenger Car	Utility	Bus	Mini Bus	Truck
Vehicle Growth Rate	7.8%	5.8%	7.1%	5.8%	6.7%	4.8%
GDP Growth Rate	6.0%					
Elasticity	1.31	0.97	1.18	0.97	1.12	0.79

Source: JICA Study in Amuru/Nwoya

**Table 10.6-8 Projected Annual GDP Growth Rate**

	2009	2010	2011	2012-20130
Annual Growth Rate	6.5%	6.8%	7.1%	6.0%

Source: IMP

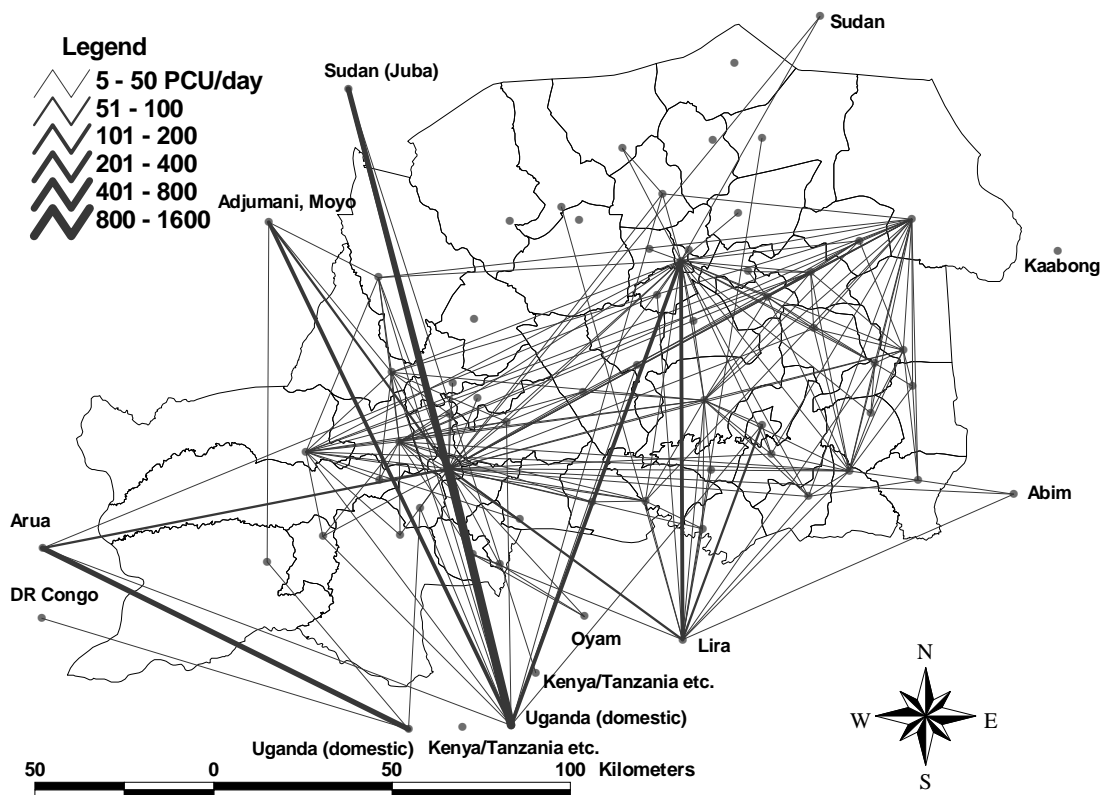
**Table 10.6-9 Expansion Factor**

	Motor-Bike	Passenger Car	Utility	Bus	Mini Bus	Truck
2009-2018	2.02	1.78	1.54	1.83	1.70	1.54
2009-2030	4.45	3.65	2.69	3.81	3.30	2.69

Source: JICA Study Team

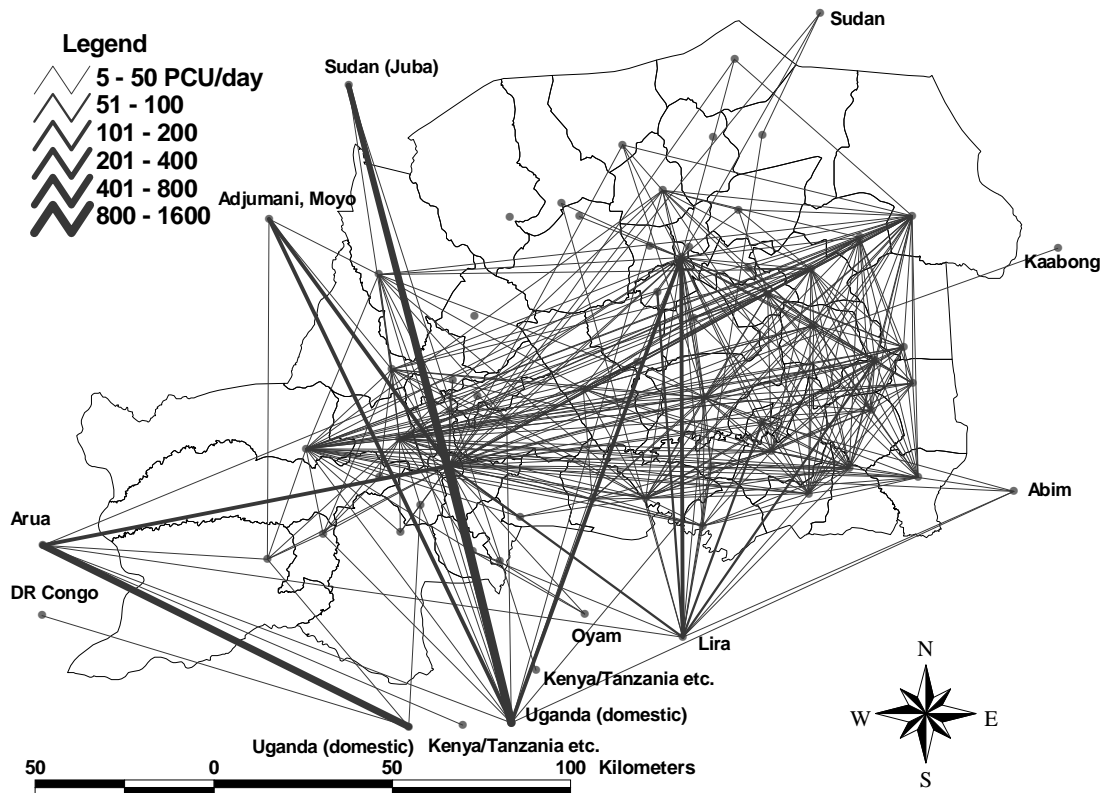
### 10.6.3 Future Traffic Demand

A model-based forecast future demand in Acholi Sub-region and external demand are combined into the future traffic demand in 2018 and 2030.



Source: JICA Study Team

**Figure 10.6-1 Desire Lines in 2018 (All Vehicles)**



Source: JICA Study Team

**Figure 10.6-2 Desire Lines in 2030 (All Vehicles)**

## 10.6.4 Future Traffic Assignment Results

### 10.6.4.1 Assignment Cases

One of the objectives of the traffic forecast is to evaluate the projects to be proposed in the Master Plan. In particular, national road improvements in the study area are considered as the most possible and feasible projects. The following table summarizes the traffic assignment cases.

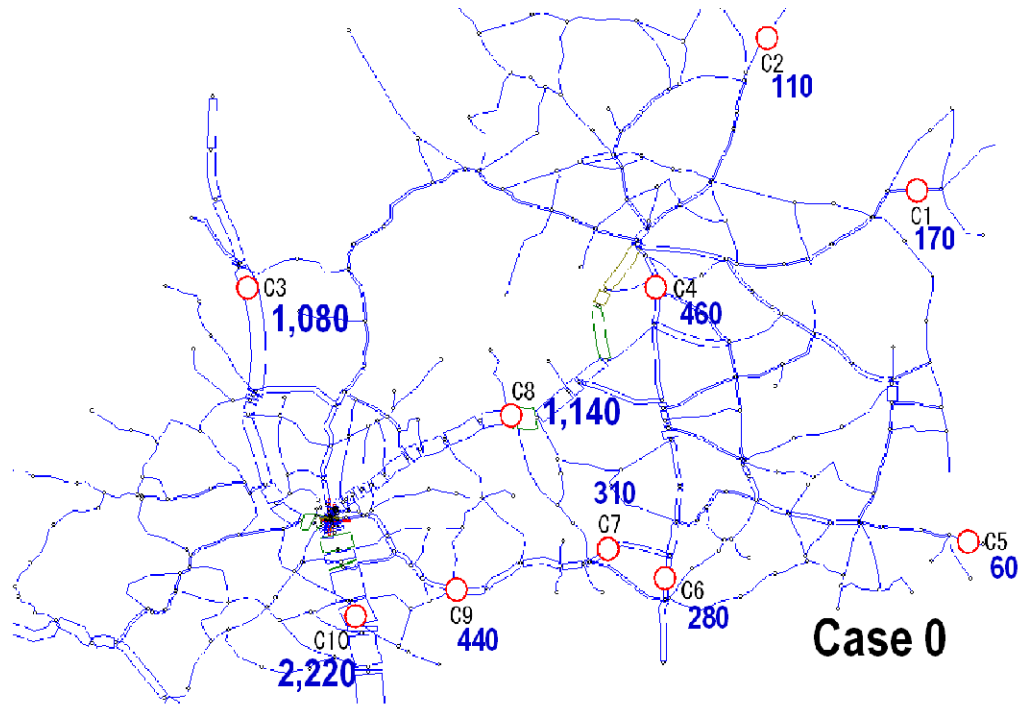
**Table 10.6-10 Traffic Assignment Cases**

Case	Description	Road Network	Traffic Demand
-	Existing	2011 Network	
0	Without Project	Do Nothing	2011 Network
1	With Lira-Kitgum Rd.	Improvement of Lira-Kitgum Rd.	2011Network + Lira-Kitgum
2	With Gulu- Kitgum Rd.	Improvement of Gulu-Kitgum Rd.	2011Netwok + Gulu-Kitgum Rd.
3	All Projects	Improvement of above Roads in the Area	2018 Network

Source: JICA Study Team

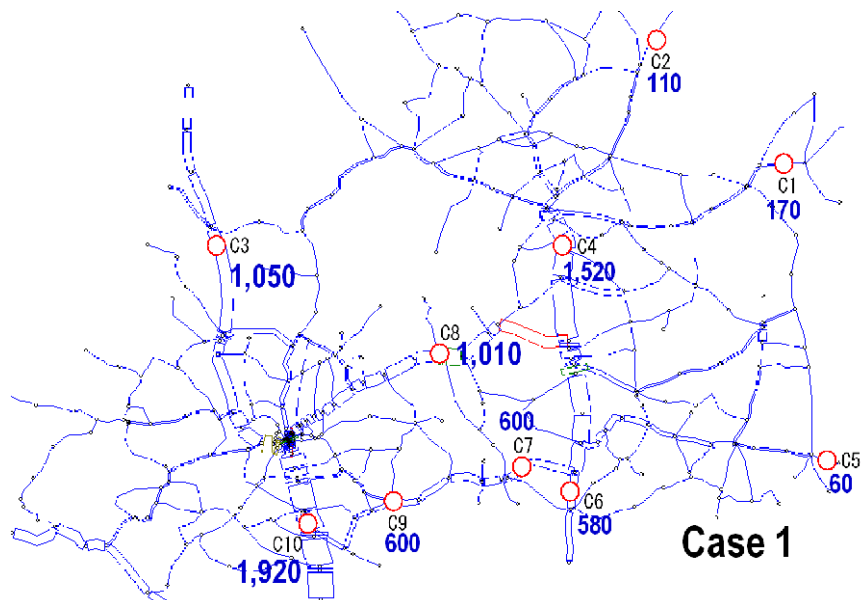
### 10.6.4.2 Traffic Assignment Results

Traffic assignments by the above cases are illustrated in the following figures.



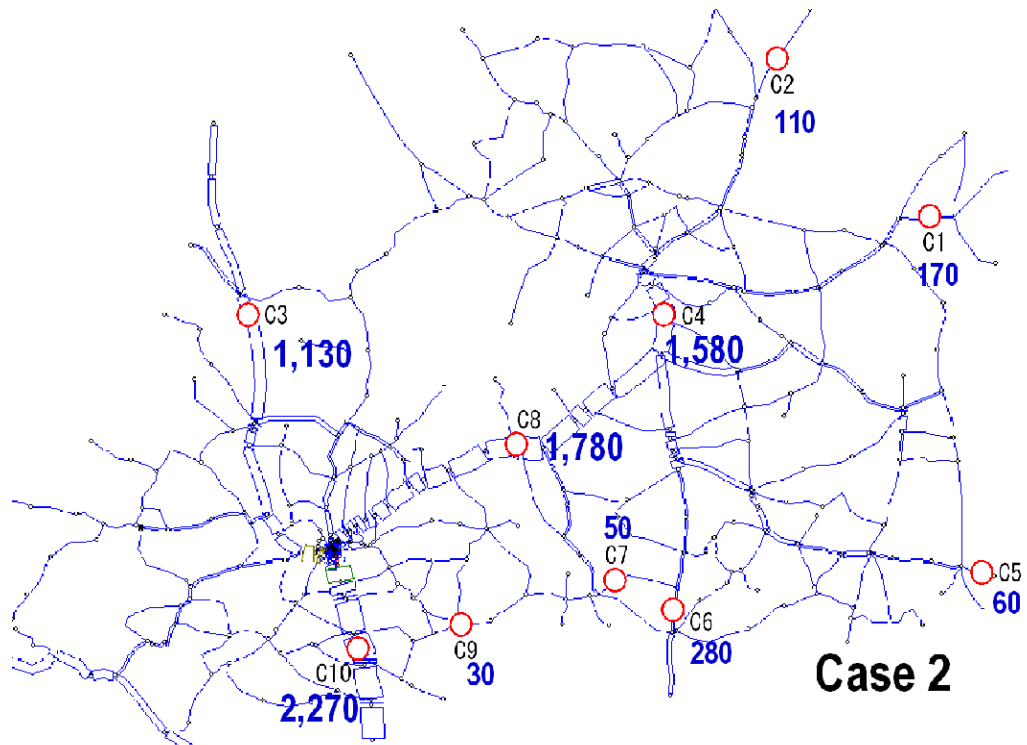
Source: JICA Study Team

**Figure 10.6-3 Traffic Assignment Result in Case 0  
(Do Nothing, 2018)**



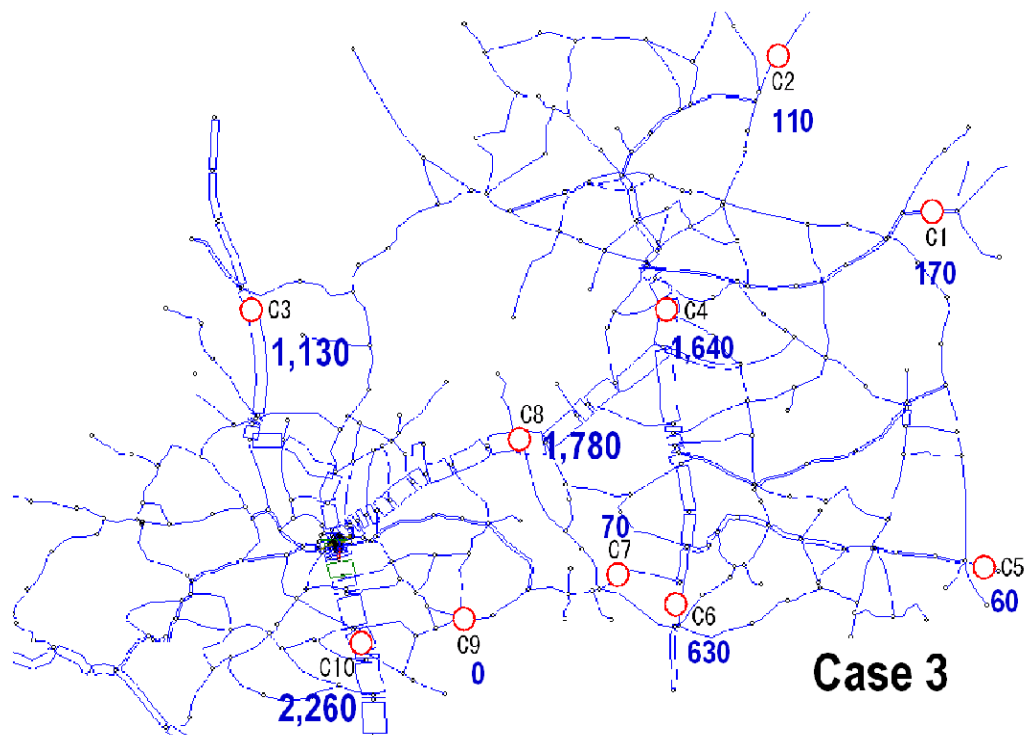
Source: JICA Study Team

**Figure 10.6-4 Traffic Assignment Result in Case 1  
(with Kitgum-Lira Improvement, 2018)**



Source: JICA Study Team

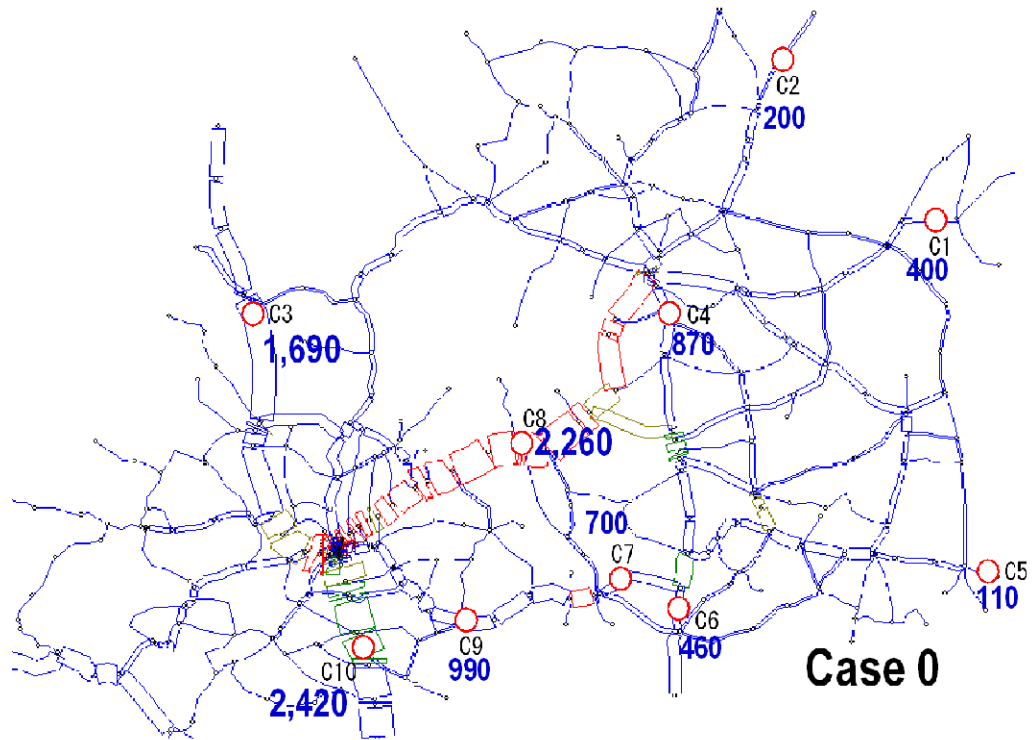
**Figure 10.6-5 Traffic Assignment Result in Case 2  
(with Gulu-Kitgum, 2018)**



Source: JICA Study Team

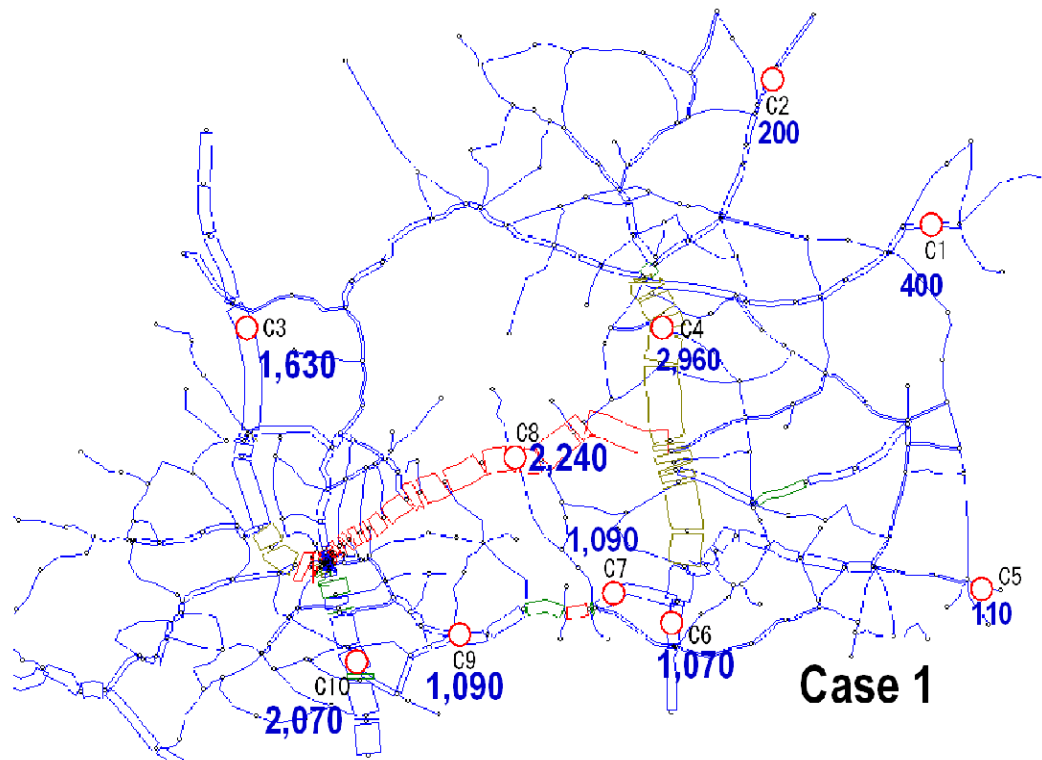
**Figure 10.6-6 Traffic Assignment Result in Case 3  
(with All NR, 2018)**





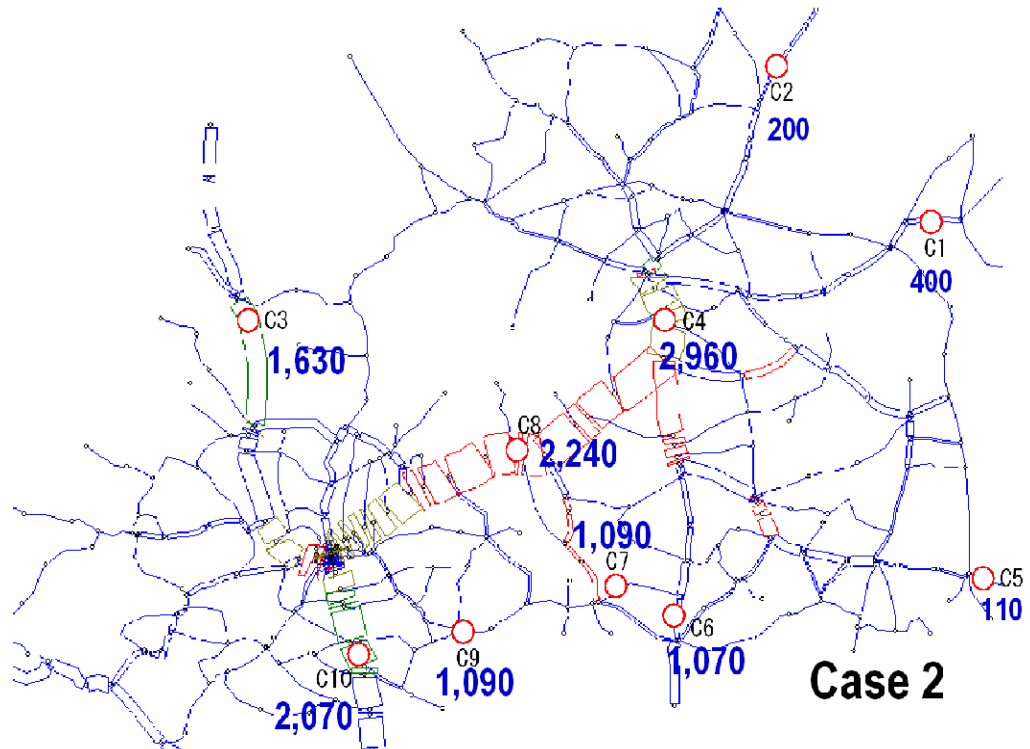
Source: JICA Study Team

**Figure 10.6-7 Traffic Assignment Result in Case 0  
(Do Nothing, 2030)**



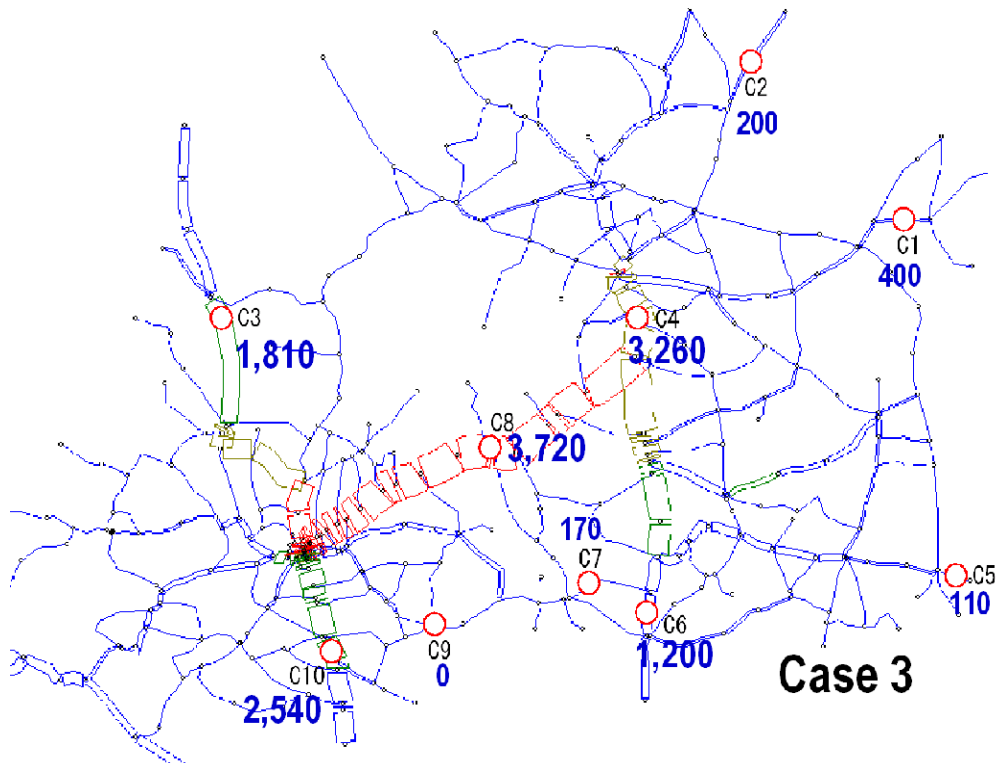
Source: JICA Study Team

**Figure 10.6-8 Traffic Assignment Result in Case 1  
(with Kitgum-Lira Improvement, 2030)**



Source: JICA Study Team

**Figure 10.6-9 Traffic Assignment Result in Case 2  
 (with Gulu-Kitgum, 2030)**



Source: JICA Study Team

**Figure 10.6-10 Traffic Assignment Result in Case 3  
 (with All NR, 2030)**