

Chapter 3. Objectives and Strategy for Angonia Regional Development

3.1. Regional Development Objectives

3.1.1. Problem structure

The existing conditions of the Study Area have been analyzed by sector and results are summarized in Chapter 2 in such a way to clarify characteristics of the Study Area. Some salient features and positive characteristics of the Study Area are noted, such as resource endowments and strategic location. Despite these, the Study Area faces various problems, which combined would work as constraints to the Angonia regional development.

Many of these problems are inter-related to cause undesirable phenomena observed. A problem structure analysis is a method to clarify these inter-relationships in a macroscopic way. The analysis, usually used during the initial stage of the planning, would allow maintaining a broad perspective without getting into details to identify more essential factors and major problems to be alleviated through planned development efforts. The analysis is used here to define development objectives and basic strategy for the Angonia regional development.

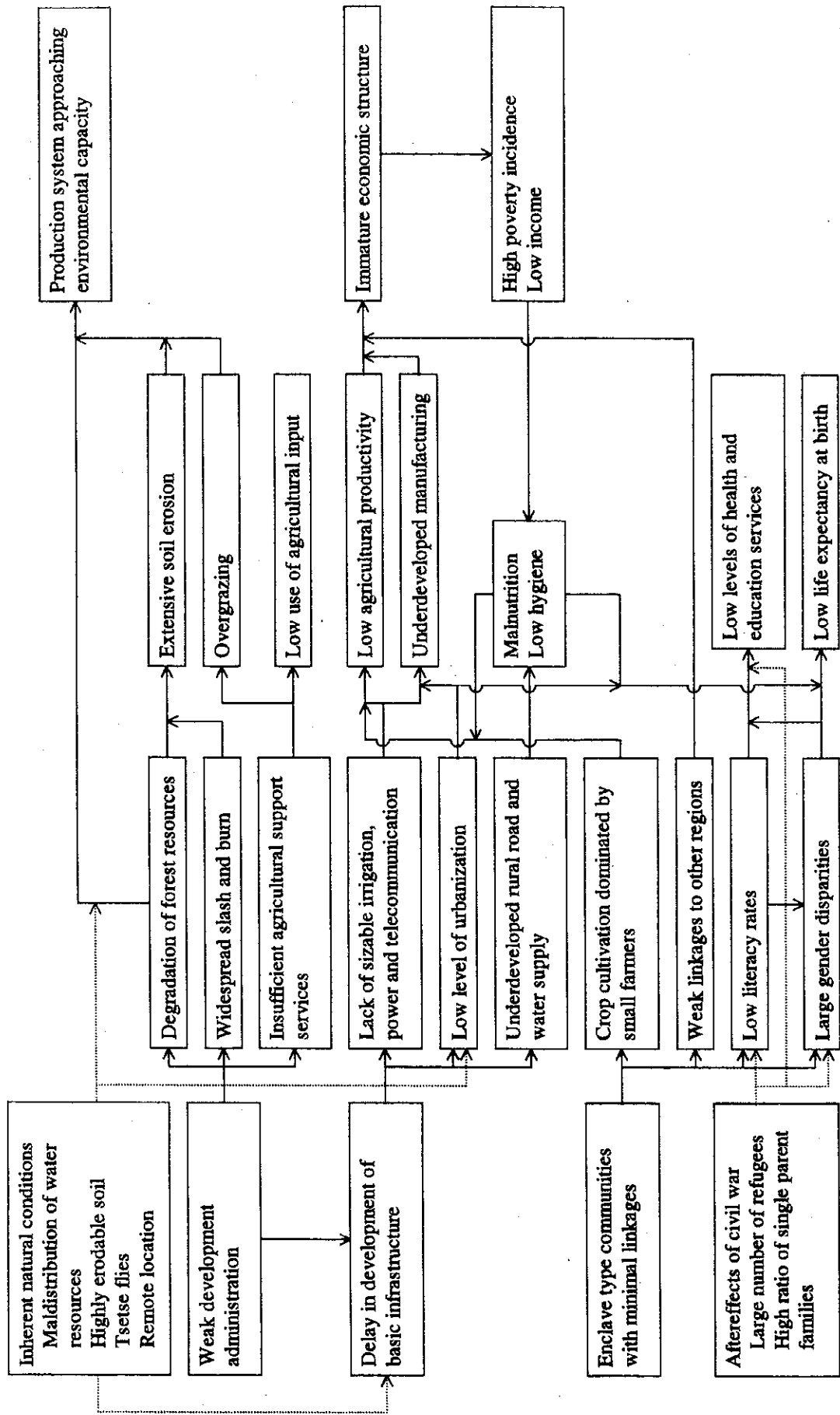
A problem structure analysis has been conducted for the Study Areas, and the results are shown in Figure 3.1. In the figure, more important factors and phenomena are shown, expressed in generic terms to imply many specific factors and phenomena. The figure also shows only main inter-relationships among them.

As shown in Figure 3.1, two sets of conditions are inherent to the Study Area. One is a set of inherent natural conditions such as maldistribution of water resources in time and space with a pronounced dry season, highly erosive soil, presence of tsetse flies, and location remote from the more advanced south. The other is due to after-effects of the civil war, represented by large number of returned refugees and high ratio of single parent, especially female headed, families as well as degraded infrastructure and disrupted socio-economic activities. These inherent conditions complicate problem interactions as indicated in the figure.

(1) Major problem phenomena

Referring to Figure 3.1, major problem phenomena in the Study Area are identified in economic, social and environmental sectors. The major problem in the economic sector is summarized as the very immature economic structure causing high poverty incidence and low income. This is due to low agricultural productivity with limited surplus production in rural areas, underdeveloped manufacturing without agglomeration economies, and weak linkages with other regions.

Figure 3.1. Problem Structure of the Study Area



The major problem in the social sector converges in low levels of health and education services and low life expectancy at birth. These are outcomes of various other problems, including low level of urbanization, underdeveloped rural roads and water supply, malnutrition and low hygiene, low literacy rates, and large gender disparities.

The major problem in the environment sector is expressed as the production system approaching environmental capacity, as a result of extensive use of land resources and environment without proper management. Specific problems include degradation of forest resources, widespread practice of slash and burn, extensive soil erosion, and overgrazing in some areas.

(2) Fundamental problems

Other than the inherent conditions mentioned above, three fundamental problems are noted as shown in Figure 3.1. These are (1) weak development administration, (2) delay in development of basic infrastructure, and (3) enclave type communities with minimal linkages. The first problem is institutional, caused by inadequate development and administrative system as a whole, and weak local administration in particular. The second problem means that even the most basic infrastructure is generally underdeveloped in the Study Area, such as irrigation, power supply, telecommunications, various urban infrastructure, and rural roads and water supply.

The third problem means that most rural communities in the Study Area exist largely in isolation with others, engaging in subsistence agriculture, deprived of basic services. They depend on small traders from outside not only for the sale of their meager surplus produce but also for supply of basic commodities. Within the traditional communities, gender disparities have been preserved with respect to education and literacy, employment opportunities and income, and exposure to larger communities.

3.1.2. Regional development objectives

Objectives for the Angonia regional development are defined addressing to the major problem phenomena identified above in economic, social and environmental sectors. Three objectives are defined as follows corresponding to the economic, social and environmental problems, respectively.

- (1) To strengthen the economic structure through enhancing agricultural productivity, accelerating industrialization, and promoting service linkages, in order to expand and diversify high earning employment opportunities and to alleviate poverty in association with such opportunities;
- (2) To improve levels and quality of various social services through selectively strengthening rural infrastructure and expanding human resources base with community participation as a means to promote regional integration or social

cohesiveness; and

- (3) To restore and enhance the environmental capacity through establishing environmentally sound and sustainable production systems in rural and urban areas with proper management organizations based on private interests and community participation.

3.2. Development Alternatives

3.2.1. Definition of development alternatives

Effective development strategies may address to more fundamental factors at the root of various interacting problems. The problem structure analysis has identified two sets of inherent problem factors and three fundamental factors. From these, more important problem factors to be addressed in the region development planning are identified as: (1) remote location from the developed south, (2) aftereffects of the civil war, (3) weak development administration, (4) delay in development of basic infrastructure, and (5) enclave type communities with minimal linkages. Each factor is clarified to define alternative development strategies.

The factor (1) may not be a constraint, if the Angonia regional development takes advantage of the closeness to other regions and neighboring countries. Promotion of regional linkages and outward orientation may constitute a sensible strategy. To address the problem factor (2), some kind of internal integration or promotion of social cohesiveness would be necessary. This may be part of good initial strategy to overcome the problem factor (5) as well. Corresponding to the factor (3) development administration may be strengthened at local, regional or central level, reflecting varying emphasis on internal integration, regional linkages and outward orientation. The problem factor (4) indicates alternative strategies to emphasize rural infrastructure, regional infrastructure or inter-territorial infrastructure. To overcome the problem factor (5), outward orientation strategy may be taken, probably in steps, at different levels: local, regional and inter-territorial.

Incorporating these strategic elements (underlined above) indicated by the different problem factors, three alternative strategies may be conceived for the development of the Angonia region. They are defined as:

Alternative 1: Internal integration;

Alternative 2: Regional linkages, and

Alternative 3: Export drive.

These are distinct alternatives conceptually, and it is possible to pursue development under any of these strategies in any region, subject to mobilization of various development resources. Selecting one for the Angonia region is not the idea here. These alternatives

may have many common elements, and one alternative may fit better to some geographic areas while another to some other areas. Also they have different phasing implications. These alternatives are presented here to clarify a range of choices and to guide the formulation of the best alternative for the Angonia region. Each alternative is described.

(1) Internal integration alternative

This alternative pursues indigenous resources-based and local market-oriented development. This is in line with an authentic approach to regional development to utilize indigenous resources by and for the benefit of local people and communities.

Enclave type communities at present would be inter-linked with neighboring communities, towns and districts within the region for more viable socio-economic activities. More commodities are produced to market outside production areas under this alternative, and in particular agricultural products are processed in neighboring towns and districts. This will help to localize value-added of agro-industrial products, minimizing leakages to other regions. Improvement of rural infrastructure would promote inter-linkages between communities, supporting transport of goods, processing and related services, and communications.

This alternative naturally fits best to local conditions. It may ensure a sustainable growth, if the indigenous resources are properly managed. This alternative, however, will not always bring about a rapid growth of the economy due mainly to a limitation on availability/development of resources and small local markets. It would not take advantage of the strategic location of the Angonia region, represented by the availability of raw materials and other goods from neighboring regions and export markets.

This alternative would maintain largely the dispersed population distribution and better rural-urban balance, as comparatively more employment opportunities may be created in rural areas and small towns by agro-processing industries and agro-related services as well as the primary production. Social cohesiveness would also be better maintained or further promoted more easily under this alternative.

(2) Regional linkages alternative

This alternative extends the first one for both resources and markets. Resources in neighboring regions would be utilized as well as indigenous ones to produce for both local and regional markets.

This alternative would promote inter-linkages between the Angonia regions and other regions. Some forerunners of activities already exist to fall under this alternative. Recently new industries were established in Tete city to process raw materials from Zambezia province: copra processed in soap and cashew processing. Some of these products are marketed outside the region. Also the newly established Angonia teacher

training school serving the entire Tete province is an example of service activities having cross-region market. Potentially the region may be a granary to supply grains throughout Central Mozambique. Improvement of regional infrastructure would be important to promote inter-regional linkages such as inter-city highways, truck/bus terminals and ports/airports. This alternative would encourage certain agglomeration of population in larger urban centers, where major processing and service activities would concentrate.

(3) Export drive alternative

This alternative pursues external market-driven development. To support this alternative, resource base would also expand further, including human and financial resources from outside.

Under this alternative, even indigenous resources are utilized for external markets. Typical economic activities are expansion of export crops, export drive for resource-based and labor-intensive industries and rapid expansion of trade, transport and communications, and private services sub-sectors. Export processing would be undertaken, utilizing raw materials and other goods from neighboring countries. International tourism and related services also fall in this category.

Products development and development of markets for new products hold a key for the Angonia region to pursue this alternative. This may necessitate substantive introduction of foreign technologies as well as foreign capital. At the same time indigenous capacity for R&D needs to be enhanced.

This alternative would encourage accelerated urbanization, and in particular concentration of urban population in Tete city and its vicinities. Provision of greatly upgraded infrastructure and urban services there is a pre-requisite to attracting foreign investments. Inter-territorial infrastructure needs to be upgraded, including highways, railways, container depots and international airports. A careful approach is necessary to deal with possible social and environmental problems under this alternative.

Some higher-order services may be established under this alternative to serve neighboring regions and countries as well as local people. They may include specialized education/training and health services, and other central functions in the context of the ZMM growth triangle initiative. This alternative would call for a higher degree of development management, as more external resources would be introduced; otherwise it may result in environmental degradation and social disruption.

3.2.2. Evaluation of development alternatives

The three development alternatives defined above are compared from economic, social, spatial/infrastructure and environmental points of view. In spatial/infrastructure aspects, implications of the alternatives to the Sena railway are mentioned. Also roles of the public

and the private sectors are indicated for the different alternatives.

(1) Economy

Typical economic activities that may be promoted under each alternative are given in Table 3.1 to further clarify the nature of each alternative. Naturally, there are many other economic activities common to all the alternatives.

The economic structure will change under any alternative, with decreasing shares of agriculture and increasing shares of industry and services. The shares of agriculture will be the largest under Alternative 1 and the smallest under Alternative 3. The economic growth is expected to be the highest under Alternative 3 and the lowest under Alternative 1. Population growth under the different alternatives may not vary so widely as the economic growth, since the labor productivity is expected to increase at progressively higher rates under Alternative 2 and further under Alternative 3. As the industry and the services sectors are more dominant under Alternatives 2 and 3, higher economic growth will be supported by comparatively smaller labor force. Still the population growth under Alternative 3 will be the highest, followed by Alternative 2, and the lowest under Alternative 1.

(2) Social aspects

Alternative 1 would generate more employment opportunities in rural areas and small towns, where most people live at present, so that social cohesiveness would be better maintained. Regional integration would be attained through increased inter-linkages between different communities without undermining their indigenous cultures. Pre-requisites would be re-vitalization of livelihood of local communities and further establishment of viable economic activities to be supported by improved provision of basic health and education services as well as access to market places.

Alternative 2 would attain a higher level of integration within the region and stronger linkages with neighboring regions. Both in- and out-migration would increase under more active socio-economic interactions between the regions. New urban communities are expected to be created in secondary towns, where better social service facilities should be provided to serve rural people in their respective hinterlands as well.

Under Alternative 3, high growth of population and its concentration in Tete city and its vicinities would occur, causing some social problems such as disruption of traditional cultures and family value. Also some communicable diseases including HIV/AIDS, and undesirable habits may spread due to increasing in-immigrants and high population concentration. Value development and advanced social services would be part of this alternative to deal with these potential social problems.

Table 3.1. Typical Economic Activities under Alternative Strategies

	Internal integration	Regional linkages	Export drive
Agriculture	<ul style="list-style-type: none"> • Increase in productivity of existing crops -- maize, potatoes, etc. • Small irrigation with community initiative • Integrated farming by small farmers (Angonia highland) • Livestock promotion through disease control and improved veterinary services 	<ul style="list-style-type: none"> • Expansion of grains production • Expansion of areas for crops to be processed -- oil crops, etc. • Introduction of milking cattle • Small livestock production (Zambezi lowland) 	<ul style="list-style-type: none"> • Crop diversification in general • Production of export crops -- high value vegetables, fruits, exotic crops • Dairy cattle production
Mining	<ul style="list-style-type: none"> • Moatize coal for local use and briquettes manufacturing • Construction materials • Quarrying for gabions, etc. 	<ul style="list-style-type: none"> • Moatize coal for domestic market • Construction materials for domestic market • Production of apatite, graphite, cement raw materials 	<ul style="list-style-type: none"> • Moatize coal for export • Construction materials for neighboring countries • Exploration of copper, rare earth materials
Manufacturing	<ul style="list-style-type: none"> • Simple agro-processing on-farm or in service urban centers • Coal briquette manufacturing • Handicrafts 	<ul style="list-style-type: none"> • Processing of raw materials from other regions -- copra, cashew, fruit juice • Agro-processing for other regions -- cereal products, milk products 	<ul style="list-style-type: none"> • Canned/bottled food for export • Frozen meat, dairy products • Iron and steel for neighboring countries
Services	<ul style="list-style-type: none"> • Agro-related services • Social services to satisfy basic human needs 	<ul style="list-style-type: none"> • Inter-regional trade and related services • Domestic tourism related services • Regional banking services 	<ul style="list-style-type: none"> • International trade and related services • International tourism related services • Higher order services, such as R&D, advanced medical care, etc. • International financial services

Source: JICA Study Team

(3) Environmental aspects

Under Alternative 1, indigenous resources will be utilized by and for the benefit of local people and communities. If local people are well organized and motivated, environmental effects of this alternative will be manageable. Sustainable capacity of the environment needs to be restored through proper watershed management, and sound practice to enhance agriculture productivity promoted under this alternative.

More agro-processing activities of larger scale based on raw materials from other regions will be established in the region under Alternative 2. They tend to capitalize on cheap and abundant industrial water and hydropower available in the region. These and other resource-based industries may cause some industrial pollution.

Expansion of export crops under Alternative 3 may involve some environmental problems such as soil degradation. Proper land use and management with alternative farming technologies as well as proper use of fertilizer and agro-chemicals need to be undertaken. The high population pressure may cause a range of environmental problems in Tete city and its vicinities such as water pollution, solid waste dumping and littering, and squatting. Solving these problems may require large development resources to be devoted to these areas, resulting in the neglect of rural environment.

(4) Spatial/infrastructure aspects

Under Alternative 1, rural communities will be linked to small towns in respective vicinities for marketing/processing of their agro-products and provision of various services. Under Alternative 2, secondary towns will be linked to Tete city, and inter-regional links will develop from both of them. Under Alternative 3, Tete city and its vicinities will become a regional center within a broader context linked to major urban centers in neighboring regions and countries.

Transport, communications and other infrastructure will develop to support the regional development under different alternatives. Various rural infrastructure will be more important under Alternative 1, inter-regional transport and communications infrastructure will be much improved under Alternative 2, and inter-territorial infrastructure will be upgraded for Alternative 3. The restoration of the Sena railway will not be justified for Alternative 1. Low level rehabilitation of the railway may be justifiable for Alternative 2. Under Alternative 3, the railway may be fully restored, and even further extension to link with Malawi may be justified.

(5) Development management

Improved development management is desirable to pursue any of the development alternatives. For Alternative 1, strengthening development administration at the local level would be essential, to meet the basic need of local communities supported by local

participation on a broad base. In fact, resource management by and for the benefit of local people and communities is the basic idea of this alternative.

To pursue Alternative 2, broader observation would be necessary to identify development opportunities combining resources in neighboring regions with indigenous ones. Development administration may need to be strengthened at the provincial and regional levels, combined with guidance to be provided to local administrations and stronger motivation to be enhanced among local people.

Alternative 3 would call for mobilizing development resources from neighboring regions and other countries to combine them with domestic resources. To guide such a development under a clear and coherent vision, the stronger initiative by the Central Government may be required to support the local administrations, the provincial government and local communities. A higher degree of development management would be required to deal with both domestic and international issues involved in large amount of resources without causing adverse effects on the people of the region and the Country such as environmental degradation and social disruption.

3.3. Basic Strategy for Angonia Regional Development

3.3.1 Strategic considerations

Three alternative strategies have been presented to clarify the range of choices and options for the Angonia regional development. As stated earlier, one strategy may fit better to some areas, while another to some other areas. One strategy may be adopted more easily for the short to the medium terms, while another may not be applied fully during initial phases.

The Angonia regional development is to be pursued by combining favorable elements of the alternative strategies in time and space for the balanced development between economic, social and environmental sectors. Considerations in combining various strategic elements are locational conditions, development phasing, existing development policies, and existing and future institutional set-ups for regional development planning and administration.

Given the low level of economic activities and the enclave type communities, the initial Angonia regional development will be pursued largely under the internal integration strategy. Local communities are encouraged to organize their people and produce agricultural goods for marketing and processing outside their respective communities. At the same time, existing regional linkages would be further developed mainly in Tete city. Export production will be limited to be in a small scale and in a few towns near the border during the initial stage.

In the subsequent stage, regional linkages will be fully exploited in the secondary and the

tertiary industries. More industries will be established in Tete city and its vicinities to process raw materials from the neighbouring provinces as well as indigenous resources. In addition, to the new Angonia teacher training school, improved social facilities for education, skill development and health care will be provided to serve the entire Tete province or even beyond the province. In fact, Tete city with its vicinities is expected to become a functional capital of the entire central Mozambique.

Export drive will be undertaken in steps after the initial internal integration strategy attains some success. It may start with strengthening of a few existing crops such as maize, potatoes and fruits. Productivity will be increased, quality improved, and price competitiveness enhanced through small scale irrigation, improved use of input and better farm management to establish/strengthen niche markets in neighbouring countries. New export products will develop subsequently such as diversified industrial crops, agro-processed products, coal and coal-based products and construction materials.

Internal integration is the essential condition for the Angonia region to pursue self-reliant and sustainable development, and thus this strategy will be fully applied to the Angonia regional development from the initial stage. Regional linkages will also be exploited from the beginning, but this strategy may give way to the export drive strategy as the Angonia region is fully integrated for sustainable development. Export drive should apply mainly to the neighbouring countries, and full application of this strategy is subject to the attainment of a high level of development management.

3.3.2. Basic strategy

The Angonia regional development will start with the internal integration, utilizing existing regional linkages and further developing them, and undertake the export drive in step. Two-pronged strategy for spatial development may support the Angonia regional development. Under this strategy, improvement of rural infrastructure for internal integration and upgrading of inter-regional and international infrastructure will be undertaken in a complementary manner.

Outward-oriented production at different levels will support the phased development of the Angonia region. First, local communities are encouraged to produce agricultural goods for marketing and processing outside their respective communities in line with the internal integration. Such activities will be broadened and diversified progressively for regional and export markets.

Development administration needs to be enhanced at different levels to support the Angonia regional development. For the internal integration and the regional linkages strategy, capacities of local administrations and the Tete provincial government should be greatly enhanced as well as local participation in line with the Government policy. A full

export drive is subject to the Government initiative that may be effected through GPZ.

Basic strategy for the Angonia regional development is established with the three components described above: two-prong strategy for spatial development, outward-oriented production at different levels, and enhancement of development administration at the local/regional levels. These correspond also to the three problem factors identified by the problem structure analysis: (1) weak development administration, (2) delay in development of basic infrastructures, and (3) enclave type communities with minimal linkages. Each component is further clarified.

(1) Strengthening the spatial structure

At present, basic infrastructure is grossly inadequate in the dominant rural area of the Study Area. To improve the situation in a cost-effective way, two directions should be pursued. The first direction is accelerated urbanization. The urbanization in the Study Area is not only inevitable but also desirable to utilize limited development resources to serve the population dispersed at present. It should be guided properly through the provision of various urban infrastructure and facilities.

The second direction is selective strengthening of rural infrastructure. To improve the social services delivery for the majority of rural people, improvement of rural infrastructure needs to be associated with development of qualified service personnel. While more qualified service personnel would be trained, their deployment in rural areas is subject to the provision of proper housing and other benefits. Therefore, efforts to improve rural infrastructure should be taken in their entirety and concentrated strategically in selected rural service centers to change the settlement pattern.

These improvements of infrastructure in urban and rural areas should be part of strengthening the spatial structure for the Angonia regional development as a whole. They should be in line with the upgrading of inter-regional and international transport infrastructure. Conversely, the improvement of basic infrastructure in rural areas and the accelerated urbanization should take advantage of the inter-regional and international transport infrastructure upgrading. The latter should cover highways upgrading, inland container depots, bus/truck terminals, river transport, international airport and the railway.

(2) Promoting outward-oriented production

At present, most small farmers do not have strong motivation to increase their production beyond their subsistence levels, as marketing opportunities are limited. Most of them are in subordinate position to small traders coming from outside to purchase their meager surplus at low prices and to supply basic commodities. To make fundamental changes to this basic structure, outward-oriented production should be promoted.

Small farmers should be organized to produce various products, existing or new, to market

outside their communities, districts or even region/country. Agricultural extension and other support services, such as market information and agricultural credit, need to be provided to organized farmers. As external markets are developed, measures should be taken to increase agricultural productivity such as irrigation, use of improved seed and fertilizer, introduction of better implements, and mechanization at their initiative.

Outward-oriented production should be promoted in other sectors as well. The Study Area should take advantage of international and inter-regional transit move of commodities, and process raw materials and intermediate goods from other regions/countries into final products for marketing outside. This kind of export processing should increase in the Study Area. Other resource-based industries should produce for external markets. Moreover, some higher-order services may be established in the Study Area, most likely in Tete city, to serve not only local people but people from neighboring countries, such as advanced health care and research, higher education, and international tourism related services.

(3) **Enhancing development administration at regional/local levels**

Development planning and administration should be much strengthened at the local level. This is a long-term goal in line with the government policy for decentralization, and cannot be realized in the short to medium term, given the very weak financial and administrative capacities of local administrations. These functions should be strengthened first at the provincial or the regional level, and GPZ, in cooperation with the provincial government of Tete, is in the best position for the Study Area.

The following are among the functions to be examined for strengthening at the regional and the local levels:

- urban planning and management within the regional development context to support the accelerated urbanization,
- water resources development and management,
- marketing and investment promotion, including a one stop service function for investors,
- planning and implementation of livelihood development projects in cooperation with local administrations,
- coordination of training activities for local enterprises, and conduct of training for local planning, environmental management, and social services delivery, and
- advisory for local taxation system, fund procurement, and financial management of local administrations.

3.4. Development Scenario with Phasing

The Angonia regional development strategy is to combine in time and space favorable

elements of the three strategies: internal integration, regional linkages and export drive. The Angonia regional development will be realized by shifting emphasis on different strategic elements along with expansion of resource capacities and institutional development (Figure 3.2).

Figure 3.2. Shifting Emphasis of Basic Strategy for Angonia Regional Development

Basic strategy	Emphasis	
	Short to medium term	Medium to long term
Spatial structure strengthening	Strengthening Tete city and its vicinities Creating rural service centers	Promoting intra- and inter-regional linkages
Outward-oriented production	Export processing in and around Tete city Promoting economic linkages among enclave type communities	Promoting export drive
Development administration enhancement	Strengthening GPZ and Tete provincial government for development planning and management	Substantiating localization and local autonomy

Sequence of activities to develop and events to take place over the planning period are described by phase in this section as the development scenario for the Angonia region. For this purpose, the planning period is divided into three phases: Phase 1 up to the year 2010, Phase 2 for 2011-20, and Phase 3 after 2021. Expected performance of the Angonia region in each phase is described.

3.4.1. Phase 1: up to 2010

(1) Overview

The Angonia regional development during this phase will be undertaken primarily under Strategy 1: internal integration, with increasing activities under Strategy 2: regional linkages mainly in Tete city and its vicinities and limited export production near the border with Malawi and Zambia. The internal integration will start with inter-linking of enclave type communities with neighboring communities and towns for more viable socio-economic interactions. Subsequently, the level of integration will be enhanced in steps to the district and inter-district, and to the region as a whole. Such integration will strengthen some regional linkages for certain commodities and services through expanding raw materials base and/or market.

As part of the internal integration strategy, efforts should be made to protect and enhance social value and environmental quality. Returned refugees and civil war victims will be

assimilated in respective communities with proper livelihood or economic activities to support common interests of their communities. Land tenure should be clearly established for them as well as other community members in such a way to encourage community-based resource and environmental management. Traditional authorities and some social organizations may be re-vitalized to promote social cohesiveness and effective resources management.

Institutional development is vital to support the Angonia regional development during this phase. Capacities of GPZ and the Tete provincial government should be enhanced for development planning and management along with increased people's participation and private sector involvement. GPZ may become an implementing agency for projects in certain sectors to be carried out by the local initiative and people's participation. Existing incentive measures for private investors in the Zambezi river basin should be streamlined into a more competitive package of measures and promulgated. For the Tete-Moatize core urban area, a new type of development management should be experimented with public-private partnership in the form of a development corporation or the like.

(2) Socio-economy

Agricultural productivity will increase steadily during this phase through increasing use of improved seed and fertilizer for maize, potatoes and other traditional crops, development of small irrigation schemes, integrated farming in the Angonia highland, and disease control and improved veterinary services for cattle in the Zambezi lowland. A few cash crops will be newly established through organizing farmers and market development as well as extension services. Small livestock production will be established in areas where the procurement of supplemental feed is easier. Farmers' associations will be promoted for various purposes including procurement of agricultural input, organized or contract farming, processing and marketing.

Production of Moatize coal will increase steadily for local use and export to neighboring countries. Coal briquettes manufacturing will start, and other coal products will be developed. A systematic exploration program will be initiated for more promising minerals including copper, graphite and apatite. Production of construction materials will increase as the regional economy grows, and diversify beyond simple quarrying and brick manufacturing. Gabions will be produced with locally available raw materials and skills for various uses. Processing activities based on raw materials from neighboring regions will diversify, and some of them will market outside the region as well. New agro-processing and construction materials industries will be established in the second half of this phase based on locally available materials.

Border trade will expand through formalizing informal activities, and related services will develop such as transport, warehousing, banking and export services. Additional services

will be induced as agricultural production increases and diversifies, and new processing industries establish. As maize and wheat production increases, major grain storage facilities will be established and operated by organized farmers for more proactive marketing and for price stabilization. Some farmers' associations may offer credit for small holders. Various forms of community-based health services will develop to complement the formal health services. The Angonia agricultural training center and the Institute of Mine and Geology will be strengthened to support new economic activities in the respective sectors, and another major education/training institute may be established to respond to emerging opportunities.

(3) Spatial development

In line with the internal integration strategy, rural infrastructure will be selectively improved in areas of high potentials. Rural roads, water supply, electricity and telecommunications will be improved together with social facilities by an integrated rural development approach for selected areas in the Zambezi lowland to create viable rural service centers. Some of the rural service centers will be linked in steps with urban centers in upper tiers of settlement hierarchy for further integration of districts' and region's socio-economy.

Tete city, as the regional center, will start to develop rapidly supported by accelerated improvement of key infrastructure such as water supply, telecommunications, electricity and urban roads. In the Tete-Moatize core urban area, sites and areas for key facilities will start to be prepared such as industrial estates, bus terminal, container depot, expansion area for the airport, and housing, in accordance with a development plan to be prepared following the Angonia regional development master plan.

Another major urban area will develop centering on Ulongue to serve the Angonia highland. A full set of urban infrastructure will be provided. In addition to the selective improvement of rural roads as mentioned above, secondary roads will be improved further to ensure access to all the district and sub-district capitals under all weather conditions.

All the preparatory works for the low cost rehabilitation of the Sena railway up to Moatize will be completed during Phase 1, and the construction of the Dongo-Vila Nova section will be undertaken as part of the low level development of the main line to Malawi. Other options will also be studied in detail, including a high-grade rail link between Moatize and Tete city, introduction of passenger services, and a new line from Cambulatsitsi to Blantyre.

3.4.2. Phase 2: 2011–2020

(1) Overview

By the beginning of this phase, rural communities will have been vitalized, regional linkages strengthened through Tete city and its vicinities, and export production started to

expand. During this phase, export drive for production and services will accelerate under Strategy 3, rapidly surpassing economic activities utilizing regional linkages. Economic expansion will be driven increasingly by active interactions with neighboring countries.

Local authorities and social organizations revitalized during Phase 1 will be strengthened with application of state-of-the-art management techniques as well as increased membership and expanded base of socio-economic activities. Use of economic incentives for effective resources and environmental management is an example of such management techniques. Management organizations will extend beyond each community to allow watershed management by a river basin-oriented approach.

Regional development by public-private partnership will be further substantiated during this phase. This applies particularly to human resources development and information services. Roles of the private sector will increase throughout this phase for education, skill training, research and development, and exchange and dissemination of information on business opportunities and markets. GPZ will accumulate experiences as an implementing agency, and specialized private firms may spin out from GPZ.

(2) Socio-economy

High productivity agriculture will be established during this phase throughout the Angonia region. Maize will be produced dominantly by a high input-high yield mode. Based on experiences on crop cycles, on-farm water management and marketing accumulated through small irrigation schemes, a few large irrigation schemes will be developed, each covering several thousand hectare area. Livestock activities will develop rapidly during this phase through integrated farming by small holders in the Angonia highland and successful disease control for cattle in the Zambezi lowland. Milking cattle will be introduced in the Angonia highland, and small livestock production will also become popular in the Zambezi lowland. The new cash crops established during Phase 1 will be expanded, and a few additional cash crops may be introduced.

Production of Moatize coal will reach a maximum level during this phase, predominantly for export through the Sena railway and the Beira port. As production of briquettes increases and income levels rise, use of firewood and charcoal will mostly be replaced by the briquette. Production of other minerals may start during this phase such as apatite, graphite and cement raw materials, and production of construction materials will further diversify to include high value products such as ornamental tiles, marble slabs and dimension stones. Export processing will develop by utilizing raw materials and intermediate goods from neighboring countries. Some existing agro-processing may also benefit from increased raw materials from these countries.

Border trade and related services will further develop as border facilities and key transport infrastructure are improved. A sort of general trading house may be established by public-

private partnership for more comprehensive services. Regional financial services will expand to cover long-term credits and equity finance. More successful schemes of community-based health services initiated during Phase 1 will be extended to cover more communities. Skill training and R&D will be undertaken increasingly by private firms. Domestic tourism-related services will further deepen the service sector structure in the Angonia region.

(3) Spatial development

Vitalized rural communities will be integrated with secondary cities for a higher level of internal integration, and regional linkages centering around Tete city and its vicinities strengthened during the early part of Phase 2. Linkages between secondary cities and Tete city, and among secondary cities will be strengthened throughout this phase. Also inter-territorial infrastructure will be upgraded during this phase to support the increasing export drive.

Tete city will be established fully as the regional center with multiple functions, including those to support the export drive such as expanded financial services and private/business services. The Tete-Moatize core urban area will develop rapidly to attract and accommodate the increasing number foreign and domestic investors from outside.

The new urban area in the Angonia highland will establish another base to support the export drive specialized particularly in agriculture, agro-processing and agro-services. Secondary and other roads will be continuously improved during this phase to strengthen linkages among district and sub-district capitals for regional integration.

The low cost rehabilitation of the Sena railway will be completed during the first half of this phase. The high-grade link between Moatize and Tete city will be established with passenger services in the second half. Detailed design of the new line to Blantyre will be undertaken, and the initial construction may start.

3.4.3. Phase 3: after 2021

(1) Overview

The Angonia region will establish itself as a coherent region with diversified socio-economic activities and dynamic interactions with the neighboring regions and countries, and open to the rest of the world. Development will be led primarily by the private sector initiative while the Government will deal with inter-territorial issues such as trade arrangements, alliances for global environmental protection and disease control, and management of the international river basin. The private sector will take part increasingly in the provision of social services and also in the implementation of some infrastructure by BOT/BOO or other schemes.

(2) Socio-economy

With much increased production of maize and wheat and effective distribution system with strategically located grain storage facilities, the Angonia region will establish itself as a granary of Central Mozambique. Rice production initiated during Phase 2 under large irrigation schemes may also contribute to this. The cash crops fully established during Phase 2 will support the export drive, and a few of them may find larger international markets. The region will become self-sufficient in livestock products, including dairy products, and some excess will be exported to the neighboring regions and countries.

The Moatize coal will continue to operate at the maximum level, and a mine-mouth coal-fired thermal power plant will be established. Together with large-scale hydropower plants on the Zambezi mainstream, developed during Phase 1-Phase 2, the Angonia region will establish itself as a power export center of the Southern Africa. Specialized manufactured goods will fully develop their respective markets, such as processed mineral products, high quality construction materials, and agro-processing and export processing goods.

The Angonia region will provide high-grade social services for the neighboring regions and countries as well. In addition to the existing Angonia agricultural training center, the Institute of Mine and Geology, and the Tete provincial hospital, to be upgraded through Phase 1-Phase 2, additional institutes and facilities established during Phase 2 will become operational. The region may also be equipped with some center functions within the context of the Zambia-Malawi-Mozambique growth triangle (ZMM-GT) initiative such as centers for environmental education and communicable diseases protection. International tourism-related services will contribute to further diversification of services sector activities.

(3) Spatial development

Physical links within the region will be completed, including rural access to remote villages. Even tertiary roads will be improved to all-weather roads. All the key inter-territorial infrastructure will have been completed, including the Tete international airport, the Sena railway, a new bridge on the Zambezi river, a container depot, and a bus terminal for international services. A local air network will be operational, linking major cities in the neighboring countries as well as those in other regions of Central Mozambique.

Tete city will establish itself as a functional capital of Central Mozambique, equipped also with center functions of the ZMM-GT, some high-grade social services, and gateway functions for international tourism. Other secondary urban centers will be equipped with specialized functions respectively within the clearly established hierarchical structure of urban centers.

Improvement of the Sena railway will continue through the previous phase. The new line

to Blantyre will be constructed. The line will constitute important part of international tourism circuits combining attractions in Malawi, the Cahora Bassa resort and Zambezi river cruising.

Chapter 4. Development Frameworks

4.1. Socio-economic Framework

4.1.1. Macro socio-economic projections

A socio-economic framework is composed of the population and economic performance of the Study Area projected to the year 2025. It serves the following purposes.

- To provide a basis to scrutinize the growth potential of each production sector: agriculture, industry and services.
- To provide a planning framework for infrastructure development.
- To provide a basis for identifying the need for projects and measures.

The socio-economic framework presented hereunder is worked out by a macroscopic approach, mainly based on the past trend in Mozambique and experiences in other developing countries.

(1) Population

Population of Mozambique, Tete province and the Study Area

The populations of Mozambique, Tete province and the Study Area are projected as shown in Table 4.1.

**Table 4.1. Population of Mozambique, Tete Province and the Study Area
Projected up to 2025**

Year	Mozambique	Tete Province	Study Area
1997	15,278	1,145	711
2000	16,405	1,237	762
2005	18,470	1,406	858
2010	20,795	1,599	995
2015	23,413	1,817	1,152
2020	26,361	2,066	1,316
2025	29,680	2,349	1,504

Source: JICA Study Team.

The population growth rates applied are 2.40% per year and 2.60% per year respectively for Mozambique and Tete province. These growth rates are taken from "Annual Population Projection by Province for 1997-2010" by the National Statistical Institute. The annual average growth rates applied to the Study Area are 2.32% for 1997-2000, 2.40% for 2000-2005, 3.00% for 2005-2015 and 2.70% for 2015-2025. The Tete province's natural population growth rate in 1997 at 2.32% was applied to estimate the population of the Study Area in 2000. The rates are assumed to grow to 2.40% in the next five years by initiation of various development projects resulting in attraction of

population from outside. This tendency would accelerate in the subsequent 2005-2015 period as the initial projects start taking effects and development activities expand and deepen. The population growth rate in this period, therefore, is set higher at 3.00% per year. The next ten years between 2015 and 2025 will see the population growth toward stabilization. The population will keep growing at this rate with in-migration continuing constantly as the projects previously started are in full operation and institutional measures introduced functioning effectively.

Population of the Study Area by district and urban-rural area

The population of the Study Area is projected by district and urban-rural area until 2025 as summarized in Table 4.2 (details in Table 4.3).

**Table 4.2. Population of the Study Area by District and Urban-Rural Area
Projected up to 2025**

Area	(Unit: 1,000)	
	2000	2025
Study Area	761.6	1,504.2
Tete City	109.2	503.0
Angonia	265.6	407.5
Chifunde	51.9	80.1
Chiuta	54.0	83.1
Macanga	49.8	76.1
Moatize	116.9	179.2
Tsangano	114.1	175.2
Urban Area	201.8	654.5
Rural Area	559.8	849.7

Source: JICA Study Team.

The total population of the Study Area is projected to double in 25 years. Tete city with strengthened urban functions will grow fastest, increasing its share from 14.3% in 2000 to 33.4% in 2025, an appropriate primacy level. The urbanization ratio will increase from the present 26% to 44% in 2025.

The following assumptions are applied.

- The population of Tete city will reach 500,000 in 2025. The role of Tete city needs to be expanded and strengthened to support the economic development of the Study Area and other parts of Tete province. Considering the population sizes of major cities along the Zimbabwe-Tete-Malawi corridor, 1.2 million in Harare and 234 thousand in Lilongwe, assuming a population at 500,000 in Tete city would be achievable and reasonable.
- The populations of the six districts in 2005, 2015 and 2025 will be distributed in equal proportions as in 2000.

Table 4.3. Urban and Rural Population in the Study Area in 1997, 2000, 2005, 2015, and 2025

(Unit: 1,000)

Area	1997			2000			2005			2015			2025		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
(Number in 10 ³)															
Study Area	711.0	188.4	522.6	761.6	201.8	559.8	857.5	252.8	604.7	1,152.4	406.9	745.5	1,504.2	654.5	849.7
Tete City	102.0	102.0	0.0	109.2	109.2	0.0	148.2	148.2	0.0	273.0	273.0	0.0	503.0	503.0	0.0
Angonia	248.0	21.5	226.5	265.6	23.0	242.6	288.7	26.0	262.7	357.9	33.3	324.6	407.5	37.7	369.8
Chifunde	48.5	3.3	45.2	51.9	3.5	48.4	56.7	4.0	52.7	70.4	5.1	65.3	80.1	5.7	74.4
Chiuta	50.4	12.9	37.5	54.0	13.8	40.2	58.9	15.6	43.3	73.0	20.0	53.0	83.1	22.6	60.5
Macanga	46.5	11.3	35.2	49.8	12.1	37.7	53.9	13.7	40.2	66.8	17.5	49.3	76.1	19.8	56.3
Moatize	109.1	26.6	82.5	116.9	28.4	88.5	127.0	32.1	94.9	157.4	41.1	116.3	179.2	46.5	132.7
Tsangano	106.6	10.9	95.7	114.1	11.7	102.4	124.1	13.3	110.9	153.9	16.9	137.0	175.2	19.2	156.0
(Urban-Rural %)															
Study Area	100.0	26.5	73.5	100.0	26.5	73.5	100.0	29.5	70.5	100.0	35.3	64.7	100.0	43.5	56.5
Tete City	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0
Angonia	100.0	8.7	91.3	100.0	8.7	91.3	100.0	9.0	91.0	100.0	9.3	90.7	100.0	9.3	90.7
Chifunde	100.0	6.8	93.2	100.0	6.7	93.3	100.0	7.1	92.9	100.0	7.2	92.8	100.0	7.1	92.9
Chiuta	100.0	25.6	74.4	100.0	25.6	74.4	100.0	26.5	73.5	100.0	27.4	72.6	100.0	27.2	72.8
Macanga	100.0	24.3	75.7	100.0	24.4	75.7	100.0	25.4	74.6	100.0	26.2	73.8	100.0	26.0	74.0
Moatize	100.0	24.3	75.7	100.0	24.3	75.7	100.0	25.3	74.7	100.0	26.1	73.9	100.0	25.9	74.1
Tsangano	100.0	10.2	89.8	100.0	10.3	89.7	100.0	10.6	89.4	100.0	11.0	89.0	100.0	11.0	89.0

Notes: (1) According to the Tete Province's statistics, the population of the district centers in Chifunde, Chiuta and Macanga is not counted as "urban" due to the absence of some basic infrastructures. The table above counts these populations as "urban" for planning purposes. In all the districts, urban population is equal to the population of the district centers. (2) Some discrepancies are due to rounding.

Source: JICA Study Team.

- Urban population in each district will grow at 2.5% per year throughout the whole period. According to the statistics obtained from the Tete province statistical office, urban population in the Study Area is found only in Tete city and the district centers of Moatize and Angonia. The population of the district centers in Chifunde, Chiuta, Macanga and Tsangano is counted as “rural” due to lack of some key urban infrastructure. In the present study, the definition of “urban” is expanded to include the population of all the six district centers and Tete city for the planning purpose.

(2) Employment

The ratio of working age population to total population or the labor force coefficient is 49% in the Study Area, slightly lower than the national average of 51%. The labor participation ratio is 70% at the national level and the same value is assumed for the Study Area. With the population of 762,000 in 2000, the labor force in the Study Area is calculated to be 261,000. Assuming the full employment including the informal sector employment, and applying the employment structure inferred in subsection 2.1.2, the sector employment at present is calculated to be 224,000 in agriculture, 10,000 in industry, and 26,000 in services.

The labor force coefficient will increase steadily as the generation affected by the civil war is replaced by the younger generation. It is assumed to increase to 55% by 2025, following the assumption at the national level (INE, 1999). The labor participation ratio may increase or decrease depending on various factors including women’s position in the society, spread of higher education, and urbanization. No change is assumed here. Then, the labor force in the Study Area will be 580,000 in 2025. The total employment may be 550,000, consisting of 310,000 or 56% in agriculture, 60,000 or 11% in industry, and 180,000 or 33% in services. Interpolating for the intermediate years, 2010 and 2020, the employment by sector will change as shown in Table 4.4.

Table 4.4. Projected Employment by Sector in the Study Area

(Unit: 1,000)				
Year	Agriculture	Industry	Services	Total
2000	224	10	26	260
2010	253	20	52	325
2020	290	45	130	465
2025	310	60	180	550

Source: JICA Study Team.

(3) Economy

Labor productivity in the Study Area is expected to increase significantly as a result of the planned development of the Angonia regional development. Labor productivity in

agriculture will increase as more high-value crops are cultivated, better input is used for crop cultivation and livestock, and irrigation is introduced. It is assumed to increase at 2.5% per annum towards the year 2025. Labor productivity in industry and services increases usually at higher rates. This is true particularly in the Study Area, and a 3.0% annual increase is assumed for industry and 2.7% for services on an average up to 2025.

Relative labor productivity in the Study Area, inferred in subsection 2.1.2 as 100 in agriculture, 200 in industry and 400 in services, will increase accordingly. Variance in labor productivity in agriculture and industry/services will increase inevitably: 185 in agriculture, 420 in industry and 780 in services in 2025. Interpolating for the intermediate years, 2010 and 2020, the relative labor productivity by sector will change as shown in Table 4.5.

Table 4.5. Relative Labor Productivity by Sector in the Study Area

Year	Agriculture	Industry	Services
2000	100	200	400
2010	125	260	520
2020	165	360	680
2025	185	420	780

Source: JICA Study Team.

Due to the variable increase in labor productivity by sector, the economic structure will change more significantly than the employment structure. Shares in the GRDP of the Study Area will be 26% for agriculture, 11% for industry and 63% for services in 2025. The economic structure will change as shown in Table 4.6.

Table 4.6. Changes in Economic Structure of the Study Area

Year	Agriculture	Industry	Services
2000	64	6	30
2010	50	8	42
2020	31	11	58
2025	26	11	63

Source: Tables 4.4 and 4.5.

The average economic growth is calculated to be 7.7% per annum over the 25-year period, and the per capita income will grow at 4.8% per annum on average. Details of the economic growth are given in Table 4.7.

While this projected annual growth rate at 7.7% seems ambitious in general, it would be within an achievable range considering the high growth potential of the Study Area. The Study Area is endowed with a number of advantages, such as high agricultural potential with fertile soil, geographical position as a transit route between Zimbabwe, Malawi and

Zambia implying high commercial development possibilities, industrial development potential capitalizing on its mineral resources, and its low level of development at present leaving ample room for economic growth and people's firm willingness to commit themselves to development efforts. Once the constraints, physical and institutional, are removed, it would be highly possible that the Study Area's economy grows at this magnitude.

Table 4.7. Economic Growth Rates of the Study Area

(Unit: % per annum)

Period	GRDP	Agriculture	Industry	Services
2000-2010	6.3	3.5	10.0	10.0
2010-2020	9.1	4.2	12.0	12.6
2020-2025	7.9	3.7	9.2	9.7
2000-2025	7.7	3.8	10.7	11.0

Source: Tables 4.4 and 4.5.

4.1.2. Micro sector estimates

The macro framework derived above is compared with the likely growth in the key production sectors: agriculture and industry. The purpose of this analysis is to assess the feasibility of the projected growth on the basis of detailed analysis of each sector.

(1) Agriculture

Crop value-added

The value-added of crop cultivation is calculated for selected crops from available information on production, farm-gate prices and input costs. Calculation for maize, the most dominant crop, is shown in Table 4.8.

Table 4.8. Value-added Estimate and Projection for Maize

	2000	2025	Notes
Farm-gate price	Mt. 2,000,000/ton	Mt. 2,000,000/ton	As of December, 2000
Production costs	Mt. 787,500/ha ^(a)	Mt. 1,962,000/ha	^(a) Only labor cost
Yields	1.0t/ha	2.5t/ha	
Net production value	Mt. 1,212,500/ha	Mt. 3,038,000/ha	
Unit value-added	Mt. 2,000,000/ton	Mt. 1,530,200/ton	
Annual production	132,068 ton	503,627/ton ^(b)	^(b) Projection by JICA Study Team
Total value-added	Mt. 264 x 10 ⁹	Mt. 771 x 10 ⁹	

Source: JICA Study Team.

The production costs of maize in 2000 are only labor costs excluding fertilizers and agro-chemicals, and the yield is the average attained in the Study Area in 2000. The production costs in 2025 include costs of fertilizers and agro-chemicals, and the yield is the estimate by MARD for Tete province under rain-fed conditions. Thus, these estimates

and projections represent the transformation of maize production from the low input-low yield to the high input-high yield models. The following are observed.

Both the production costs and the yield will increase by 2.5 times by adopting the high input-high yield model, but unit value-added per production will decrease. Per capita consumption of maize may decrease from 230kg in 2000 to 160kg in 2025 due to diversification of diet along with income increase. The estimated maize value-added in 2000 accounts for 20.5% of the agricultural GRDP (Mt. 1,290 x 10⁹ in 2000) and 13.1% of the GRDP (Mt. 2,020 x 10⁹ in 2000) in the Study Area. The maize value-added is projected to increase at 4.4% per annum over 2000-25.

Similar calculation has been made for pulses, potatoes and tobacco. For other crops, rough estimates have been made for the present value-added, which has been projected to the year 2025 by applying plausible grown rates. The results are summarized in Table 4.9.

Table 4.9. Crop Value-added in the Angonia Region

Crop	2000	2025	Growth rate % p/a	Notes
Maize	264	771	4.4	as calculated
Other grains	30	100	4.9	
Pulses	30	48	1.9	as calculated
Potatoes	100	260	3.9	as calculated
Vegetables	50	150	4.5	
Tobacco and other cash crops	50	200	5.7	including new cash crops for 2025
Others	86	91	0.2	
Total	610	1,620	4.0	

Source: JICA Study Team.

The share of maize in the total crop value-added is 43% in 2000, while maize occupies about two-thirds of the total cultivated areas. It will increase to 48% by 2025. Other grains, potatoes and vegetables as well as tobacco are considered cash crops in the Study Area. The combined value-added of these crops will increase at 4.6% per annum over 2000-25.

Area cultivated

Following the projection above, the area cultivated under maize will increase from some 130,000ha at present to 200,000ha in 2025. This represents 54% increase at 1.74% increase per annum, which is considered quite manageable. The area cultivated under other crops may increase more rapidly as crops are diversified and new cash crops established. It may increase from some 70,000ha at present to 120,000ha in 2025, representing 2.18% average annual increase. This seemingly modest increase in cultivated land will allow several-fold increase in production due to significant yield

increases. A major factor for the yield increases of these crops is irrigation, which is practically non-existent at present. The total irrigated area may reach 50,000ha by the year 2025, corresponding to 16% of the total cultivated area.

Livestock value-added

Livestock population in the Study Area consists of 52,500 cattle, 67,300 sheep and goats, 14,000 pigs, and 442,800 poultry in 2000 (Tete Provincial Directorate of Agriculture and Rural Development). This is converted to the annual meat production by assuming the period of maturity for sales, loss ratio and dressing ratio. Prices of meat products are taken from statistics and the socio-economic survey. Production value for livestock products is calculated based on these data. Since only labor costs are involved in the processing of livestock, the production value is practically equivalent to the value-added as summarized in Table 4.10.

Table 4.10. Estimated Livestock Production and Value-added in the Study Area, 2000

Livestock	Population	Production (1,000 ton)	Price (Mt. million)	Value-added (Mt. billion)
Cattle	52,500	2,940	68.8	202,272
Goat and sheep	67,300	673	39.7	26,718
Hog	14,000	628	13.9	8,729
Poultry	442,800	1,993	8.5	16,940
Total				254,659

Source: JICA Study Team.

Livestock population is projected to increase at 7.0% per annum until the year 2025. This high rate of increase is necessary to ensure self-sufficiency in meat products by 2025 at much higher per capita consumption assumed. With such increase, substantial export margins will be generated by 2025 for beef (43% of the total production), goat meat and mutton (18%), and poultry (16%). Livestock value-added in 2025 is calculated accordingly (Table 4.11).

Table 4.11. Projected Livestock Production and Value-added in the Study Area in 2025

Livestock	Population	Production (1,000 ton)	Price (Mt. million)	Production value (Mt. billion)	Value-added ratio (%)	Value-added (Mt. billion)
Cattle	285,200	15,969	68.8	1,098,832	90	988,949
Goat and sheep	365,500	3,655	39.7	145,162	90	130,646
Hog	75,800	3,410	13.9	47,420	80	37,936
Poultry	2,403,300	10,815	8.5	91,477	60	54,886
Total				1,382,891		1,212,417

Source: JICA Study Team.

Agricultural value-added

Value-added of other components of agriculture is difficult to estimate due to lack of data. Applying the per capita consumption of meat in Tete province, the meat consumption in the Study Area is estimated at 1,581 tons for beef and veal, 75 tons for mutton and goat meat, 527 tons for pork, and 1,431 tons for poultry. This may correspond to value-added of some Mt. 130×10^9 , about a half of the estimate above. Clearly a large amount of home consumption and informal transactions elude the value-added estimate. This applies also to various fruits produced in large quantities mostly for self-consumption. These are not included in the crop value-added estimate presented above. Moreover, fishery and forestry activities, through minor, are almost exclusively informal.

It is judged that minor activities including crop cultivation for staple crops, fruits and vegetables, simple on-farm processing, fishery, and forestry account for at least 30% of the agricultural GRDP. The agricultural GRDP is roughly projected by component to the year 2025 as shown in Table 4.12.

Table 4.12. Agricultural Value-Added in the Angonia Region

(Unit: Mt. billion in 2000 prices)

Component	2000	2025	Growth rate 2000-25 (% p.a.)
Crops	610	1,620	4.0
Livestock	255	1,210	6.4
Others	425	450	0.0
Total	1,290	3,280	3.8

Source: JICA Study Team.

The growth of agriculture due to macro projections is attainable. It may be led initially by the crop cultivation subsector dominating in the Study Area, but the livestock subsector will become increasingly more important supported by large land available and increasing availability of feed.

(2) Industry

Subsector structure

Estimates of industrial value-added are constrained critically by the lack of data. Only rough estimates are made to indicate the subsector structure of industry. At present, the mining and quarrying subsector is dominated by coal, produced at more or less 20,000 tons annually. This production may correspond to the value-added of some Mt. 10×10^9 (in December 2000 prices). Other activities are mostly quarrying-related.

The manufacturing subsector is not much developed in the Study Area, but still claims the largest share. This subsector contains many informal activities in brick making, charcoal manufacturing and other simple processing. These informal sector activities combined

may have a total value-added of Mt. $5-10 \times 10^9$ although it is not counted in the manufacturing value-added. The formal manufacturing value-added should be much larger than this, by an order of magnitude.

The utilities subsector is minimal in the Study Area as water supply is limited and power generation is almost non-existent. The construction subsector employs almost the same number of workers as the manufacturing subsector in Tete province and probably also in the Study Area. Its value-added share must be much smaller in the Study Area, as the construction industry is not actually booming.

Based on the reasoning above, the industrial value-added is roughly estimated by sector to bear a total value-added of Mt. 120×10^9 for 2000. The industrial value-added may consist of Mt. 20×10^9 for mining and quarrying, Mt. 55×10^9 for manufacturing, Mt. 5×10^9 for utilities, and Mt. 40×10^9 for construction.

Value-added projection

The estimated industrial value-added by subsector is projected up to the year 2025, again very roughly. Coal production will increase at least by 100 times to some 2 million tons annually, but the value-added ratio per unit production will decline significantly due to more capital-intensive operation. A few other mineral resources will be extracted in significant quantities.

The manufacturing subsector is expected to grow steadily as its structure diversifies. The utilities subsector will expand significantly as water supply expands and large-scale energy generation starts in the Study Area. The construction subsector will grow more or less in line with the growth of the overall regional economy over the extended period of time.

Given the reasoning above, the industrial value-added is projected up to the year 2025 by sector (Table 4.13). This represents an only indicative projection to clarify the direction of development in the industrial sector.

Table 4.13. Industrial Value-added in the Angonia Region

(Unit: Mt. billion in 2000 prices)

Subsector	2000	2025	Growth rate 2000-25 (% p.a.)
Mining and quarrying	20	600	14.6
Manufacturing	55	600	10.0
Utilities	5	100	12.7
Construction	40	200	6.6
Total	120	1,500	10.7

Source: JICA Study Team.

This projected value-added probably represents conservative estimates, especially for the mining and quarrying and the manufacturing subsectors. Coal production of much larger

scale, up to 6 million tons/year, may be contemplated, and another mineral may be found to be significant through further exploration and analysis. The manufacturing value-added may be attained without the proposed iron and steel manufacturing. The informal activities will become formal to add to the total value-added. All in all, the growth of industry due to the macro projections is attainable.

4.2. Spatial Framework

Spatial development of any region is affected by various factors such as natural conditions including resource endowments, existing infrastructure facilities, existing distribution of population, economic activities and wealth, and other physical and socio-cultural factors as well as policy intervention. Three most dominant factors, that are more directly subject to planned development, are (1) distribution of settlements, (2) transportation network, and (3) land use and potentials. Land use and potentials may not pose serious constraints to the Angonia regional development as the topography is generally flat to rolling and land resources are plentiful in the Study Area. A land use framework is presented in the next sub-section. Urban and transportation systems are examined in sub-section 4.2.2 to set another framework for the spatial development of the Angonia region.

4.2.1. Land use framework

Existing land use

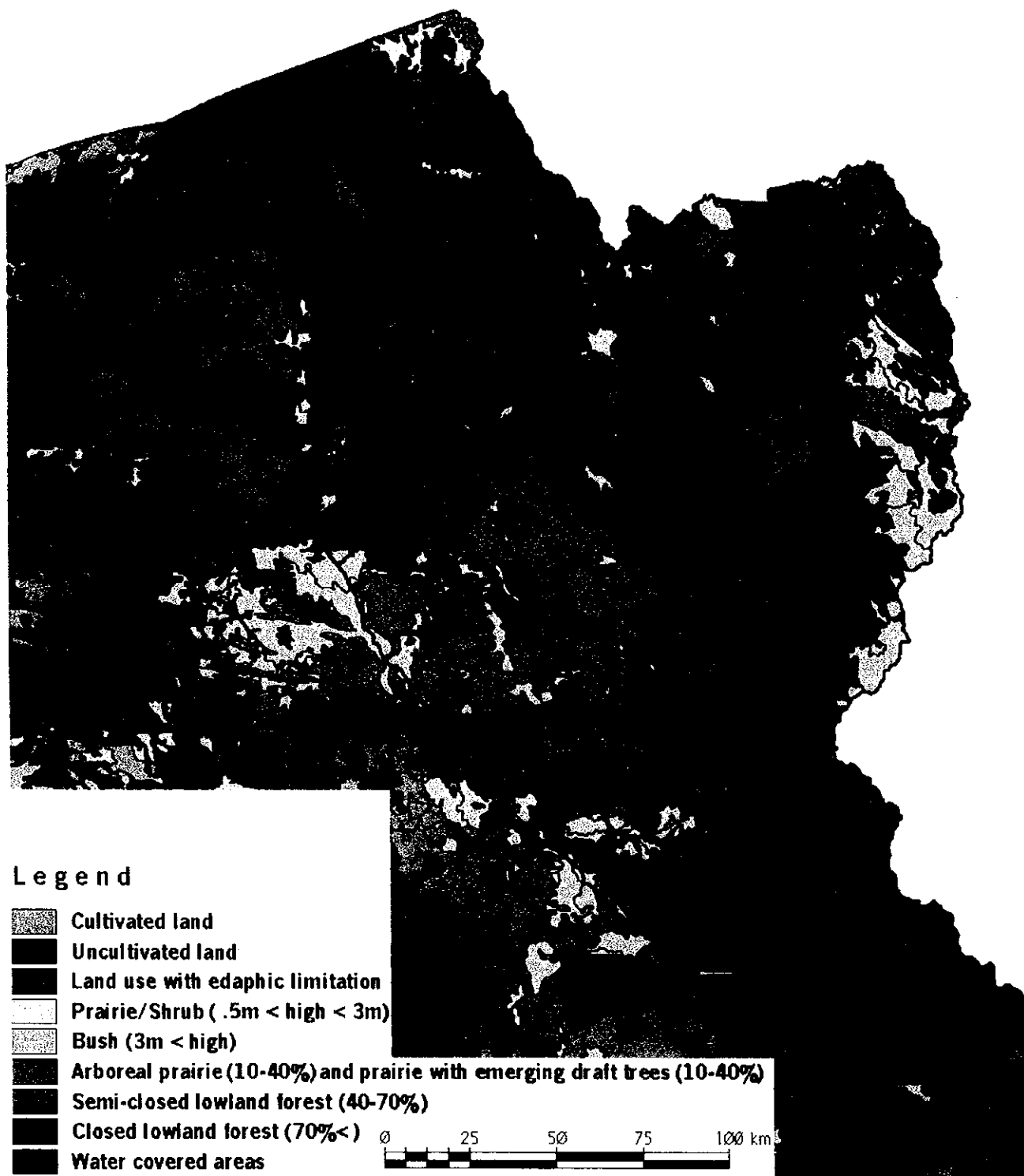
Existing land use is analyzed by using a GIS for digitized land cover maps available for the Study Area. Simplifying land use classification of the maps for the planning purpose, the existing land use in the Study Area is classified into eight categories as shown in Table 4.14 (Figure 4.1).

Table 4.14. Present Land Use in the Angonia Region

	(Unit: km ²)							
	Angonia	Chifunde	Chiuta	Macanga	Moatize	Tsangano	Tete city	Study Area
1. Cultivated land	1,670	293	72	255	124	592	65	3,071
2. Developed areas	2	0	0	1	0	0	17	20
3. Bare/degraded/flood-prone land	65	9	4	0	5	1	2	86
4. Shrubland	251	450	529	241	452	991	134	3,048
5. Bushland with varying density	373	1,032	2,851	186	517	344	24	5,327
6. Open forest	99	3,419	1,151	474	3,843	309	21	9,316
7. Other forests	757	4,303	2,509	6,040	3,450	1,424	0	18,483
8. Water areas & miscellaneous uses	43	0	9	0	38	0	23	113
Total	3,260	9,506	7,125	7,197	8,429	3,661	286	39,464

Source: GIS database.

Figure 4.1. Existing Land Use



The cultivated land occupies highland areas of Angonia and northeastern part of Tsangano, and small patches of land mostly along the main tributaries of the Luia river. The shrubland and the bushland are distributed widely in the Zambezi lowland area and also along the border with Malawi in Tsangano and Moatize.

Land capacity

Land capability for agriculture is analyzed by using a soil map. For the planning purpose, the land in the Study Area is evaluated into five classes as shown in Table 4.15. The land most suitable for intensive and diversified agriculture is found mostly in Angonia and Tsangano in the highland area. The land suitable for semi-intensive agriculture is distributed in Tsangano, Angonia, Moatize, Macanga, and Chiuta. The land in Chifunde and Tete city is suitable only for extensive agriculture. For the Study Area as a whole, 60% of the land is suitable only for extensive agriculture.

Table 4.15. Land Capability in the Angonia Region

	(Unit: km ²)							
	Angonia	Chifunde	Chiuta	Macanga	Moatize	Tsangano	Tete city	Study Area
1. Most suitable for intensive agriculture	1,744	0	179	237	61	890	0	3,111
2. Suitable for intensive agriculture	99	0	1	60	111	0	0	271
3. Suitable for semi-intensive agriculture	1,090	0	333	489	784	1,498	0	4,194
4. Suitable for extensive agriculture	96	7,477	4,482	3,797	6,220	813	287	23,172
5. Not suitable for agriculture	173	1,752	2,130	2,528	1,132	407	0	8,122
Total	3,202	9,229	7,125	7,111	8,308	3,608	287	38,870

Source: GIS database.

Framework for land use planning

A future land use plan is prepared by combing the existing land use and the land potential. Future land use may be classified broadly in the following:

- ① Diversified agricultural land,
- ② Agricultural land for intensive/semi-intensive cultivation,
- ③ Other agricultural land for semi-intensive cultivation, tree crops, and managed pasture,
- ④ Grazing land,
- ⑤ Forests,
- ⑥ Developed areas including settlements, and
- ⑦ Land for other miscellaneous uses.

Future land use may be designated for each combination of existing land use and land

potential class by constructing a land use conversion matrix as shown in Table 4.16.

Table 4.16. Land Use Conversion Matrix

Existing land use	Land use potential				
	Specialized & diversified	Intensive	Semi-intensive	Semi-extensive	Not suitable
1. Cultivated land	①	②	③	③	④
2. Developed Areas	⑥	⑥	⑥	⑥	⑥
3. Bare/degraded/flood-prone land	⑦	⑦	⑦	⑦	⑦
4. Shrubland	①	②	③	③	④
5. Bushland	①	②	③	③/④	④/⑤
6. Open forest	②	③	④	④	⑤
7. Other forests	②	⑤	⑤	⑤	⑤
8. Water areas	⑦	⑦	⑦	⑦	⑦

Source: JICA Study Team

Future land use in the Study Area is summarized in Table 4.17. To clarify areas where land development efforts should be concentrated in years to come, another map has been prepared. Figure 4.2 highlights areas where land use should be converted, together with areas to be cultivated continually and areas to be protected and enhanced for forests.

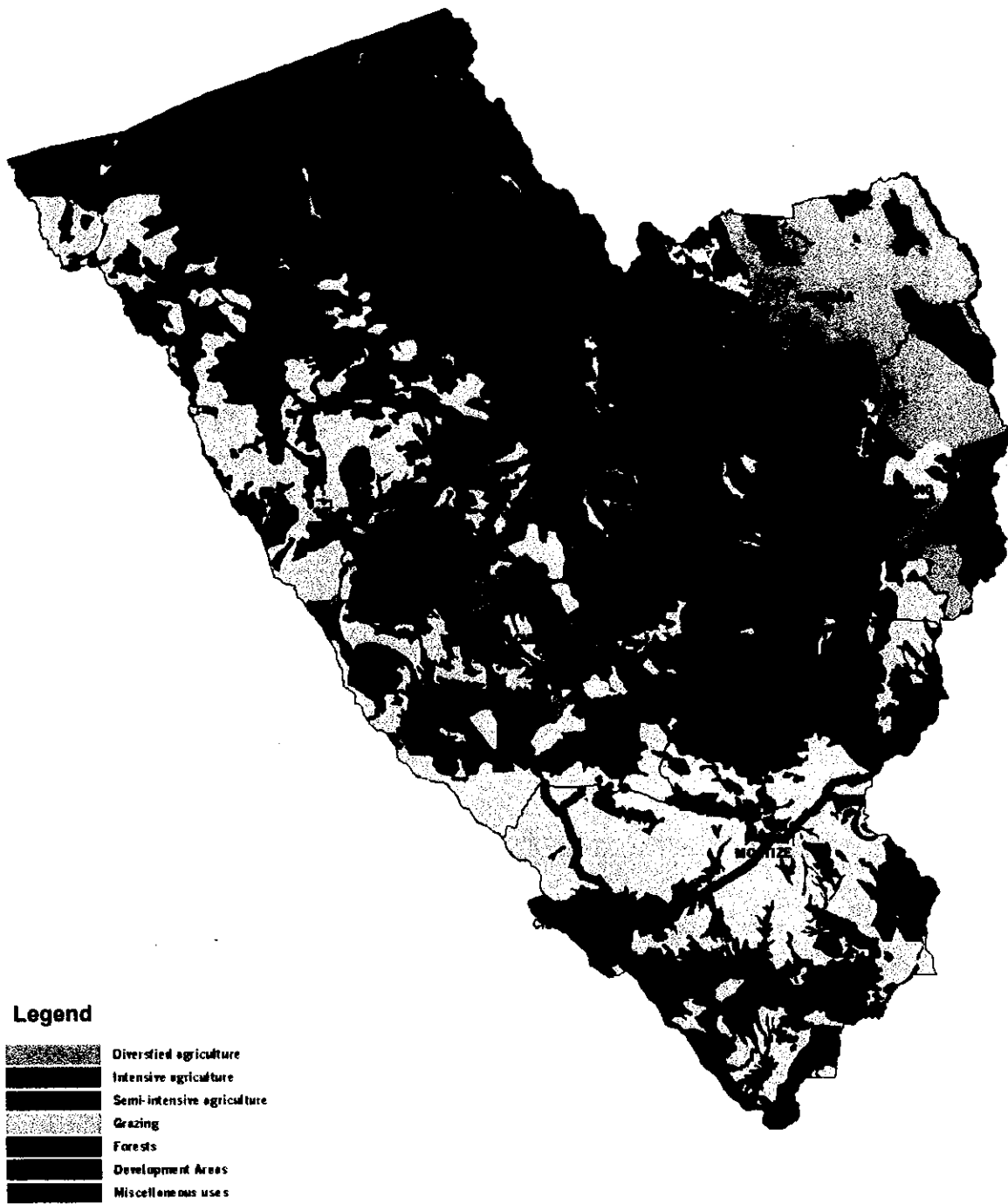
Most productive land for diversified agriculture is found mostly in Angonia and Tsangano, occupying in total 2,546km² or 6.7% of the total land area. Less productive land for intensive or semi-intensive agriculture occupies 6,253km², accounting for 16.3%, found dominantly in Chiuta, Chifunde and Moatize. Extensive grazing land occupying 26.2% of the total area is found also in these districts. Forest areas cover almost a half of the land in the Study Area.

Table 4.17. Future Land Use in the Angonia Region

								(Unit: km ²)	
	Angonia	Chifunde	Chiuta	Macanga	Moatize	Tsangano	Tete city	Total	Share (%)
Diversified agriculture	1,620	0	82	22	0	822	0	2,546	6.7
Intensive agriculture	212	4	99	244	55	37	0	651	1.7
Semi-intensive agriculture	90	1,555	2,242	489	850	248	128	5,602	14.7
Grazing land	393	2,962	2,014	457	3,485	691	21	10,023	26.2
Forests	713	4,703	2,676	5,533	3,851	1,611	0	19,087	49.9
Development areas	20	3	11	10	23	10	126	203	0.5
Miscellaneous uses	72	9	10	0	7	1	25	124	0.3
Total	3,120	9,236	7,134	6,755	8,271	3,420	300	38,236	100.0

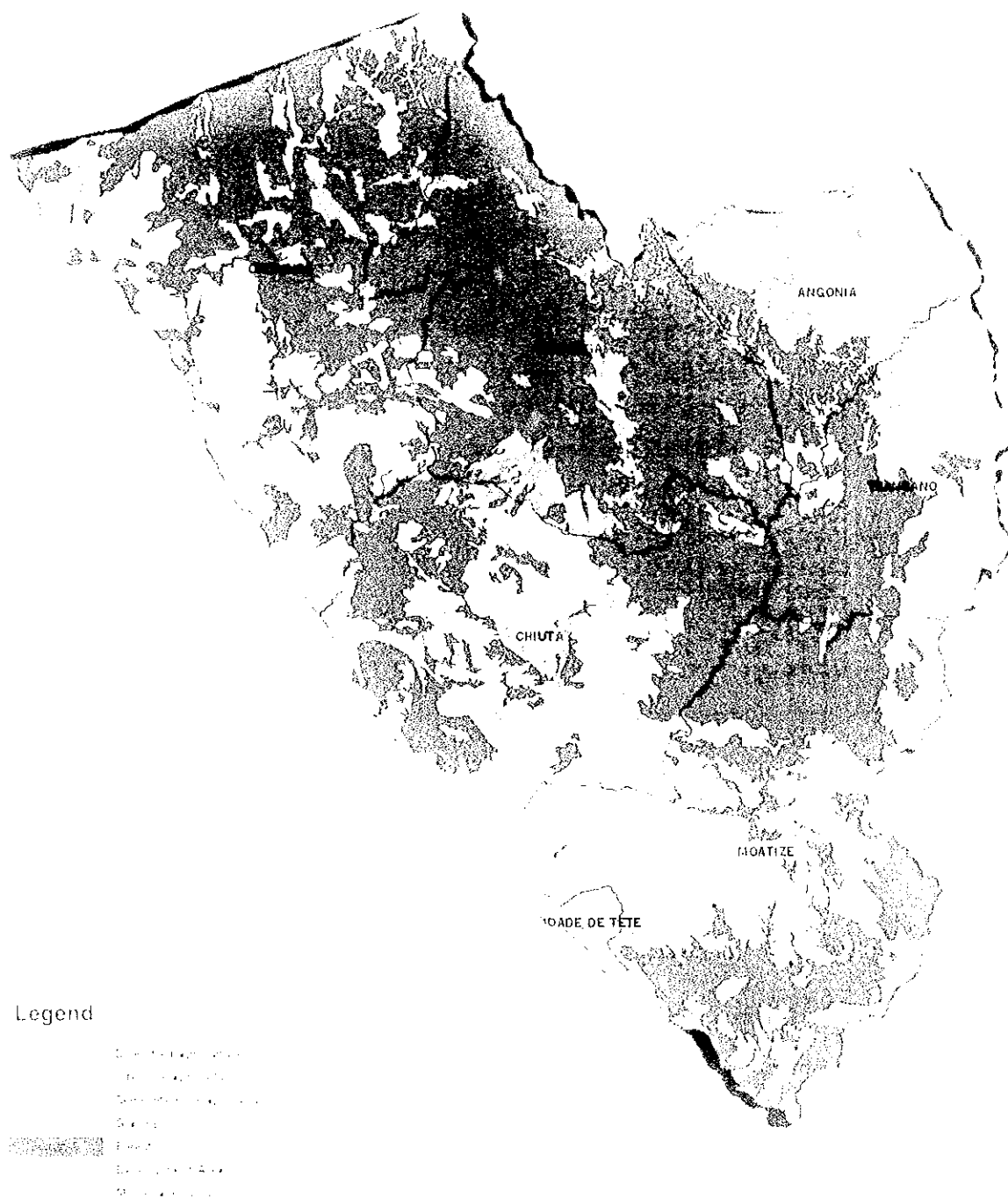
Source: GIS database.

Figure 4.2. Indicative Future Land Use



0 25 50 75 100 kilometers

Figure 4.2. Indicative Future Land Use



Map of Mozambique showing indicative future land use across provinces: Inhambane, Inhhamitanga, Manhiça, Matigato, Sofala, Tete, Zambezia, and Zumbo.

4.2.2. Urban and Transportation Systems

(1) Broader context of central Mozambique

Central Mozambique and national artery

Spatial framework is analyzed first within a broader context of the central Mozambique. In the present context, the central Mozambique is defined largely coinciding the Zambezi river basin as shown in Figure 4.3. This region has four large urban centers: Beira with the total population of 397,368 in 1997, Chimoio with 171,056, Quelimane with 150,116, and Tete with 101,984. These are third, fourth, sixth and seventh largest urban centers in Mozambique. Beira and Quelimane are port towns, and Chimoio is located on the fringe of the region. Tete is the only city having potential to serve a large area in the central Mozambique.

The national artery road is defined to link major centers in Mozambique, leading from Maputo in the south all the way up to Pemba and Macinboa in Cabo Delgado, more or less along the coastline. In the central Mozambique, the national artery road should serve Beira and Quelimane, although it would not pass through these cities. This section also needs upgrading as it becomes impassable at present during major floods.

Regional artery system

Three regional artery roads may be identified in the central Mozambique. All of them are international arteries. As shown in Figure 4.3, these are the following:

- 1) Beira corridor: Zimbabwe – Chimoio – Beira (Indian Ocean)
- 2) North-south artery: Zambia – Tete city – Chimoio – Beira (Indian Ocean), and
- 3) East-west artery: Malawi – Tete city – Changara – Zimbabwe.

In addition, the following may be defined as the secondary artery to supplement the three regional artery roads: Tete/Moatize – Mutarara/Caia – Quelimane (Indian Ocean)

(2) Spatial framework for the Study Area

Artery system for the Study Area

The artery system for the Study Area may be defined within the framework of the regional artery system for the central Mozambique. Naturally, two artery roads are defined as the north-south and the east-west arteries as shown in Figure 4.4. The north-south artery links Zambia in the north and Tete city with ER548, EN221 and EN222, and extends to the south with EN103. The east-west artery links Malawi in the east and Tete city with EN103, which extends through Changara to Zimbabwe to the west.

Urban system

Within the spatial framework of the central Mozambique, Tete city has potentials to become a functional capital of the region. Tete city is centrally located in the central

Figure 4.3. Spatial Framework for Central Mozambique

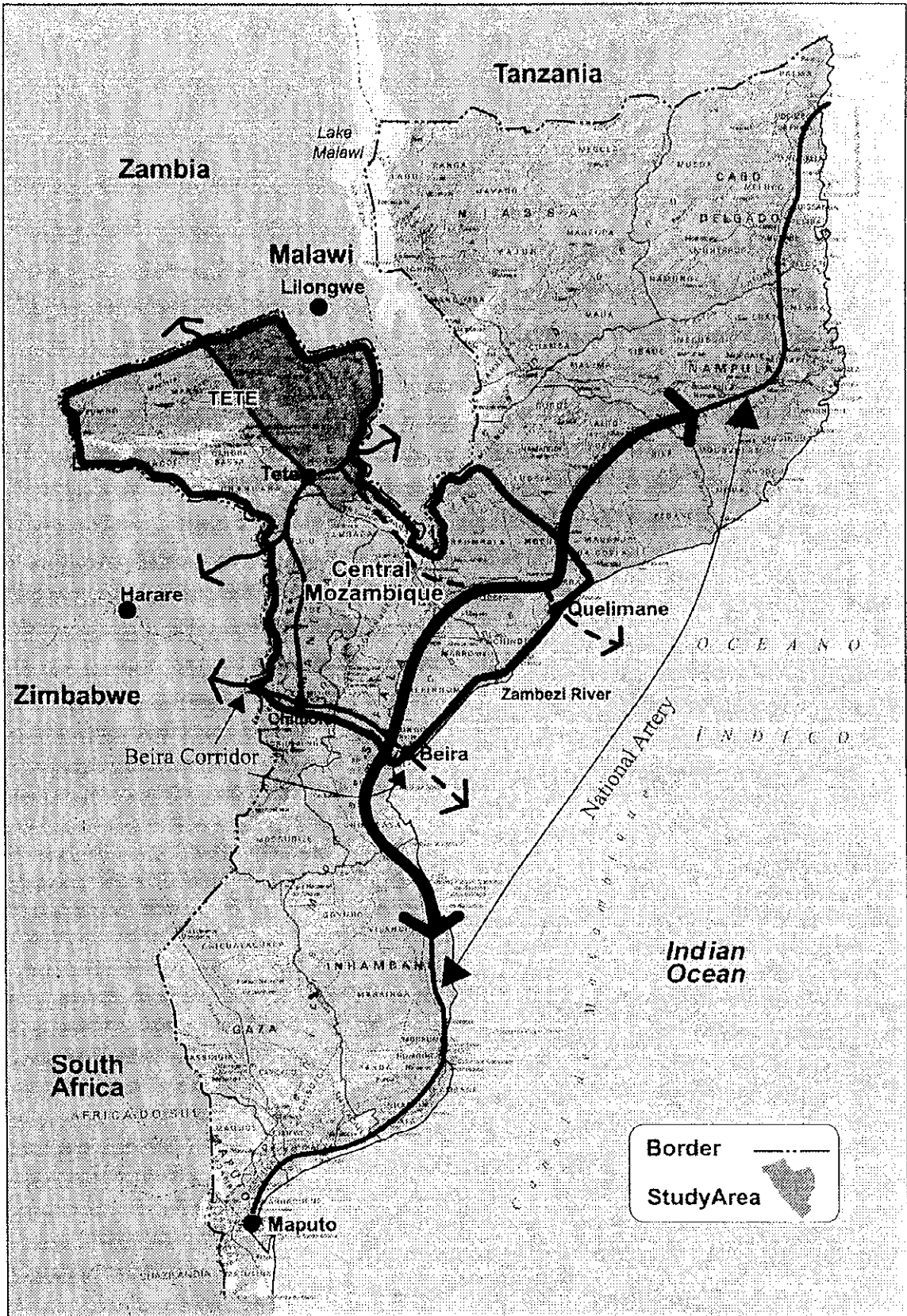
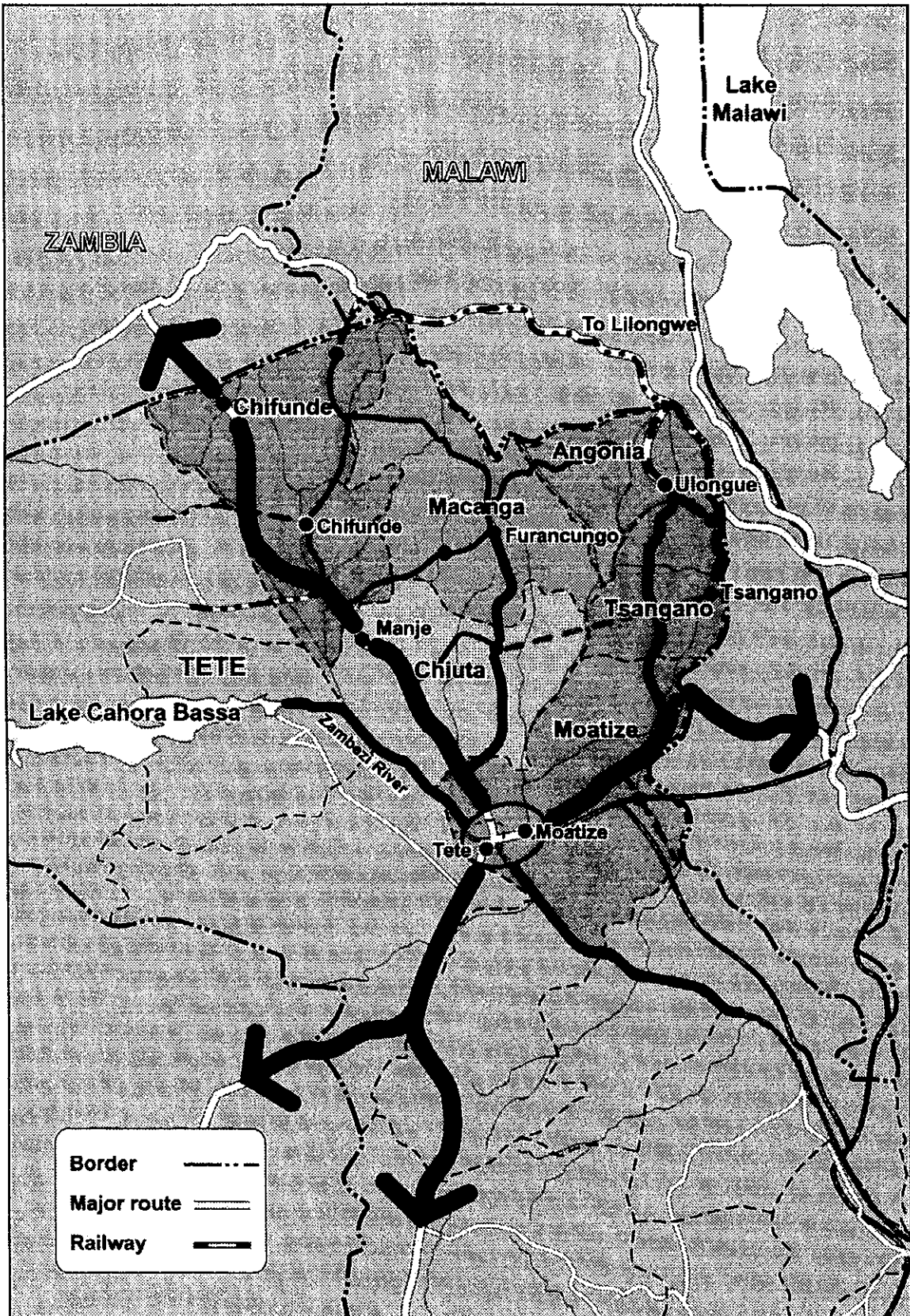


Figure 4.4. Spatial Framework for the Study Area



Mozambique, on the Zambezi river, and at the nodal point in the regional artery system. It has large land availability for further urbanization, and productive hinterlands. The only problem is that it is too small at present.

In fact, development of Tete city holds a key for the Angonia regional development in a few important ways. First, delivery of various social and urban services for the majority of local people can be effectively improved by upgrading service functions of the city and establishing service networks to cover other areas. Second, linkages with other regions can be strengthened effectively by improving transport and communication infrastructure in the city and by promoting trade and processing activities of commodities to be provided from outside. Third, Tete city may be equipped with some center functions within the context of the Zambia-Malawi-Mozambique Growth Triangle (ZMM-GT) initiative.

To serve these functions, accelerated urbanization is desirable for Tete city. Given the small population size at present, complementary development with the neighboring town of Moatize may be conceived. For manufacturing industries, one possibility is for Moatize to specialize in resources-based industries, and for Tete to develop more consumer goods industries based on inter-regional trade and existing agglomeration. Various urban infrastructure in these cities should be upgraded also in a complementary manner.

With this strong core urban area at the top, a hierarchical structure of urban centers should be established in steps with functional division among urban centers at different tiers. The five other district capitals will naturally constitute the second tier of urban centers. At the third tier, selected settlements may be strengthened with improved infrastructure to serve respective neighboring settlements for agricultural support services and basic social services. These settlements may be called urban service centers. At the fourth tier, rural service centers will provide community and basic social services for people in the centers and their respective rural hinterlands.

The hierarchical system of settlements is summarized in Table 4.18. The Tete-Moatize core urban area may have the total population of 700,000 in 2025, of which some 80% may be urban. The population size of other centers is expected to be more or less as follows: 20,000-40,000 (60% urban) for secondary urban centers, 5,000 (50% urban) for service urban centers, and 2,000 (mostly rural by definition) for rural service centers.

Transportation network

With the artery system and the urban system outlined above, the transportation system of the Study Area may be defined. Under the two artery roads, the following sets of roads may be defined to support the Angonia regional development.

- Supplemental artery roads: to ensure access to all the district and sub-district capitals

- Secondary roads: to provide links between district, and sub-district capitals, and alternative access to district capitals
- Inter-linkage roads: to provide access to/from neighboring regions/countries
- Intra-linkage roads: to provide linkages to/from economic development areas

Table 4.18. Urban Hierarchical System for the Angonia Region

Level of Hierarchy	Urban Center	Functions
Regional Center	Tete	Multi-functional urban center and functional capital of central Mozambique; commercial and trade center, and tourism gateway; specialized in consumer goods industry
	Moatize	Industrial center specialized particularly in resource-based manufacturing; energy and mining center
Secondary Urban Centers	Ulongue	Agro-related trading and agro-processing center; tourism sub-center
	Manje	Agricultural trade and distribution center
	Furancungo	Agricultural service center
	Chifunde	Social service center
	Tsangano	Agricultural service center
Service Urban Centers	Domue	Social service sub-center; agricultural sub-center
	Mualadze	Social service sub-center
	N'sadzu	Border trade center; social service sub-center
	Kazula	Agricultural service center
	Chidzolomondo	Social service sub-center
	Zobue	Border trade center; social service sub-center
	Cambulatsitsi	Social service sub-center
	Ntengo-Mbalme	Social service sub-center
Rural Service Centers	About 25 centers to be selected	Community centers

Source: JICA Study Team.

River transport should become more important to supplement the road-based transportation system. Some 100-ton ships may navigate the Zambezi river up to Tete city, and smaller ships may navigate the upstream reach. Then river transport may be used to carry raw materials to Tete city such as logs and agricultural products and processed goods from Tete city downstream. Tourists as well as local passengers may also be carried on small ships.

The Sena railway to be restored will constitute important part of the transportation network in the future. The GPZ study of the Sena line program recommends the low-level rehabilitation scenario to re-establish the line from Dondo through Sena and Vila Nova da Fronteira to Malawi but not the Moatize branch. Still, a new link from Tete/Moatize to Blantyre in Malawi may be an option worth serious consideration as well as the full restoration of the Sena railway.