ANNEX XIV

TECHNOLOGICAL DEVELOPMENT PROGRAM FOR SUSTAINABLE AGRICULTURE AND LIVESTOCK FARMING

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1 Present Status of Agriculture and Livestock Farming in the State and Constraints of Development

After creation of the State of Tocantins in 1989, a diversification of agriculture and livestock farming having been observed. In recent years, the large scale farming of soybean and paddy rice has been progressing in some areas of the State by utilizing the favorable conditions of land and abundant resources.

However, most of the farmers are engaged in the traditional farming. The middle and large scale farmers owning more than 320 ha of land carry out breeding of local beef cattle, Nelore. In most of their farms, beef cattle are raised in the extensive pasture area by burning the field at the end of dry season. Even in tame pasture, the grazing capacity has been declining due to soil erosion and reckless management of pasture. As a consequence, the livestock farming came to a deadlock situation.

On the contrary, the small scale farmers make their living by subsistence farming at the burnt field, because of lack or shortage of funds. And all of the farmers in the State are in an economical crisis and crave for new opportunities which can break the deadlock situation of the farming.

Besides, the State is facing with various environmental problems, such as the land clearing by burning the field, soil degradation and soil erosion.

The State of Tocantins is located in the Amazons legal area which has restricted development policies, and an indigenous reservoir, and the Bananal Island, one of the world humanity patrimony. Considering these facts, the State Agriculture and Livestock Farming Development should be planned.

To develop the new farming under these situation in the State, the crop rotation between cereals and pasture, the elaborate soil conservation/management practices to prevent soil erosion and the efficient new technologies of livestock raising should be introduced and promoted positively to transfer the technology to farmers.

However, until now, there has been no systematic research and technological development of the agriculture and livestock farming in the State. The Center (Division) of agronomy of the University of Tocantins (UNITINS), which is the only one research institute in the State, barely fulfills the responsibility of research in the State with a few researchers and poor research facilities in cooperation with EMBRAPA.

2 Progress of Researches on Agriculture of Cerrado in Brazil

The greater part in the Tocantins State is located in Savanna (Cerrado). The agriculture development in the Cerrado was commenced in 1970s by the Government of the Federal Republic of Brazil and the Cerrados Agricultural Research Center (CPAC) was set up in 1975. According to the results of the researches on the soil improvement, the development measures such as improvement of soil acidity, application of macro- and micronutrients, etc., were rated high, and the central region of Brazil has become the great granary.

The Japan-Brazil Agricultural Research Cooperation Project which aims at development of the technology for agricultural production in Cerrado was initiated in 1978. The first project, from 1978 to 1985, was carried out to develop the technologies of agricultural production in semi-arid and poorly vegetated region of Cerrado. The second project, from 1987 to 1992, aimed at the development of technologies for agricultural production in acid savanna region of Cerrado.

The agricultural production of Cerrado has made rapid progress as mentioned above, but soil degradation and soil erosion have also progressed in some areas with insufficient consideration on environment. The third project, from 1994 to 1999, aims at sustainable agricultural development and natural resources conservation in Cerrado. The ongoing project has four main research subjects as follows;

1. Evaluation of agro-environmental resources of Cerrado
2. Development and improvement of technologies to prevent soil degradation by physical, chemical and biological means
3. Development of integrated pest management
4. Improvement of the cropping systems to maintain the field condition sustainable

3 Development of Farming Technologies Needed Urgently for the Agricultural Development of the State

It is necessary to develop useful technologies for the planning and promotion of the sustainable agriculture and livestock farming and environment conservation in the State, referring to the results of the researches in CPAC and succeeding the results of Japan-Brazil Agricultural Research Cooperation Project.

The Technological Development Program on Sustainable Agriculture and Livestock Farming is the technological development of farming with farm machinery and farm facilities in real size farms, which have common area of farmer's land in Brazil.

Contents of the program are mentioned below and are discussed in detail in the subsequent sections .

- Technological development on environmental monitoring and environmental impact assessment

- Technological development on sustainable agriculture and livestock farming
- Technological development on the new livestock farming

4 Technological Development on Environmental Monitoring and Environmental Impact Assessment

4.1 Monitoring and Assessment of the Effects of Farming on the Natural Environment

4.1.1 Studies on the Methodologies of Design on Legal Reserve Area of Farm

These studies aim to clarify the methods of suitable design on Legal Reserve area to keep the river pollution induced by farming to a minimum level. At present, the studies are carried out on the suitable width of Legal Reserve area from river in locations of different gradients and natural vegetation. As a results of these studies, the effects of forestation on environment conservation in different slopes could be assessed and the guidance on designs of Legal Reserve area of farms, namely width of Legal Reserve area for each slope and methods of forestation (tree species, planting rate, etc.), is established.

With regard to the atmospheric environment, gas densities, such as CO_2, CH_4, etc., are measured at different heights from the ground surface in various locations of fields and Legal Reserve area. These data are contributed to the establishment of methodology on measurement of gas densities related to the atmospheric environment.

4.1.2 Studies on the Effects of Farming on the Natural Environment

At present, amounts of precipitation and runoff of soil, water and fertilizer components are measured successively in various fields under different cultural conditions and in various locations of the Legal Reserve area. These data are contributed to clarify the crop cultivation methods and soil management methods to keep the river pollution by farming to a minimum level.

4.2 Trials and Assessment of Forest Conservation

The various treatment areas of forest conservation are made in Legal Reserve area to clarify the suitable forest conservation methods. The treatments on forest conservation are considered as follows;

1) Leaving in natural state,
2) Suitable forest management, such as thinning, weeding and vine clearing, etc.,
3) Forestation of various tree species and suitable forest management, and so on.

When the trees grow up to available as woods, the studies on methods of collecting timber and skidding to keep the river pollution by farming to a minimum and of reforestation are carried out.

4.3 Trials and Assessment of Soil Conservation

At present, the effects of contour cropping and contour ridges on the runoff of soil, water and fertilizer components are studied. In this studies, the runoff of soil, water and fertilizer components are measured in fields of different intervals of contour ridges and at ridges having different heights and widths in locations of various slopes. Besides, the effect of existence of cover crops on surfaces of ridges and effective species of cover crops for runoff are also studied.

5 Technological Development on Sustainable Agriculture and Livestock Farming

5.1 Trials and Assessment of Rotation between Cereals and Pastures

The benefits of the sustainable farming by rotation between cereals and pastures are as follows;

- Cereals share the benefits of supplying soil organic matter.
- Pastures receive the benefits of improving soil pH and supply of macro- and micro-nutrients during cereals cultivation.
- Besides, proper soil management prevents soil erosion and the rotation and supply of livestock urine results in improving soil fertility, water capacity and proper soil structure.
- Consequently, crops grow healthy and farmers could reduce the amount of chemical fertilizer and pesticides application.

These studies aim to establish the guidance of sustainable farming to prevent the soil degradation and soil erosion. The details of the studies are as follows;

- Optimal terms (years) of cereals cultivation and pasture cultivation in rotation,
- Fertilization methods in cereals and pasture cultivation,
- Cultivation methods of cereals in wet season to prevent soil erosion,
- Irrigation and cultivation methods of cereals in dry season,
- Cultivation methods of cover crops in fields and contour ridges,
- Effective machinery operation systems in crop cultivation,
- Cropping patterns in cereals cultivation, and so on.

In these studies, runoff of soil, water and fertilizer components are measured and the new technologies are assessed from the point of view of environment conservation as well as development of new technologies.

5.2 Trials and Assessment of No-tillage Cultivation in the Large Scale Field

These studies aim to establish the guidelines for sustainable no-tillage cultivation of cereals, especially soybeans, to prevent the soil degradation and soil erosion. The details of the studies are as follows;

- Selection of suitable cereals and species for no-tillage cultivation,
- Suitable seeding period in no-tillage cultivation,
- Effective mechanization method for no-tillage cultivation,
- Improvement of no-tillage seeding machine,
- Suitable permissible term (years) of successive no-tillage cultivation of cereals,
- Effective fertilization methods in no-tillage cultivation,
- Weeds control methods no-tillage cultivation, and so on.

In these studies, runoff of soil, water and fertilizer components are measured and the new technologies are assessed from the point of environment conservation as well as development of the new technologies.

5.3 Trials And Assessment of the Effective Mechanized Cultivation and Use of Cover Crops

Cover crops in cereals cultivation fields and contour ridges are useful to prevent soil erosion in early stage of crops growth, which crops can not cover the soil surface enough, in the wet season.

The studies aim to establish the guidance of cover crop cultivation and harvesting methods to prevent the soil degradation and soil erosion. The details of the studies are as follows;

- Selection of suitable cover crops and species in cereals cultivation fields and contour ridges, selection of suitable bottom grasses in orchard and effective seeds production methods,
- Cultivation methods of cover crops in fields and contour ridges and of bottom grasses in orchard,
- Harvesting methods of cover crops by machinery to prevent soil erosion, and so on.

In these studies, runoff of soil, water and fertilizer components are measured and the new technologies are assessed from the point of view of environment conservation as well as development of the new technologies.

5.4 Selection of Varieties for Cereals, Vegetables and Fruit Trees

These studies aim to select the suitable varieties of cereals, such as soybeans, maize for food and animal feed, upland rice, feijao, etc., in wet season and in dry season under irrigation, vegetables and fruit trees in each region of the Tocantins State.

5.5 Selection and Breeding of Pastures for Vegetative Control of Soil Erosion

In general, pasture crops are considered to be excellent for the control of soil erosion. Nevertheless, the pasture crops which are largely utilized in the Brazilian tropic, such as "Guine Grass" or "Brachairy", are not of the stolonipherous type thus being inefficient

against the soil erosive process. Therefore, it is fundamental to research new pasture varieties, with good nutritive contents, stolonipherous type, good regrowth capacity, tasty for animals and good as vegetal coverage. For this purpose, collection, selection and breeding of pasture plants varieties are carried out.

In this studies, runoff of soil, water and fertilizer components are measured and the new varieties are assessed from the point of view of environment conservation as well as development of the new varieties.

5.6 Improvement of Mechanized Cultivation and Establishment of Farm Work Systems

The objectives of the studies are to establish the effective farm work systems, namely useful machines, combination of machines, needed manpower, etc., in cereals cultivation, contour ridge making, cover crop cultivation and bottom grasses cultivation.

5.7 Methodology of Farm Design and Farm Management Design, Considering Environmental Preservation

The study aims to confirm the suitable combination of techniques in each individual farming system and to clarify the methods of suitable farm design, farm management design and the plan of farm environment conservation under conditions of each farming, such as the area under management, work forces, geographical and social conditions, soil conditions, farm machinery and facilities, funds and objectives of farming, etc.

At present, the study is carried out to establish the methods of suitable farm design and farm management design by computer simulation models with personal computer as well as collection and processing of data and information. In near future, the methodology of farm design and farm management design is studied with a large scale computer.

6 Technological Development for New Livestock Farming

6.1 Intensive Grazing Methods in the Pasture Areas with Irrigation Facility

The study aims to establish the intensive rotational grazing methods in the pasture areas equipped with irrigation facility, such as center pivot, linear movement irrigation system, etc.

Grazing stock management practices such as designing of paddocks, periods of the rotational grazing, methods of wiring the electric pasture-fence and shifting daily, management practices of pasture, etc., are clarified for the groups of breeding cows and calves and the groups of fattening cattle, separately.

6.2 Improvement of Beef Cattle Production by Introduction of European and American Breeding Stock

In order to be free from the breeding of just the local beef cattle, Nelore, and following the traditional production methods of fattening simply by purchase of calves, the studies aim at the diversification of beef cattle production as follows;

Nelore is used as cows for breeding and European and American breeding stocks, such as Simmental, Limousin, Santa Gertrudes, etc., are used as bulls for breeding. In the studies, the optimal combination of races in the first cross of hybrid is investigated. Besides, the studies are also carried out on the effective fattening methods of the hybrids.

New breed of cattle shows a high increase rate of body weight and the shortening of fattening period can be obtained through the supply of excellent irrigated pasture even in dry season. It is estimated that a new breed cattle reaches 350 kg to 400 kg of body weight within 30 months from its birth. These expected effectiveness of the hybridization of beef cattle is verified in these studies.

Beef cattle production by hybrid results in high quality of meat, high breeding efficiency and possibility of meat export after stamping out the Foot and Mouth Disease of livestock.

6.3 Improvement of Hog Production by Introduction of European and American Breeding Swine

Swine is now produced from local variety of swine in Tocantins State, and the local swine has low quality of pork and low breeding efficiency. In order to be free from the local races and traditional production methods, the studies aim at the diversification of pork production as follows;

Piglets are produced by triple cross within improved races, such as Large Yorkshire, Landrace, Duroc, etc., and the optimal combination of races in the first cross of hybrid is investigated in the studies. Besides, the studies are also carried out on the effective fattening methods of the hybrids.

In actual farming, the piglets of the hybrid of European and American breeding swine are supplied to farmers after weaning (2 months from birth). The farmers carry out fattening of 50 piglets for 4 months in one time, totaling 150 heads in three times a year.

The improved swine has high quality of pork, high breeding efficiency and possibility of export of pork, after stamping out the Foot and Mouth Disease of livestock.

6.4 Improvement of Animal Feeding

The studies aim to establish the guidelines for effective and low cost raising technologies of beef cattle, dairy cattle, swine, chicken, honeybees, freshwater fishes, etc.

6.5 Establishment of Effective Prevention of Animal Epidemics

The studies aim to verify the effective methods of diagnoses and control of the main diseases of domestic animals, especially the Foot and Mouth Disease, and to contribute for the control planning of animal epidemics in the Tocantins State.

7 Organization to Implement the Program

At present, there is no agricultural experiment station to implement the program mentioned above. However, it is anticipated that the research system of the technological development in the real size farm would be established by strengthening of the technology promotion section of SAG as nucleus of the system, and the research station of the technological development would be constructed in a land of 800 ha area in the suburb of Palmas owned by SAG.

ANNEX XV

SPECIFIC SECTORS DEVELOPMENT

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1 Development of the State s Water Resources

1.1 Introduction

The Tocantins State is crossed from north to south by two big rivers: the Araguaia river which is the border between the states of Pará and Mato Grosso, and the Tocantins river which crosses the state territory in the north-south axis. These two rivers have many tributaries constituting a dense fluvial network.

The abundant precipitation in the State allows the development of the water resources of the region fluvial system, not only in the rainy season but also during the dry one. Having specific soil conditions of the Cerrados (Brazilian Savanna), the discharge of the small tributaries are also relatively stable even during the dry season. It was confirmed that there are several rivers with irrigation potential, and the topography around many of these rivers allows the gravity irrigation. The State water resources were not extensively explored up to this moment, thus there aren't problems related to water use rights at present. Once the lands are still under utilized, it is going to be easier to carry out the necessary construction works for the development of the water resources.

As mentioned before, the State water resources potential is very high, however their development is hindered by the non existence of detailed studies about the fluvial system hydrology. Therefore, it can be said that the potential of this dense fluvial network is being under utilized.

The development of these water resources is essential for the development of the State, not only for the utilization for irrigation purposes but also for transportation, hydroelectric plants, water supply and other items which are the base for this development.

These resources shall be utilized in an efficient and orderly way, at first acknowledging the potential through detailed studies and estimation based on them. An harmonious and sustainable development is primordial to avoid future complications.

The water resources can be divided in 3 major groups: the underground, the superficial and the atmospheric one. Among these resources, it can be said that the underground and the superficial ones are directly usable by people.

At last, it is proposed to carry out the following studies.

1.2 Basic Hydrological Studies

The study aims to evaluate the existing water resources of the State, based in the characteristics of its hydrology. For this purpose the following items are necessary;

- The available hydrometeorologic and sedimentological studies and data shall be recompiled, analyzed and synthesized, not only in the ambit of the State, but also concerning to other hydrographic basins which have potential comparable with these basins.

- Survey of appropriate places for the location of hydraulic works.
- Obtainment of additional information aiming to adjust the available information through short term studies to be carried out.
- Determination of treatment methodologies for the available information, including the comparison with similar basins.
- Elaboration of hydrological, climatological and agrometeorological information at the operational level, according to the requirements of modeling techniques and other hydrological methods foreseen, through the preparation of basic historical series, thematic maps, etc.
- Objective evaluation of the state hydrological system knowledge level, in the quantitative and qualitative aspects, in the superficial and underground phases, aiming to determine the guidelines for the improvement of this knowledge, even through the improvement of the regional network of hydrometeorologic and water quality observation.

Once the State has a large territory and many rivers, it would be to complex to study the whole State, therefore its a pre-requisite to give priority to sub-basins for the purpose of the studies.

In order to attain the before mentioned items the following basic studies shall be carried out;

(1) Hydrometeorologic Studies

- Collection and analysis of available data;
- Organization and implantation of data basis for processing;
- General climatological aspects, pluviometric analysis of basin/sub-basin and monthly estimation of the evaporation;
- Fluvio-morphological characterization of the basin/sub-basin;
- Analysis of the fluviometric data consistency;
- Statistic treatment of the information;
- Characterization of the hydric regimen;
- Regionalization of the discharges permanency curves;
- Regionalization of the maximum, medium and minimum discharges;
- Analysis of the specific contributions of the major tributaries;
- Characterization and evaluation of the superficial water quality;
- Water use / cadaster of users.

(2) Hydrogeological Studies

- Collection and analysis of existing data;
- Organization and implantation of a data basis for processing;
- Elaboration of location map of wells and identification and mapping of aquiferous systems;
- Analysis, processing and interpretation of data;
- Characterization of aquiferous;
- Definition of Hydrogeological models - reloading conditions, flowing off and discharge of underground water;
- Evaluation of hydric potential and availability;
- Analysis of the river-aquifers relations;
- Characterization of the water quality;
- Water use;

(3) Sedimentological Studies

- Collection and analysis of sedimentometric data;
- Organization and implantation of data basis for processing;
- Analysis of the erosion and mining zones maps;
- Evaluation of production and transportation of sediments in the basin;
- Contention measures.

It is observed that in the before mentioned studies, it is included the hypothesis of dams constructions, once many of the Araguaia and Tocantins rivers tributaries have the need of dams to keep the water availability during the drought.

1.3 Model of Evaluation/Management of Water Resources

The model of evaluation and management of water resources (model) shall be elaborated or adjusted to already existing models with the objective to evaluate/manage the region superficial water resources, also concerning to floods, through proper modeling techniques at the available information level supplied by the Basic Hydrological Study.

The model shall cover the potential hydrographic basins and shall obey a functional configuration indicated the following;

- To obtain monthly fluviometrical series, characteristics of the considered historical period for each hydrographic unit, based on the basic regional or extra-regional hydrometeorologic series, resulting from the Basic Hydrological Study;
- To generate long term synthetic fluviometric series, through statistical hydrology techniques or other one, in significant points of the regional hydrographic network;
- To study the extreme pluvio-fluviometrical values (floods and drought), as well as the determination of flood risks;
- To study the projects hydraulic through the calculation of water availability in a large repertoire of development scenarios of hydraulic infrastructure and simulation policies associated to assurance levels of resources availability;
- To study and simulate the water quality in hydric systems through the modeling of:
  a. Transportation and dispersion of polluting and nutrient agents;
  b. Eutrophization;
  c. Concentration of solids;
  d. Micro-organisms indicative of pollution;
  e. Concentration of heavy metals and toxic compounds;
  f. Concentration of oxygen and organic matter.
- To study and select alternatives through socio-economic optimization techniques (or sub-optimization ones), covering the sectors to be served by the project.

1.4 Inventory of Regional Water Resources

This inventory consists on an informative technical document about the State water resources availability, aiming not only to support the Project elaboration but also to give information about this theme to interested public and private organisms. The inventory document shall contain a synthesis of the results aiming the utilization of regional water resources, distinguishing the following aspects:

(1) Utilization of Superficial Water Resources

This document will consist on the characterization of a group of representative points of the regional hydrographic network, through availability indicators in each point calculated by the "model", for several inventory scenarios, which constitute in the identification of several conventional situations of development and operation of the regional hydraulic infrastructure. This part of the inventory will be formulated considering the following guidelines;

- The inventory network shall be determined through the selection of characteristic points of the regional hydrographic network, to represent the fluviometric posts, the location of existing and potential hydraulic works, the confluence and interpolated points according to other criteria;
- The hydraulic availability indicators are basically the annual maximum available modulated volumes and assured according to requirement of the respective inventory scenery; these indicators, for each of the hydraulic works, shall be individually specified;
- The inventory scenarios will conventionally characterize the modeled system status in the following aspects:
  - the development rate of the hydraulic infrastructure, through a set of works eventually associated to the temporal horizons of the Project;
  - the considered types of water and energy demand, characterized, for example, by the monthly percentage of served annual demand;
  - the guarantee levels of requirable services for each demand;
- For practical reasons, the inventory scenarios shall be formulated basically aiming efficacy criteria, adopting strong conventional simplifications with a reasonable representativeness of the inventory. Therefore, it shall be considered a system with several varying scenarios, structured over the following basis:
  - at least 4 infrastructure development scenarios associated to representative situations of the natural regimen and of the development status at short, medium and long terms, respectively;
  - at least 3 demand types as the uniform type, the seasonal type and the mixed type, necessarily internalizing the environmental protection criteria;
  - at least 3 plausible guarantee levels, defined in the terms required by the "model", absorbable as the empirical guarantees of around 100, 85 and 79 percent, obtained by direct raffle model of historical series.

(2) Utilization of Underground Water Resources

The inventory part related to this item will basically consist in the presentation of the available information in order to guide these resources management. Such information shall be followed by:

- a significant inventory of the existing catchment, characterized by their location, served utilization, type of catchment, Hydrogeological characteristics - formations, levels, discharges, quality parameters;
- thematic maps representative of the available knowledge about the aquifers and orientation about the catchment perspectives.

(3) Support System to the Monitoring of Water Resources Utilization

For the monitoring of water resources it shall be proposed a system based on sensoring techniques and geographical information system, which will allow the execution of

studies and mapping of these resources utilization in a more exact and fast manner. In this item, it shall be contained the effective utilization of technology for mapping the resources use dynamic.

1.5 Perspectives of Water Resources Utilization

To compare the scenarios resulting from the water resources study-inventory, verifying their feasibility before the environmental and social dynamics, detected in the diagnosis, allowing to show the consequences of these scenarios implementation according to the different technical and political intervention levels, in the environmental framework of the selected basin, selecting the best development alternatives.

1.6 Meteorological and Hydrological Stations

The knowledge of climatological and hydrological conditions, together with other natural factors such as soils, topography, ect., are the base for that the various planning, research, execution organisms can carry out precise and reliable works.

All the natural factors are important, although individually their utilization is limited. Each natural factor interacts, influencing the others, thus becoming difficult to evaluate them individually. Therefore it is essential to collect several factors data parallelly forming a set of basic natural data.

The Tocantins State has several measurements of natural conditions. However this data is incomplete and partial, not proportioning full conditions for more refined work.

Another important item is the availability of this data. The access to this data shall be easy, which doesn't happen in the reality, hindering the execution of many projects and plans.

The basic studies previously presented will only be effective if there is availability of meteorological and hydrological data.

(1) Climatological Stations

The Tocantins State has 88 meteorological stations, as listed in the table XV-1, however the majority of them only carries out precipitation measurements, not precise ones, the observation being carried out not continuously. The majority of these stations were established before the creation of Tocantins State. It must be said that 16 of them are already out of work.

The climatological data are fundamental not only for the development of irrigation projects but also for other projects such as cattle raising ones, benefiting various sectors. This data is the base for many studies and projects, and without it the projects and studies would be doubtful.

For such a purpose it would be necessary to remodel the existing data collection system in the State which is now in precarious conditions and depends on organisms of other states or of the federal government.

a) Present Situation of the Meteorological Stations

The existing meteorological stations of Tocantins State are administrated mainly by DNAEE, the other being administrated by INMET, ELETRONORTE, SUDENE, CEMAR and others. Therefore, there are few stations administrated by the State, hindering the collection of data.

The main data collected in these stations is the pluviometric precipitation, and very few stations have complete climatological measurements.

According to the obtained information, many of the equipment is obsolete, damaging the reliability of the collected data.

- Existing Data

The measurement periods highly vary, as shown in the Table XV -1. It can also be verified that many of the collected data in these stations are incomplete, as presented in the Table XV-2, for the north region.

b) Necessary Measures

Considering the present conditions of the meteorological stations in the State, in principle the following measures can be proposed:

- Establishment of agreements between the State and organisms responsible by the measurement;
- Checking of the stations operation conditions;
- Reestructuration of the data exchange and storage system;
- Recadastering of all stations in the State;
- Reevaluation of location and number of stations;
- Training of technicians;
- Project of standard stations;
- Evaluation of the necessary quantity of stations;
- Selection of necessary software.

Other measures can be presented in the realization of these items.

- Establishment of Agreements

It shall be established an agreement between the existing measurement organisms and the Tocantins State to facilitate the availability of data, with the direct delivery of data to the State. Therefore, it would be make a good use of the existing stations. This agreement could be carried out between several organisms and the UNITINS, through the Meteorology and Water Resources Nucleus - NEMET.

- Recadastering of Stations

The recadastering of stations would be essential for the determination of the necessary number and location of the station in the State. In case of the north region as example, it is verified that the coordinates of the stations registered in the DNAEE list have doubtful locations as shown in figure XV-1.

- Evaluation of the Stations Conditions

It would also be necessary to evaluate the operation conditions of all stations, concerning to equipment and location, once there is information that some facilities are installed under the shadow of buildings and in valleys at river margins where the humidity would be different from that observed in the major part of the station covering area, producing non representative data of the region.

- Quantity of Stations

The quantity of stations shall also be reevaluated, avoiding excess or lack of stations. This quantity shall depend on the location once the maximum coverage area varies according to these conditions.

- Training of Technicians

The training of technicians shall cover a range which goes from data collection method to simple maintenance in order to make the stations the more independent as possible. Therefore, it will be avoid undesirable interruptions in measurements due to simple problems which could be solved in the very place.

Some technicians shall be trained to periodically check and gauge each station equipment and to be always ready to attend the stations with problems.

These employees shall also acquire the knowledge about the importance of the collected data for the development of the State.

- Data Collection System

Another necessary restructure would be in the collected data exchange and storage means. It is proposed the formation of local, regional and central stations. The central one shall be the UNITINS, through its Meteorology and Water Resources Nucleus, which for a long time has being developing time, climate and water resources monitoring activities, having many connections with several national and state organisms. Therefore the NEMET would be the responsible for the diffusion of data to other sectors of the State.

The recording of data shall be standardized to facilitate its utilization. The software to be utilized shall be easily manageable, and shall automatically calculate items such as evapotranspiration, water demand of several crops, etc. The computers for this purpose shall be installed in the regional stations.

The stations shall be standardized in order the data is measured equally in qualitative and quantitative terms.

In figure XV-2, the main structure of the proposed meteorological data collection system is presented. This system basically consists in converging data to the central stations. The data collected in the local stations would converge for the regional ones which would be responsible for their regional data storage, which by their turn would converge to the central station, where the whole State data would be stored.

Local Stations: these stations would carry out only measurements, being responsible to send the collected data to the regional stations. At least it shall be measured the precipitation, temperature, humidity and wind data. It is proposed that these stations are automatically operated due to the lower cost and possibility to be located in remote places. In order to avoid damages to the equipment, it shall be given priority to the installation in the urban center of each municipality (policy stations) and in the case of no available cities (Jalapão case), an easy access location shall be chosen.

Regional Stations: these stations should carry out the storage of data of their own region, the necessary calculations (for instance the water demand of several crops) and be responsible to send the data to the central station. It is proposed the installation of conventional stations (more precise ones) which would at least measure the precipitation, humidity, wind, pressure, evaporation, temperature, insolation and radiation data.

Central Station: in this station it would be carried out the conference and analysis of data, besides the storage of the whole State data. It is also proposed the installation of a conventional station identical to the regional station one.

In figure XV-3, it is presented the regional system of data collection, utilizing as example the north region. The stations were plotted in the urban center of the municipalities due to the existence of doubtful coordinates. These locations shall be reevaluated after the recadastering.

At present, the existing stations in the region are: Xambioá, Piraque, Paranã, Wanderlândia, Muricilândia, Araguaína, Palmeirante, Fazenda Porto Lemos, Fazenda Boa Vista and Fazenda Primavera. It is verified that to cover all the north region it would be necessary to reckon on data of stations located out of the region such as Colinas do Tocantins, Arapoema and Carolina, the last one located in Maranhão State.

The number of meteorological stations shall be revised for the whole State in order to avoid unbalance and excess of stations. For instance, there are many stations in the central strip of the State, however there are few stations in the East region (Jalapão) and the Bananal Island.

Considering that the existing stations are presently located in urban areas, their coverage area should be as shown in figure XV-4 (dark blue). If the stations located in farms and cities outside the state are substituted with the creation of new stations, we would have those plotted in light blue shown in figure XV-4. It is verified that out of the 12 existing stations, 4 stations were initially substituted, amounting to 11 stations to cover the north region, pointing out that all the stations would be located within the state. It is verified that the north region has a good distribution of stations, with similar coverage areas.

The number of stations shall be revised according to the region area and mainly according to the implantation location.

The minimum necessary equipment for each station is described the following:

- Main and Regional Station:

1. Rain Gage
2. Barometer

3. Micro-barograph
4. Dry and humid thermometer
5. Maximum and minimum thermometer
6. Maximum and minimum thermometer (tank)
7. Minimum thermometer (lawn)
8. Soil thermometer (2;5;10;20;30;50 and 100 cm)
9. Therm-hygrograph
10. Windmill
11. Contact anemometer
12. Totaling anemometer
13. Anemograph
14. Piche evaporimeter
15. Class A evaporation tank
16. Heliograph
17. Actograph

- Local Station:

1. Rain Gage
2. Dry and humid thermometer
3. Maximum and minimum thermometer
4. Totaling anemometer

As broadly known, the collected data is going to become useful only after some time. Therefore, it would be essential to carry out studies and the implantation as soon as possible.

c) Situation after the System Implantation

It will be created a practical, efficient and mainly independent data collection system. With this measure, the obtainment of data will be facilitated and the data would be more consistent, propitiating benefits to several sectors.

Once this data is available in a certain quantity, the projects could utilize reliable data, the researches could be carried out utilizing more concrete factors, it would be possible to carry out meteorological forecast and many other activities for the development and maintenance of business in Tocantins State.

Furthermore, it could be created the basis for the research of natural phenomena such as "veranico" which occurrence periods and causes are not yet well defined, although it causes strong damages to the agriculture and livestock sector of the State.

(2) Hydrological Stations

a) Present Conditions

Although there are many measurements being carried out in the Araguaia and Tocantins rivers, there are few measurements in their tributaries, i.e., the countryside of the State. The number of registered stations amount to 100 (table XV-3) and they are administrated by organisms such as DNAEE, FURNAS, ELETRONORTE, PORTOBRAS and others.

The registered stations in the State are shown in the following table:

River	Registered	Extinct	Existing
Tocantins	43	10	33
Araguaia	15	6	9
Others	42	10	32
TOTAL	100	26	74

Out of the existing 100 stations, 26 were already extinct. Out of the remaining 74 ones, 33 stations are located in the Tocantins river, 9 in the Araguaia river and 32 in tributaries. The Araguaia-Tocantins proportion is very high, showing that the Tocantins river was more privileged. The Araguaia-Tocantins and internal rivers proportion should be higher once the State has a dense fluvial network. It is also verified that the 32 stations in tributaries are located in only 23 rivers.

The projects to be implanted need these data, specially the irrigation ones. Therefore, it would be very important to implant hydrological stations, at least in the most important basins and which have irrigation potential.

b) Necessary Measures

The decision about the location of stations would be taken only after the elaboration of priority projects studies. That is, it would be necessary to elaborate a time schedule with priority projects to be studied and to know the basins to be measured, and their installation time. In reality, it would be ideal to carry out the measurement in all the basins but, once it is not viable, the measurements shall be carried out in multiple use potential basins.

Taking the example of the State north region, the main sub-basins are shown in Figure XV-5. It is verified that there are few remarks in the tributaries of the Araguaia and Tocantins rivers, as presented in the mentioned figure, which have observation periods presented in the Table XV-4. The measurement posts could be established in strategic locations of basins with adequate hydric potential for development.

The proposed collection and storage system would be similar to that in the meteorological stations, and the smaller unit, the local stations, would be replaced by each basin/sub-basin station. The central one could be UNITINS in Palmas, allowing the storage in one only point, thus facilitating the management of data and generation of information.

All the measurements shall be carried out by the same method in order to standardization of data. This information is useful when there is a big amount of data, i.e., long periods to attain reliability, avoiding to utilize data which doesn't express the real climate-meteorological conditions of the several natural environments of the State.

c) Situation after the Implantation of the Project

After the implantation of these stations, it will be known the annual variations of rivers and it could be possible to estimate future variations.

This data could also be utilized to avoid future conflicts caused by indiscriminate utilization of river waters. That is, lack of water at downstream due to inadequate utilization at upstream.

At moment, there is no occurrence of such conflicts due to the few number of irrigants, however after the start of development it is for sure that these conflicts will occur. Therefore it would be better to prevent such situations elaborating a good water resources utilization strategy.

There will be ways to monitor the soil humidity and to show the farmers the best periods for planting, as well to assist, through the monitoring of time and climate, in the application of agricultural defensive and in the forecast of droughts or floods.

2 Aquaculture Development Program

2.1 Brief Historical Review

Araguaína was the first municipality in the state of Tocantins which started to develop the Aquaculture activity in 1986, where the nursery farming of shrimp culture from Malaysia was constructed,

In 1988, the municipality of Berejinho de Nazaré began this activity through the construction of 10 ha of nursery and one laboratory for the production of post-larva of shrimps,

The State Secretariat of Agriculture carried out the first Aquaculture survey in Tocantins in 1995, and 31 fish breeders were identified in 16 municipalities, The extensive production system was utilized and fishes, shrimps and alligators were found in 24 ha of water with an yearly fish production of 120 ton,

At present, the aquaculture activity is developed in around 30 municipalities of the State with a fish production of 600 ton in 150 ha, represented by fishes such as caranha, tambaqui, piau, pacu and tambacu, The most representative regions of the implemented area, production and laboratories are the municipality of Brenjinho de Nazaré, Porto Nacional and Paraiso do Tocantins,

2.2 Importance of Aquaculture

The aquaculture in the State of Tocantins is characterized by an accelerated growing as a result of the promotion by the private sector, favored by the climatic conditions, land value, few uneven relieves, lack of pollution and stimulation of the public sector,

There is a need to collect more information regarding this agricultural sector in order to reach a strong development, aiming at the production of qualified fishes within the national and international requirements and destining the production to the big markets,

The present production mean of fish farming is around 6,000 Kg/ha/year, Each kilo of fish is traded by wholesales in R$ 2.25, The mean production cost of 1 Kg is R$ 1.25,

Increasing of the breeding areas is a natural tendency, from 10 ha registered in 1989 in 1998 reached 150 ha, and the mean productivity per ha rose through the use of new

technologies, However, consequently with the rise of the offer, the prices went down becoming the aquaculture of Tocantins an activity without the main attraction, that is the good relation between the cost and the benefit,

Therefore, the main proposal is the elaboration of a Technical, Economical and Social Feasibility Study regarding the Aquaculture in Tocantins, where the production may be increased with the security of how and where may be traded,

2.3 General and Specific Objectives

2.3.1 General Objective

Elaborate a study in order to identify the suitable areas for the development of the aquaculture in Tocantins, This study shall cover all the regions of the State, aiming the stimulation for the improvement of the life conditions of rural producers and increasing the fish offer to cover the market requirements with qualified products,

2.3.2 Specific Objectives

1. To elaborate an study in order to identify the real conditions of farmers, aptitudes, technical and operational needs required for the implantation of the program;
2. To promote the stimulation of the aquaculture development through the elaboration of plans together with the measures necessary for the conservation and preservation of the natural resources;
3. To elaborate an study in order to identify and promote the areas suitable for the implantation of fish nurseries and industries for processing of fish;
4. To elaborate studies about the species suitable for the State region with more adaptation probability, good productivity and also apt for industrialization, considering the market that is desired to be reach;
5. To elaborate studies about which of the national and international market shall be the best buyer o the chosen species;
6. To insure, through the program, the technical and scientific support to the fish breeders and industries implanted in the state;
7. To guarantee the access, of the investors interested in aquaculture, to the credit lines necessary for the development and stimulate the creation of other way of subsides and financing,

2.4 Target

The Program shall cover the whole state of Tocantins involving states organs and prefectures being divided in 2 Phases.

The time necessary for the study shall be as maximum 6 months between the beginning and the final report, The effective implantation of the Program shall begin after the Study Report until the year 2012.

2.4.1 1st, Phase (May-October)

Discrimination	Quantity
1. Municipality	40
2. Training for Technicians	5
3. Brazilian Technical Personnel	13
4. Foreign Technical Personnel	6
5. Complete Computer with software	1
6. Support Room	1
7. Utility Vehicle (Toyota double cab)	2
8. Facsimile	1
9. Chairs	20
10. Tables	10
11. Air conditioner 12,000 BTU's	4
12. Photographic Camera	2
13. GPS	2
14. Material	Not defined

2.4.2 2nd, Phase (1999-2012)

The development of Aquaculture shall be carried out based on solid bases, therefore, proceedings that stimulate the growing of this activity shall be performed after the result of the 1st phase,

- Promotion through local and national means of the results obtained in the 1st phase,
- To make the necessary adjustment during the execution of the Program
- Creation of 01 Demonstrative Unit in Palmas;
- To train and recycle 10 Technician per year;
- To develop 01 Diagnostic of Aquaculture each 2 years,
- To promote and support 01 Seminar, 02 field works and 04 technical courses per year;
- To create and support partnerships and agreements with organs related to the development proposal.

2.5 Operational Process

A diagnostic of the aquaculture sector in the state shall be carried out each two year. These information shall be storage in a data system and shall be use to make a feed back and adjust the program to new tendencies and technologies requested the fish breeders, industry and market.

2.5.1 Strategic of Action – 1st Phase

- To acquire vehicles, combustible, and drivers according to the expected goals;

- To acquire computers and office supply according to the goals;
- To agree contracts with Banks, RURALTINS and prefectures;
- To Train technicians in Production center of Aquaculture Technologies;
- To elaborate file and documents necessary to journeys;
- To elaborate research about the national and international market;
- To divide the state into 4 different geographic;
- To make technical visit to the fish breeders and municipalities;
- To evaluate the best areas for the implantation of fish nurseries and industries;
- To identify on the map the exact location of the visited areas;
- To evaluate the most suitable species for breeding and industrialization;
- To submit technical report of the journey;
- To analyze and issue reports;
- To file date of the inappropriate areas;
- To elaborate technical projects specific for each feasible area;
- To make available the information, especially for the visited regions were interest and aptitude was notify

2.5.2 Strategic of Action – 2nd Phase

- To divulge in the local mean the results of the 1st phase;
- To divulge in the national mean the results of the 1st, Phase;
- To install a Demonstrative Unit based on the data collected in the 1st phase taking advantage of the Native Fish Production Center of the SAG;
- To carry out technical promotions, partnerships and agreements performed with the Demonstrative Unit;
- To carry out yearly technical seminar, courses and training in order to support the implantation of industries and fish farming projects;
- To issue annual reports regarding development and reached index;
- To support the recycling and training of technician involved in the project

2.6 Project Cost

1st Phase (6 Months) unit: R$ 1.00

Item	Quant.	Total
Vehicles	2	100,000
Computer	1	4,000
Facsimile	1	1,000
Support room	1	
Chairs	20	1,600
Air conditioner 12,000 BTU's	4	4,000
Photographic Camera	2	1,000
Tables	10	2,000
GPS	2	3,000
Materials		
Means		50,000

Technical Brazilian Staff Medial Level	8	48,000
Technical Brazilian Staff Superior Level	5	67,500
Foreign Technical Staff with expenses	6	549,960
Seminary	1	30,000
Total		862,060

2nd Phase (1999-2012)

Item	Quant,	Total
Local and International Mean		2,000,000
Demonstrative Unit	02	1,000,000
Training/recycling	30	450,000
Diagnostic	07	700,000
Courses	30	240,000
Seminars	15	450,000
Field Training	15	225,000
Total		5,065,000

2.7 Project Implementation Agency and Agencies Involved

2.7.1 Main Agencies

1) SAG –State Agriculture Secretary
2) RURALTINS – Tocantins State Rural Development Institute

2.7.2 Agencies Involved

1) Prefectures
2) BASA
3) Banco do Brasil

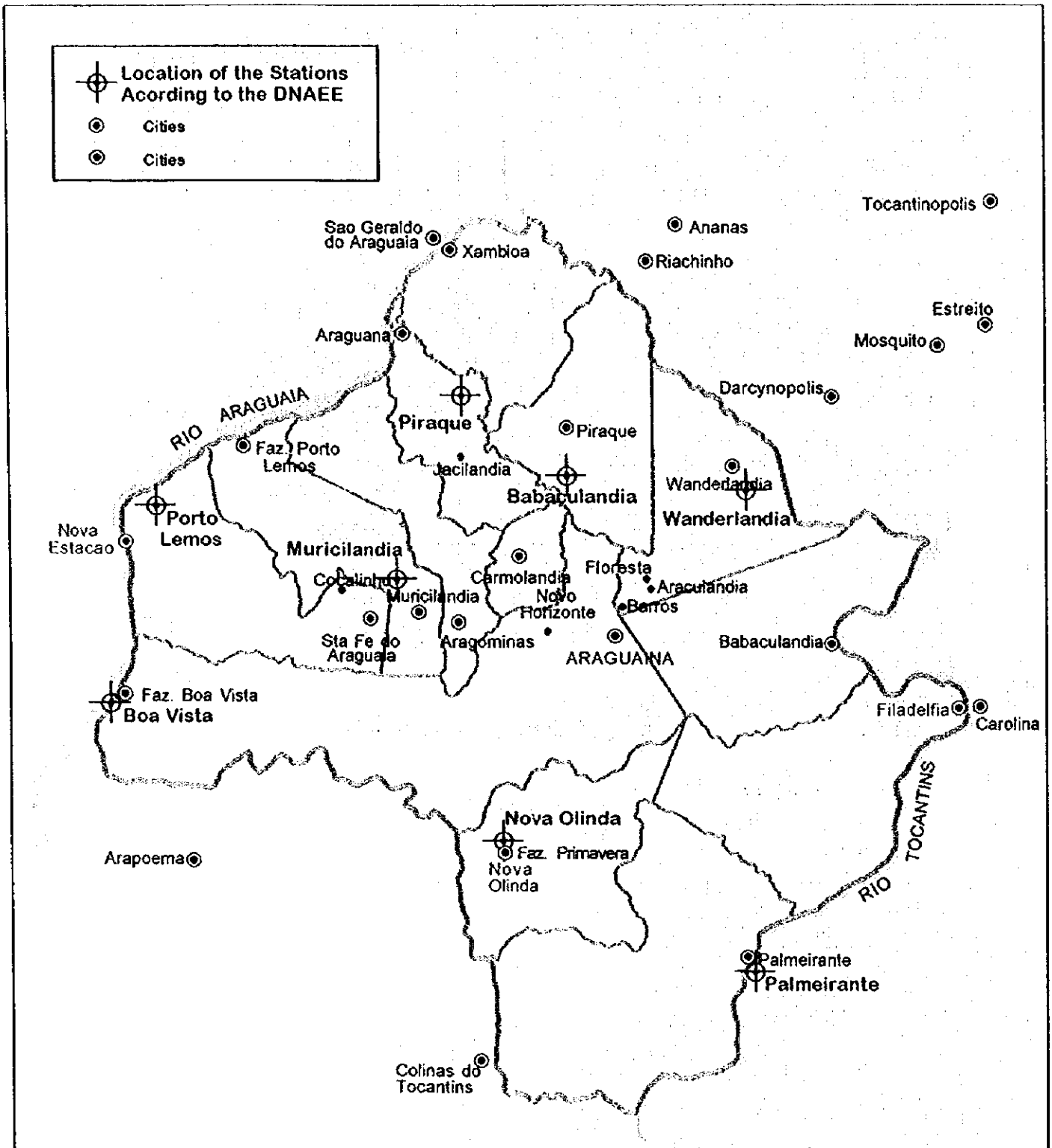

Figure XV-1: Localization of DNAEE's Cadastrated Stations

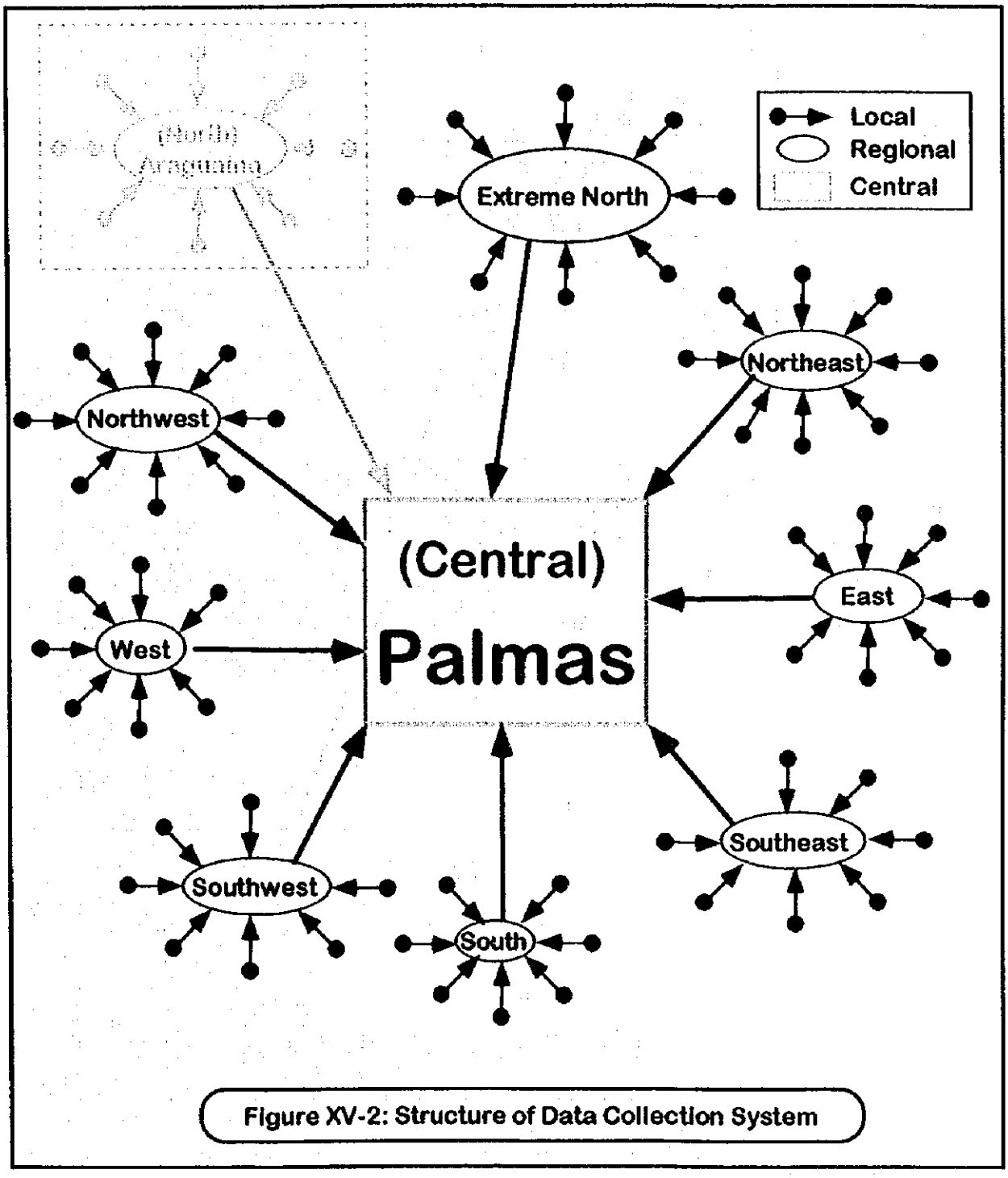

Figure XV-2: Structure of Data Collection System

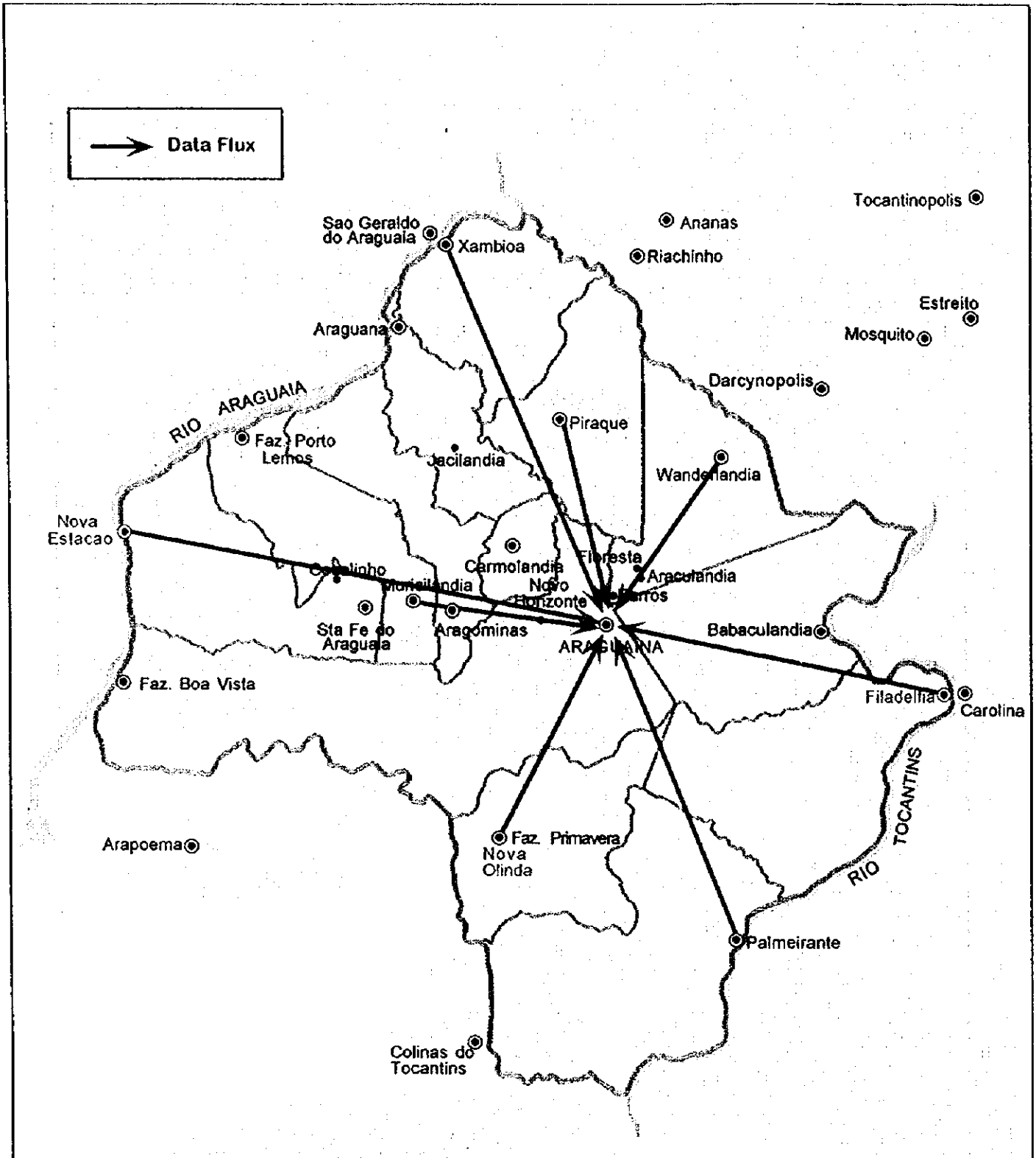

Figure XV-3: Regional Data Collection System (North)

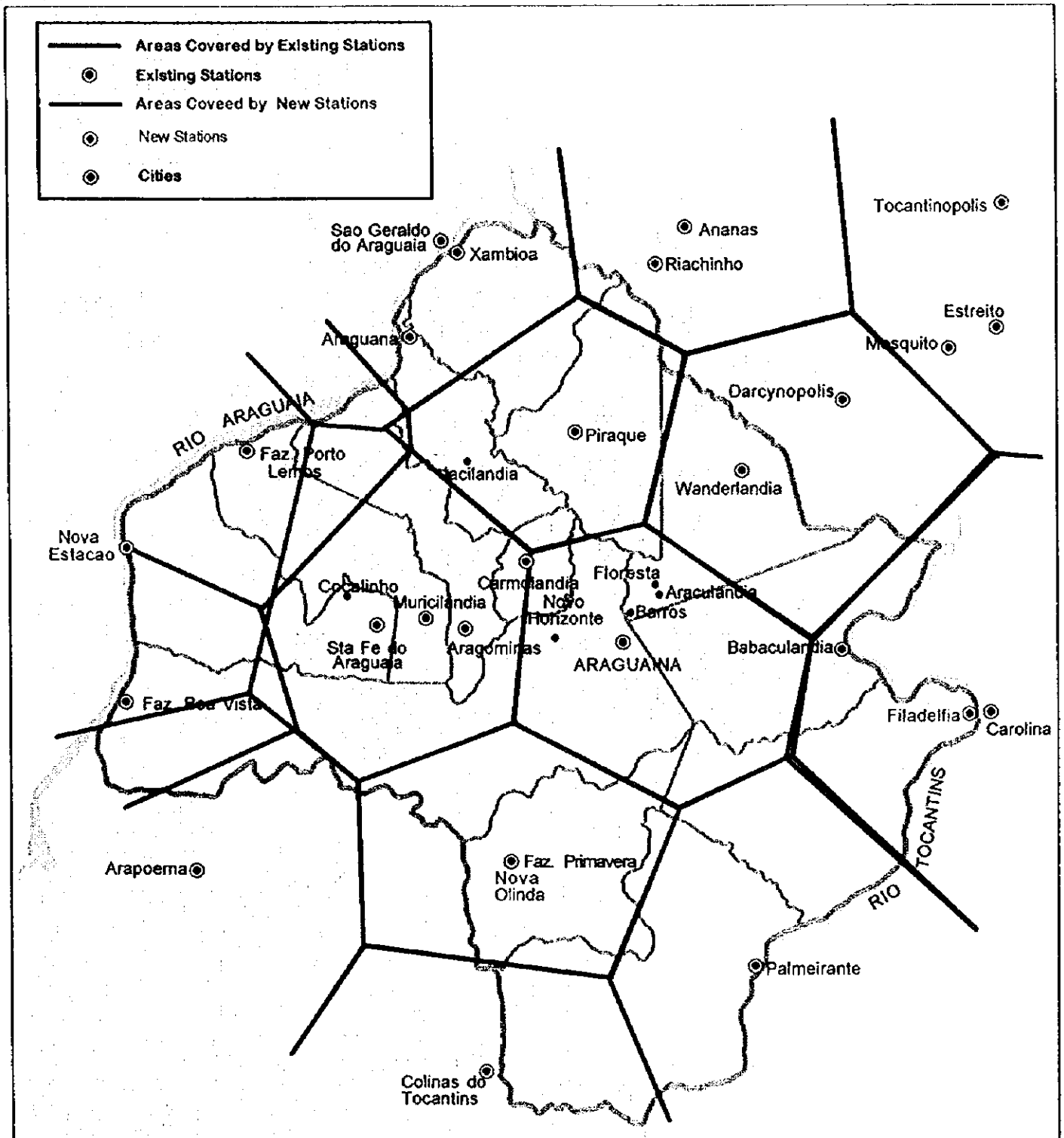

Figure XV-4: Areas Covered by the Stations (Thiessen Method)

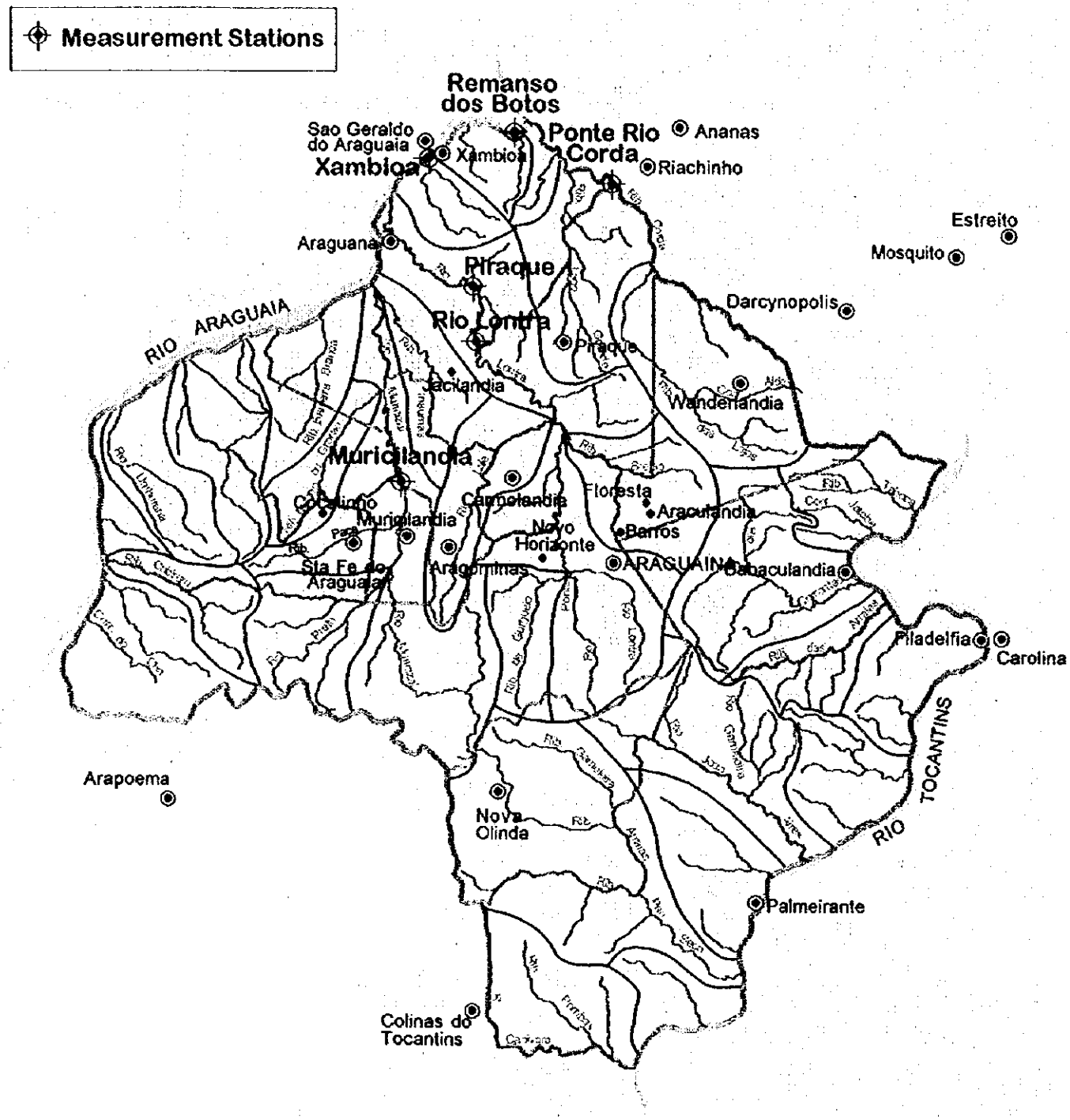

Figure XV-5: North Region Fluvial Basins

Table XV-1: Meteorological Stations (1/1)

No	Cod.	Station	Type	Municipality	Entity	Lat	Long	Altitude	Start	Final
1	547002	Itaguatins	PRE	Itaguatins	DNAEE	05°43'00"	47°30'00"	-	06/1969	
2	547004	Descarreto	P	Itaguatins	DNAEE	05°46'00"	47°29'00"	-	09/1969	09/1976
3	548000	Araguatins	PR	Araguatins	DNAEE	05°39'00"	48°07'00"	-	08/1974	
4	548001	S. Sebastiao do TO	P	S. Sebastiao do TO	DNAEE	05°17'00"	48°12'00"	-	01/1984	
5	647000	Tocantinopolis	PR	Tocantinopolis	DNAEE	06°19'00"	47°25'00"	-	08/1969	
6	647001	Wanderlandia	P	Wanderlandia	DNAEE	06°51'00"	47°51'00"	300	09/1973	
7	647003	Tocantinopolis	P C	Tocantinopolis	INEMET	06°19'00"	47°26'00"	131	03/1916	07/1932
8	648000	Xambioa	PR T	Xambioa	DNAEE	06°22'00"	48°33'00"	-	08/1969	
9	648001	Ananas	P	Ananas	DNAEE	06°22'00"	48°03'00"	-	08/1974	
10	648002	Piraque	P	Xambioa	DNAEE	06°40'00"	48°28'00"	-	08/1974	
11	648003	Faz. Dico Ribeiro	P	Babaculandia	DNAEE	06°49'00"	48°15'00"	-	10/1967	1971
12	648004	UHE Sta Isabel	PREC	Ananas	ELETRONORTE	06°09'00"	48°18'00"	154,2	09/1981	1989
13	649003	Porto Lemos	P	Araguaina	DNAEE	06°52'00"	49°06'00"	-	05/1985	
14	747001	Goiatins(PIACA)	P	Goiatins(PIACA)	DNAEE	07°42'41"	47°18'54"	-	11/1971	
15	747009	Palmeirante	P	Filadelfia	DNAEE	07°51'35"	47°51'43"	-	01/1984	
16	748000	Araguaina	PR	Araguaina	DNAEE	07°12'00"	48°12'00"	-	11/1971	02/1985
17	748001	Colonia	P	Bernardo Sayao	DNAEE	07°52'40"	48°53'43"	200	09/1973	
18	748002	Faz. Primavera	P	Nova Olinda	DNAEE	07°34'00"	48°24'00"	200	09/1973	
19	748003	Muricilandia	P	Araguaina	DNAEE	07°02'00"	48°36'00"	-	08/1974	
20	748004	Araguaina-ENGOPA	PREC	Araguaina	INEMET	07°12'00"	48°12'00"	229	1974	
21	749000	Arapoema	P	Arapoema	DNAEE	07°37'00"	49°12'00"	200	09/1973	
22	749001	Boa Vista	P	Araguaina	DNAEE	07°17'00"	49°12'00"	-	01/1983	
23	847000	Conceicao	P	Itacaja	DNAEE	08°51'00"	47°32'00"	400	05/1973	09/1977
24	847001	Itacaja	P	Itacaja	DNAEE	08°20'00"	47°45'00"	250	08/1973	
25	847002	Cachoeira Mt Lindo	P	Goiatins(PIACA)	DNAEE	07°42'35"	46°55'35"	-	01/1984	
26	848000	Colinas do TO	P	Colinas do TO	DNAEE	08°03'10"	48°28'54"	-	12/1971	
27	848001	Guarai	P	Guarai (Tupirama)	DNAEE	08°49'51"	48°31'01"	300	08/1973	
28	848002	Itapora do TO	P	Itapora do TO	DNAEE	08°34'23"	48°41'27"	300	08/1973	
29	848003	Tupiratins	P	Presidente Kennedy	DNAEE	08°23'53"	48°07'49"	-	08/1969	
30	848004	Pedro Afonso 82863	PRECT	Pedro Afonso	INEMET	08°58'00"	48°11'00"	187	05/1936	
31	849002	Araguacema	P	Araguacema	DNAEE	08°48'37"	49°33'22"	150	08/1973	
32	946003	Lizarda	P	Lizarda	DNAEE	09°36'00"	46°40'00"	620	04/1973	
33	946004	Lizarda	PR	Lizarda	SUDENE	09°33'00"	46°40'00"	620	10/1963	12/1979
34	947000	Dois Irmaos	P	Rio Sono	DNAEE	09°19'00"	47°49'00"	-	07/1973	09/1977
35	947001	Mansinha	P	Rio Sono	DNAEE	09°28'00	47°20'00"	-	01/1983	
36	948000	Miracema do TO	PR	Miracema do TO	DNAEE	09°34'30"	48°23'42"	-	08/1969	
37	948001	Porto Real	P	Porto Real	DNAEE	09°11'00"	48°02'00"	-	09/1969	
38	948002	Tocantinia	P	Tocantinia	Outras	09°34'00"	48°22'00"	170	1939	12/1970
39	949000	Abreulandia	P	Araguacema	DNAEE	09°37'30"	49°09'18"	200	08/1973	
40	949001	Dois Irmaos	P	Dois Irmaos	DNAEE	09°15'26"	49°03'51"	200	09/1973	
41	949002	Pte Rio Piranhas	P	Dois Irmaos	DNAEE	09°04'00"	49°23'00"	-	06/1974	07/1975
42	950000	Caseara	P	Caseara	DNAEE	09°16'15"	49°57'33"	200	08/1973	
43	950002	Cangassu	P	Pium	DNAEE	09°59'00"	50°00'00"	-	01/1984	
44	1047000	Jatoba	P	Rio Sono	DNAEE	10°01'12"	47°25'42"	250	08/1973	
45	1047001	Novo Acordo	P	Novo Acordo	DNAEE	10°00'00"	47°40'30"	300	12/1971	
46	1047002	Porto Gilanda	P	Monte do Carmo	DNAEE	10°46'00"	47°59'00"	300	08/1969	
47	1047003	Rio das Balsas	P	Novo Acordo	DNAEE	10°00'00"	47°54'00"	-	08/1975	
48	1047004	Pte Alta do TO	P	Pte Alta do TO	DNAEE	10°45'00"	47°32'00"	-	01/1984	
49	1048000	Fatima	P	Fatima	DNAEE	10°45'30"	48°54'12"	-	11/1971	
50	1048001	Paraiso do TO	P	Paraiso do TO	DNAEE	10°09'48"	48°53'12"	-	12/1971	
51	1048002	Porto Nacional	PR T	Porto Nacional	DNAEE	10°43'00"	48°25'12"	-	08/1969	11/1977
52	1048003	Porto Nacional 83064	PRECT	Porto Nacional	INEMET	10°43'00"	48°25'00"	239	01/1915	
53	1048004	Porto Nacional	P C	Porto Nacional	DEPV	10°43'00"	48°25'00"	265	08/1966	
54	1048005	Sta Fe Taquarucuzinho	P	Taquarussu do Porto	DNAEE	10°12'00"	48°20'12"	-	06/1976	
55	1049000	Barreira da Cruz	P	Pium	DNAEE	10°33'36"	49°56'00"	-	09/1969	02/1972
56	1049001	Pium	P	Pium	DNAEE	10°26'00"	49°11'00"	-	01/1983	
57	1050002	Sta Terezinha	P	Pium	DNAEE	10°25'00"	50°30'00"	-	10/1985	
58	1146000	Dianopolis	PR	Dianopolis	DNAEE	11°37'30"	46°49'00"	-	12/1971	

Table XV-1: Meteorological Stations (1/2)

No	Cod.	Station	Type	Municipality	Entity	Lat	Long	Altitude	Start	Final
59	1147000	Almas	P	Almas	DNAEE	11°34'12"	47°10'00"	600	09/1973	
60	1147001	Natividade	PRE	Natividade	DNAEE	11°37'48"	47°44'48"	600	08/1973	
61	1147002	Pindorama do TO	P	Pindorama do TO	DNAEE	11°08'30"	47°34'18"	600	09/1973	
62	1140003	Porto Alegre	P	Porto Alegre do TO	DNAEE	11°36'48"	47°02'42"	-	08/1975	
63	1148000	Faz. Lobeira	P	Natividade	DNAEE	11°31'00"	48°19'00"	300	08/1969	
64	1149000	Duere	P	Duere	DNAEE	11°21'00"	49°16'00"	200	09/1972	
65	1149001	Formoso do Araguaia	PR	Formoso do Araguaia	DNAEE	11°48'00"	49°32'00"	300	09/1973	
66	1149002	Gurupi	P	Gurupi	DNAEE	11°43'30"	49°04'00"	-	11/1971	
67	1149003	Poco de Pedra	P	Duere	DNAEE	11°10'00"	49°34'00"	-	01/1984	
68	1150000	Faz. Telesforo	P	Formoso do Araguaia	DNAEE	11°55'00"	50°40'00"	-	08/1969	
69	1150004	Sta Izabel do Morro	P C	Cristalandia	DEPV	11°34'00"	50°38'00"	210	1974	1976
70	1246000	Pte Alta do Bom Jesus	P	Pte Alta do Bom Jesus	DNAEE	12°05'30"	46°28'48"	600	08/1973	
71	1246001	Aurora do Norte	P	Aurora do TO	DNAEE	12°39'30"	46°24'30"	700	08/1973	
72	1246002	Taguatinga	P	Taguatinga	DNAEE	12°24'24"	46°26'00"	650	08/1973	09/1977
73	1246003	Taguatinga 83235	PRECT	Taguatinga	INEMET	12°24'00"	46°26'12"	604	12/1915	
74	1247000	Conceicao do TO	P	Conceicao do TO	DNAEE	12°13'00"	47°17'18"	-	08/1973	
75	1247001	Parana	PR T	Parana	DNAEE	12°37'00"	47°52'42"	-	10/1970	11/1977
76	1247002	Rio da Palma	P	Conceicao do TO	DNAEE	12°25'12"	47°11'30"	400	06/1973	
77	1247003	Parana 83231	PRECT	Parana	INEMET	12°33'00"	47°51'00"	275	01/1916	
78	1247005	Faz. Sta Rita	P	Parana	DNAEE	12°42'00"	47°16'00"	-	02/1984	
79	1248000	Peixe	P	Peixe	DNAEE	12°01'42"	48°32'18"	373	03/1970	11/1970
80	1248001	Colonha	P	Peixe	DNAEE	12°23'12"	48°42'30"	-	08/1974	
81	1248002	Peixe 83228	PRECT	Peixe	INEMET	12°03'00"	48°32'00"	373	1938	
82	1248003	Palmeiropolis	P	Palmeiropolis	DNAEE	12°59'00"	48°24'06"	-	02/1978	
83	1248004	UHE Peixe	P	Parana	FURNAS	12°00'00"	48°00'00"	-	12/1994	
84	1249000	Alvorada	PR	Alvorada	DNAEE	12°28'48"	49°07'12"	-	12/1971	
85	1249001	Araguacu	P	Araguacu	DNAEE	12°55'48"	49°49'30"	500	09/1973	
86	1249002	Proj. Rio Formoso	PRE	Formoso do Araguaia	DNAEE	12°02'00"	49°43'00"	-	12/1980	
87	1249003	Barreira do Pequi	P	Formoso do Araguaia	DNAEE	12°05'00"	49°56'00"	-	04/1984	
88	1249004	Praia Alta	P	Araguacu	DNAEE	12°25'00"	49°47'00"	-	04/1986	

Table XV-2: Precipitation Measurement

North Region

No	Station	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97
1	Wanderlandia																
2	Xambioa																
3	Piraque																
4	Faz. Dico Ribeiro																
5	Porto Lemos																
6	Palmeirante																
7	Araguaina																
8	Faz. Primavera																
9	Muricilandia																
10	Araguaina																
11	Boa Vista																

Adjacent Regions

No	Station	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97
1	Tocantinopolis																
2	Tocantinopolis																
3	Ananas																
4	UHE Sta Isabel																
5	Goiatins(PIACA)																
6	Colonia																
7	Arapoema																
8	Cachoeira Mt Lindo																
9	Colinas do TO																

Complete Data
Incomplete Data
Existinting Data

降雨データ.xls

Table XV-3: Fluviometric Measurement (1/1)

No	Cod.	Station	Type	River	Entity	Lat	Long	Drainage	Inicial	Final
1	21080000	Sao Salvador	FRD	Rio Tocantins	DNAEE	12°44'35"	48°14'16"	63522	11/1977	
2	21650000	Montante Barra do Palma	F D	Rio Parana	DNAEE	12°37'16"	47°53'10"	40466	11/1977	
3	21800000	Parana (Prada)	F	Rio Parana	Outras	12°34'00"	47°52'00"	-	10/1930	03/1948
4	21850000	Rio da Palma	F D	Rio Palma	DNAEE	12°24'57"	47°11'44"	12527	06/1973	
5	21890000	Barra do Palma	F D	Rio Palma	DNAEE	12°36'12"	47°51'41"	17547	12/1971	
6	21900000	Parana	F D T	Rio Parana	DNAEE	12°36'49"	47°53'40"	58013	10/1970	
7	22030005	AHE Peixe-Escondido	F	Rio Tocantins	FURNAS	12°28'14"	48°12'41"	125174	04/1989	
8	22030010	AHE Peixe-Cruzeiro	F	Rio Tocantins	FURNAS	12°26'50"	48°16'05"	125174	05/1989	
9	22030015	AHE Peixe-Sao Luis	F	Rio Tocantins	FURNAS	12°21'18"	48°15'32"	125174	06/1989	
10	22030020	AHE Peixe-Mira A	F	Rio Tocantins	FURNAS	12°18'58"	48°18'56"	125174	04/1994	
11	22030025	AHE Peixe-Mira B	F	Rio Tocantins	FURNAS	12°19'06"	48°15'23"	125174	04/1994	
12	22030030	AHE Peixe-Mira C	F	Rio Tocantins	FURNAS	12°18'49"	48°15'29"	125174	03/1990	
13	22030035	AHE Peixe-Mira D	F	Rio Tocantins	FURNAS	12°18'50"	48°15'31"	125174	04/1994	
14	22030040	AHE Peixe-Mira E	F	Rio Tocantins	FURNAS	12°18'28"	48°15'26"	125174	04/1994	
15	22030045	AHE Peixe-Mira F	F	Rio Tocantins	FURNAS	12°18'41"	48°15'43"	125174	04/1994	
16	22030050	AHE Peixe-Mira G	F	Rio Tocantins	FURNAS	12°18'16"	48°15'44"	125174	05/1989	
17	22030055	AHE Peixe-Mira H	F	Rio Tocantins	FURNAS	12°18'37"	48°15'59"	125174	06/1990	
18	22030060	AHE Peixe-Mira I	F	Rio Tocantins	FURNAS	12°18'03"	48°16'01"	125174	04/1994	
19	22030065	AHE Peixe-Mira J	F	Rio Tocantins	FURNAS	12°18'23"	48°16'14"	125174	04/1994	
20	22030070	AHE Peixe-Jatoba	F	Rio Tocantins	FURNAS	12°15'43"	48°19'45"	125174	05/1989	
21	22030080	Peixe		Rio Tocantins	FURNAS	12°18'24"	48°15'52"	-		
22	22040000	Faz. Angical	FRD	Rio Tocantins	DNAEE	12°15'06"	48°20'47"	125436	07/1974	
23	22050000	Peixe	F	Rio Tocantins	Outras	12°01'20"	48°32'00"	127720	09/1938	02/1946
24	22050001	Peixe	F D	Rio Tocantins	DNAEE	12°01'20"	48°32'00"	130052	09/1938	
25	22100000	Colonha	F D	Rio Sta Tereza	DNAEE	12°23'32"	48°42'46"	8690	08/1974	
26	22150000	Jacinto	F D	Rio Sta Tereza	DNAEE	11°59'03"	48°39'33"	13811	12/1971	
27	22190000	Porto Alegre	F D	R. Man. Alves da Nativ.	DNAEE	11°36'44"	47°02'43"	1801	08/1975	
28	22220000	Porto Jeronimo	F D	R. Man. Alves da Nativ.	DNAEE	11°45'28"	47°50'15"	10373	08/1974	
29	22230080	Manuel Alves Natividade		Rio Tocantins	ELETRONORTE	11°41'00"	48°09'00"	10780		
30	22250000	Faz. Lobeira	F D	R. Man. Alves da Nativ.	DNAEE	11°31'56"	48°17'23"	14462	08/1969	
31	22340000	4km Mont. de Porto Nac.	F D	Rio Tocantins	ELETRONORTE	10°45'34"	48°24'42"	173728	07/1974	03/1978
32	22340001	Ribeirao dos Potes	F D	Rio Tocantins	ELETRONORTE	10°44'00"	48°25'00"	178660	12/1983	08/1989
33	22349080	Porto Nacional		Rio Tocantins	ELETRONORTE	10°46'00"	48°24'00"	177800		
34	22350000	Porto Nacional	F D Q	Rio Tocantins	DNAEE	10°42'31"	48°25'09"	173828	08/1930	
35	22400000	Barra do Matanca	F D	Rio Tocantins	ELETRONORTE	10°31'00"	48°27'00"	-	03/1984	08/1989
36	22490000	Lageado Faz. Brejinho	F D	Rio Tocantins	ELETRONORTE	09°44'00"	48°22'00"	190010	08/1973	09/1977
37	22499008	Tocantinia	F	Rio Tocantins	Outras	09°34'00"	48°23'00"	-	04/1939	08/1945
38	22500000	Miracema do TO	F D Q	Rio Tocantins	DNAEE	09°33'00"	48°24'00"	186834	08/1969	
39	22550000	Pedro Afonso	F	Rio Tocantins	Outras	08°58'00"	48°11'00"	-	1942	1948
40	22601080	Balsas I		Rio das Balsas	ELETRONORTE	10°34'00"	47°51'00"	8890		
41	22639080	Balsas II		Rio das Balsas	ELETRONORTE	10°01'00"	47°54'00"	11860		
42	22661080	Sono I		Rio do Sono	ELETRONORTE	10°11'00"	46°59'00"	9820		
43	22680000	Jatoba	F D	Rio do Sono	DNAEE	10°06'00"	47°18'00"	13855	06/1973	
44	22680080	Sono II		Rio do Sono	ELETRONORTE	10°01'00"	47°43'00"	17850		
45	22700000	Novo Acordo	F D	Rio do Sono	DNAEE	10°02'00"	47°48'00"	18511	12/1971	
46	22710000	Faz. Porteira	F D	Rio das Balsas	ELETRONORTE			4268	03/1986	
47	22730000	Porto Gilandia	F D	Rio das Balsas	DNAEE	10°46'00"	47°47'00"	7735	07/1969	11/1982
48	22750000	Rio das Balsas	F D	Rio das Balsas	DNAEE	10°00'00"	47°59'00"	11862	08/1975	
49	22850000	Dois Irmaos	F D	Rio Perdida	DNAEE	09°19'00"	47°49'00"	10545	07/1973	
50	22900000	Porto Real	F D	Rio do Sono	DNAEE	09°11'00"	48°02'00"	44910	08/1969	
51	23100000	Tupiratins	F D	Rio Tocantins	DNAEE	08°23'30"	48°06'41"	243841	08/1969	
52	23130000	Proximo Colinas de GO	F D	Rio Capivara	DNAEE	08°04'09"	48°27'06"	515	02/1984	
53	23140000	Ribeirao dos Cavalos	F	Ribeirao dos Cavalo	Outras	08°17'00"	47°43'00"	-	03/1974	07/1975
54	23150000	Itacaja	F D	R. Man. Alves Peq	DNAEE	08°23'30"	47°45'55"	2776	08/1973	
55	23200000	Pedra Chorosa	F D	Rio Tocantins	DNAEE	07°27'00"	47°36'00"	259724	07/1974	02/1980
56	23220000	Cachoeira Mt Lindo	F D	R. Man. Alves Gde	DNAEE	08°03'00"	47°02'00"	4158	01/1984	
57	23230000	Jacare	F D	Rio Vermelho	DNAEE	07°57'48"	47°15'40"	5069	01/1984	
58	23250000	Goiatins	F D	R. Man. Alves Gde	DNAEE	07°42'28"	47°18'42"	9636	11/1971	
59	23260000	Faz. Manuel Alves	F D	Rio Tocantins	ELETRONORTE	07°25'00"	47°35'00"	-	05/1985	08/1989

Table XV-3: Fluviometric Measurement (1/2)

No	Cod.	Station	Type	River	Entity	Lat	Long	Drainage	Inicial	Final
60	23461000	Faz. Boqueirao	F D	Rio Farinha	ELETRONORTE			4914	07/1986	
61	23462000	Pte BR-230	F D	Rio Farinha	ELETRONORTE			5132	05/1985	
62	23470000	Faz. Veredao	F D	Rio Tocantins	ELETRONORTE			1233	08/1986	
63	23600000	Tocantinopolis	F Q	Rio Tocantins	DNAEE	06°19'00"	47°25'00"	290570	01/1955	
64	23600002	Tocantinopolis	F	Rio Tocantins	DNAEE	06°19'00"	47°25'00"	-	10/1930	1941
65	23620000	Faz. Palmeirinha	F D	Rio Tocantins	ELETRONORTE			3646	08/1986	
66	23700000	Descarreto	F D	Rio Tocantins	DNAEE	05°46'00"	47°29'00"	298559	09/1969	
67	23700080	Sto Antonio (Estreito)		Rio Tocantins	ELETRONORTE	05°46'00"	47°29'00"	302800		
68	23710000	Itaguatins	F	Rio Tocantins	DNAEE	05°43'00"	47°30'00"	298689	09/1969	
69	23710500	Faz. Lajinha	F	Rio Tocantins	ELETRONORTE			299750	01/1989	
70	23710501	Faz. Lajinha-Sec.02(Br.Dir.)	F D	Rio Tocantins	ELETRONORTE			299750	11/1987	
71	23710502	Faz. Lajinha-Sec.02(Br.Esq.)	F D	Rio Tocantins	ELETRONORTE			299750	11/1987	
72	23720000	Sitio Soturno	F	Rio Tocantins	ELETRONORTE	05°45'00"	47°30'00"	305430	11/1973	03/1978
73	26010000	Faz. Mirindira	F	Rio Araguaia	PORTOBRAS	12°38'00"	50°39'00"	-	10/1982	
74	26020000	Faz. Presidente	F	Rio Araguaia	PORTOBRAS	12°13'00"	50°39'00"	-	10/1982	1986
75	26030000	Faz. Telesforo	F D	Rio Araguaia	DNAEE	11°55'00"	50°40'00"	1311600	08/1969	
76	26650000	Faz. Boa Vista	F	Rio Araguaia	PORTOBRAS	10°41'00"	50°36'00"	-	10/1982	1986
77	26710000	Barreira do Pequi	F D	Rio Javaes	DNAEE	12°05'00"	49°56'00"	-	04/1985	
78	26720000	Praia Alta	F D	Rio Formoso	DNAEE	12°25'00"	49°47'00"	-	04/1986	
79	26750000	Proj.Rio Formoso	F D	Rio Formoso	DNAEE	12°04'00"	49°44'00"	7920	12/1980	
80	26770000	Rio Taboca	F D	Rib. Itaboca	DNAEE	12°05'00"	49°38'00"	366	12/1980	05/1982
81	26800000	Barreira da Cruz	F D	Rio Javaes	DNAEE	10°32'00"	49°56'00"	40327	09/1969	
82	27100000	Caseara	F D	Rio do Coco	DNAEE	09°44'00"	50°01'00"	5873	08/1973	12/1985
83	27150000	Caseara	F	Rio Araguaia	PORTOBRAS	09°14'10"	49°57'30"	-	07/1984	1986
84	27200000	Caseara Eixo 650	F	Rio Araguaia	PORTOBRAS	09°14'00"	49°57'00"	-	07/1984	1986
85	27300000	Rio Caiapo	F D	Rio Caiapo	DNAEE	09°18'00"	49°42'00"	3738	09/1973	01/1980
86	27320000	Araguacema	F	Rio Araguaia	DNAEE	08°48'11"	49°33'22"	308094	08/1974	
87	27380000	Pte Rio Piranhas	F D	Rio Piranhas	DNAEE	09°11'00"	49°22'38"	3748	08/1974	1994
88	27450000	Faz. Sao Jose	F	Rio Araguaia	PORTOBRAS	08°28'00"	49°22'00"	-	10/1982	1986
89	27550000	Arapoema	F D	Rio Jenipapo	DNAEE	07°37'00"	49°03'00"	-	05/1985	
90	27600000	Pau D'arco	F	Rio Araguaia	DNAEE	07°31'00"	49°23'00"	343119	08/1974	
91	28150000	Muricilandia	F D	Rio Muricizal	DNAEE	07°02'00"	48°36'00"	2024	08/1974	
92	28230000	Rio Lontra	F D	Rio Lontra	Outras	06°47'00"	48°27'00"	-	09/1973	07/1975
93	28240000	Piraque	F D	Rio Lontra	DNAEE	06°40'00"	48°28'00"	3488	08/1974	
94	28300000	Xambioa	F D T	Rio Araguaia	DNAEE	06°23'00"	48°33'00"	364496	08/1969	
95	28320000	Ponte Rio Corda	F D	Rio Corda	DNAEE	06°28'00"	48°12'00"	-	06/1985	1994
96	28340000	Remanso dos Botos	F	Rio Araguaia	DNAEE	06°22'00"	48°23'00"	365609	08/1973	
97	28500000	Faz. Sta Luciana	F	Rio Araguaia	ELETRONORTE	05°59'00"	48°19'00"	357020	10/1974	09/1977
98	28544080	UHE Sta Izabel	F D	Rio Araguaia	DNAEE	06°07'00"	48°19'00"	372200	09/1981	
99	28545000	UHE Sta Izabel	F D	Rio Araguaia	DNAEE	06°07'00"	48°19'00"	372200	09/1981	
100	28850000	Araguatins	F D	Rio Araguaia	DNAEE	05°39'00"	48°07'00"	376659	08/1974	

Obs.: F=Fluviometry; D=Net Discharge; T=Telemetry; Q=Water Quality

Table XV-4: Discharge Measurement in Inner Part of North Region

North Region

No	Station	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96
1	Muricilandia							■	■	■	■	■	■	■	■	■	■	■	■
2	Rio Lontra							■											
3	Piraque							■	■	■	■	■	■	■	■	■	■	■	■
4	Xambioa						■	■	■	■	■	■	■	■	■	■	■	■	■
5	Ponte Rio Corda													■	■	■	■	■	
6	Remanso dos Botos							■	■	■	■	■	■	■	■	■	■	■	■

Adjacent Regions

No	Station	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96
1	Faz. Manoel Alves													■	■	■	■	■	■
2	Carolina																		
3	Carolina	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

ANNEX XVI

PRIVATE SECTOR INCENTIVE PROGRAM

ANNEX XVI

PRIVATE SECTOR INCENTIVE PROGRAM

1 Export Incentive Program

1.1 Economic Development Promotion (PROSPERAR)

At the State level, the most important one is the Incentive Program for the Economic Development of the State of Tocantins - PROSPERAR, in which incentives are given by means of technical and financial support to whatever economic activity may promote agricultural, cattle-raising, industrial, commercial and tourism development.

PROSPERAR doesn't mean exemption for tax of ICMS (Imposto sobre Circulaçào de Mercadorias e Serviços), but the company with a permit can be postponed to pay up to 70% of ICMS for 10-15 years

PROSPERAR functioned the tax exemption as a matter of fact in the past due to high inflation, giving the companies a great deal of incentives, but nowadays becomes only a mechanism to payment postponement of ICMS in a certain level. As the present situation has been changed, entrepreneurs ask for new incentive.

New policies under discussion are supposed to give a equivalent amount to the tax payer to attain production target from the fund which was donated 10% of financed amount compulsory. And SEINC takes a consideration of the charge reduction from 0.5%, 6 installments on the financed amount to 0.3%, 12 installments.

Cities of Araguaína, Grupi, Paraiso do Tocantins, Porto Nacional and Palmas established an industrial zone where the infrastructure such as electricity supply, water supply and sewage, city-facilities are equipped in order. And these municipals treat the advanced companies into a industrial zone for local-tax exemption for 10 years under PROSPERAR.

PROSPERAR started in 1989 has applied to 39 companies by 1996, including companies related to agricultural products. 15 companies are applying for PROSPERAR at present.

1.2 Araguaína Export Processing Zone

The Araguaína Export Processing Zone (ZPE), created by the Federal Decree No.98,123 of September 6th, 1989, is a mechanism aimed at the regional economic development through the establishment of export-connected enterprises, with an extremely favorable fiscal and foreign-exchange treatment. It is located on the Belém-Brasilia roadside and it shall be interconnected by a secondary road up to the North-South Railway.

The ZPE-Tocantins keeps a surface of 300 ha, in future the area to be expanded up to

1,000 ha, with a perimeter of 7.12 km. It is located 13.8 km from the Araguaína Airport. The construction was commenced in 1995, and completed in 1996, including the customs office and other related facilities. No factory is not in operation yet actually, even though some foreign companies are interested in their advance there. Some appropriate measures that meet the current demand are keenly requested because the world trade circumstances has been greatly changed since Decree for ZPE was established in 1989.

1.2.1 Exportation Processing Zone-ZPE-Araguaina

(1) Background to the foundation

a) Purpose of the foundation period

According to the Federal Government, the creation of the ZPE had the purpose to provide an instrument to some regions, an instrument destined to contribute in the correction of regional unbalances, generation of employment, strengthening of the stock payment and diffusion of new technologies and more modern management methods. Therefore it became in a mechanism that aimed the economical development of certain region through the establishments of exportation firms with differential fiscal and exchange treatment.

b) Legislation for the creation of the ZPE

The Federal Government created through the Decree No. 2452, of July 29th 1988 that regulates the tributary, exchange and administrative regime for the ZPE.

Within the purposes exposed by the Federal Government, the ZPE was characterized as a free area, for the custom control as primary zone specially destined for the installation of firms concerned for the production of goods to be commercialized in the foreign market.

Through the Decree No. 96752 of September, 22nd. 1988, The Federal Government regulates the Decree-low No. 2452, that creates the ZPE.

The National Council of the ZPE was created through the Decree No. 96.759 of September, 22 1988 in order to apply penalties, analyze proposal for its creation and the approval and authorization for the installation of industrial projects in this area.

The ZPE of Araguaina was created by the Decree No. 98.123 of September 6th. 1989.

c) Location and situation of the Brazilain ZPE's

Initially, the proposal for the implantation of ZPE was the North and Northeast region which might have a development alternative independent of subsides and other federal resources as well as the relocation of productive activities of the remaining region of the country. However, then it was extended to other region with success potentialities in the utilization of this instrument.

c.1) ZPS`s that already started the infrastructure works

Municipality of Imbituba - State of Santa Catarina

It has Master Plan, Environmental Studies, the RIMA Project custom already approved.

From 5 projects submitted to CZPE, three are already approved. They referrers to shoes, furniture and electronic equipment for security sector. The investment of those three factories is about US$ 15 millions and expecting the generation of approximately 900 employment. The proposed area for the ZPE is around 6 Km. From Imbituba to Florianopolis 100 Km. The Imbituba port is private property well managed. The installation are proper for ZPE, it operates with grains, general charges and containers.

The conclusion of the infrastructure works is foreseen for the end of 1997. The provable structure of the Imbituba ZPE shall be closer like the traditional structure of the ZPE than the remaining projected for other region.

Municipality of Teofilo Otoni - State of Minas Gerais

With a fenced area of 16 ha. And 90%of the building already built in an area of 3 ha. The basic infrastructure was implanted through the join actions of businessmen, Municipal and State Government. Three firms considered anchor in the processing of precious and semi-precious stones are elaborating projects to be submitted to the CZPE. The partnership of public sector, Municipal Prefecture, State Government and Private Sector made possible the implantation of the ZPE where they already invested R$ 5,000,000.00. Finishing of works are expected for the end of the year.

Municipality of Rio Grande - State of Rio Grande do Sul

The ZPE of Rio Grande is the only ZPE which basic infrastructure is already finished: highway and railway access , 600 telephone lines channels, low and high tension net, etc. However, Environmental Studies, Environmental Impact Report and Master Plan are being elaborated together with the ZPE manager and the Municipal Prefecture. Therefore the approval for the installation project together with the ZPE Council, Federal Budget and Environment Secretary is very delayed.

c.2) the ZPE`s with high success probabilities and which the beginning of works depend on details and very expected are:

Municipality of Corumba - State of Matto Grosso do Sul
Municipality of Sao Luis - State of Maranhao

c.3) the ZPE`s that depend on more complicated procedures, besides their feasibility are:

Municipality of Itaguai - State of Rio de Janeiro
Municipality of Vila Velha - State of Espiritu Santo

c.4) the Northern ZPA's that in general fulfill all the location requirements but with the exception of Sao Luis, they are in stand by stage, awaiting the decision of the remaining exportation zone.

Municipality of Suape - State of Pernambuco
Municipality of Acaraju - State of Sergipe

c.5) the ZPE's with reduced possibility for implantation are:

Municipality of Itacoatiara - State of Amazonas
Municipality of Barcarena - State of Para
Municipality of Paranaiba - State of Piaui
Municipality of Ilheus - State of Bahia
Municipality of Carceres - State of Mato Grosso

d) Present situation of the ZPE - Araguaina

The owners of the ZPE - Araguaina, a partnership between the State Government and private sector has already invested R$ 1,400,000.00. The facilities already finished are, the civil works, administrative buildings, custom buildings, complementary buildings, fencing and urbanization works such as internal infrastructure, pavement, supply of water and electrical works.

The request for the approval of the work executed in the ZPE was already submitted to the Federal Revenue in Palmas in order to obtain the liberation of the area. The EIA - Environmental Impact Study and the RIMA Environmental Impact of the place where the ZPE-Araguaína is implanted and the approval is in judging stage.

The ZPE-Araguaína is lack of any industrial project or investment to be placed inside the area. This ZPE is very delay comparing to the ZPE's of Imbituba - SC, Teofilo Otoni - MG, and Rio Grande - RS. The first of them has already three industrial projects approved by the CZPE and the other two has projects under studied.

e) Economic scenery of the ZPE-Araguaina creation period and present situation

The industrial and foreign commerce policy of the last three governments had as remarkable characteristic the gradual and controlled opening of the economy to the international markets. The arisen of some "accidents" that made necessary the use of resources did not change the basic orientation of that policy. From the point of view of the monitory of the opening, good theory lessons and international experiences were used, being eliminated the no-charge barriers, setting only the customs charge as responsible for the protection of industry, a gradual reduction system of aliquot was adopted, according to a schedule previously agree with the industrial sectors for a determined period.

The final objective of that opening process was not obviously the reduction of the charge to zero but leave them in a medium level capable to supply an appropriate residual protection to the national industry, then decrease it enough up to expound it to

the international demand that obligate to the national industry to look for better efficiency standard and higher competitiveness, facts that were not included before within its strategic priorities.

This opening strategic was characterized by the gradual expansion way along four years as well as the agreed generic and uniform charge reduction or "phasing-out" that value for all national territory and for al sectors, without local/regional difference or of nature sector, and even after finishing of the reduction process, the aliquots shall remain in a level capable to supply protection steel necessary to the national industry. From this point, the continuation of the opening process can be pretended without previous removing of structural inefficiencies of the economy (precarious transportation system and port installation, cascade tributary incidence, etc.) and careful evaluation of the first "round" of the structural protection reduction.

The ZPE are only a part of that economy opening policy and as instruments of that policy, the ZPE are characterized by the promotion of a specially located liberation valid for a perfectly delimited area (different from the generic opening strategy that is extended to all national territory) for immediate operation (and not operated along a determined period) and complete (the charge of the ZPE are reduced to zero).

Once all the products manufactured in the ZPE are destined for exportation, there is any risk for disloyal competence with the national industry out of the ZPE. It is the same in case of the selling of some production in the domestic market, considering that this operation shall be treated as normal importation.

The main difference of both system is that the ZPE produce immediately and completely the necessary opening to make feasible determinate activities and attract investment that may not wait (under the risk of losing them) the conclusion of a liberation without period for completion.

f) Central administrative institution and support institutions

The Council of the ZPE created by Decree N° 2452 in July 29th. 1988 integrated to the basic structure of the Industry and Commerce Ministry and composed by the Ministry of Industry and Commerce as president of the Council, Ministry of Finance as Vice-President ; the Minister of Science and Technology; Civil Cabinet Chief of the Presidency; Chief of the Planning and Coordination Secretary of the Presidency and General Secretary of the National Security Council, and the responsible for the administration the ZPE.

The administration of each ZPE is exercised by the administration firm created for this purpose by the State or Municipality

For the administration of the ZPE -Araguaína, the State Government of Tocantins created the Administration Company of ZPE-TO, an economy partnership where the state has 20% of the capital and the remaining is formed by private capital.

In national level, there is a class entity, the Brazilian Association of ZPE -ABRAZPE

g) Present situation of the internal structure

The ZPE- Araguaína has an availability of 300 ha. of total area, for the moment with 25 ha of fenced area, pavement works already finished since one year ago and two traffic road. The civil works such as administrative buildings, custom buildings and complementary works are already finished.

There are also internal infrastructure, pavement, water, and electrical energy. The communication system shall be installed after the requirement of custom and administration of ZPE.

h) Present situation of the existing external infrastructure

The ZPE- Araguaína, is strategically placed by the side of the North-South Railway that is linked to the Itaqui Port in Maranhão, port with exceptional characteristic for exportation with immediate benefit in the transportation cost for the products manufactured in the ZPE-TO, due the low cost of the railway transportation and for the close location of the Itaqui Port that is connected to the main port of the United States and Europe

Immediately, the products destined for U.S.A and Europe may be exported along of 240 Km through highway up to Imperatriz - Maranhão, from there to the Port of Itaqui in São Luis Maranhão through the Carajás Railway in an extension of approximately 100 Km.

i) Existing problems

i.1) Managing of the project

Few interaction between the private sector partner responsible for the managing of the Project and the public institutions in who define the macro policies such as SEPLAN, and departments SEINC and SEFAZ, besides other related entities.

i.2) Information of the ZPE functioning

There is a generalized lack of information regarding what it is, functioning and real benefits of the ZPE. This is lack of knowledge is found even in the business sector, mainly the potential domestic investors an also in the technical staff of the linked interested institutions.

i.3) Lack of a strategy plan of effective occupation

The lack of a Strategy Plan creates a negative background for the multiple attraction actions of potential investors and for the effective occupation of the ZPE-Araguaina.

j) Elaboration of the improvement plan

Short Term Plans

a) Solution of the bureaucratic disputes (certifications, associations to ABRAZPE and others)
b) The stimulation of investments with resources of local businessmen shall be an important factor in order to attract international investors as well as for the consolidation of the ZPE-Araguaína.
c) Elaboration of informative materials remarking the comparative advantages for the installation of industrial units detailing the financing conditions and interest rates, for the importation of industrial equipment and accessories and also mention the solution given by the ZPE, regarding the civil works and associated production costs which projects are already under execution.

k) External improvement plans

a) Project for the Construction of a North-South Railway section, linking the ZPE-Araguaína to the Itaqui Port in São Luis of Maranhão.
b) Creation of the Development Bank of Tocantins, that may support the strengthening action of the ZPE.
c) Elaboration of Road works Plan in order to improve the transportation of production from different point of the state to the industrial pole of ZPE-Araguaína.

l) Effective occupation plan of the ZPE-Araguaina

The attraction of national and international investors in a short period may be reached through the elaboration of an Effective Strategic Occupational Plan that involves the different sectors of the society.

1.3 Program for Installation of a Dry Port in Tocantins

1.3.1 Scenery for the Installation of a Dry Port

(1) Definition of Dry Port

Dry Port or Interior Custom Station - EADI, an organ subordinated to the Secretary of the Federal Budget of the Finance Ministry, which main purpose is to attend the demands in fiscal terms of juridical and physical terms for foreign trading importation and exportation. The custom clearing is done in the interior of the country, away from the reception port or airport the same as the dispatch of commodities from the exterior.

Within the new philosophy of foreign trading established by the Federal Government, the Dry Port aims to insure, to the manufacturers, the access to the international market in the way the productions of goods, mainly agriculture products, extends the its frontiers to the west.

(2) Objectives

As it might be known, the production of goods for the foreign market is one of the main economic development factors, considering that once the substitutions of importation policy is overpassed, the policy for promotion of exportation is developed.

The lack of a foreign trading logistic that may reduce the costs and make possible the importation of commodities by businessmen of the State can also affect the exportation of industrial products of Tocantins which utilize imported components and to the agriculture products of the state too.

Presently, the possibility to access to the foreign market may be the difference between the economical development, supported by exportations or the conformity to play a secondary role within the national economy scenery

A foreign trading may be implemented by the cooperative action of the government administration together with the private sector based on clear definition of responsibility. The government investment in infrastructure may be improved with private investments destined for the implantation of rendering of service structures, remunerated by the users, necessary for liberation of commodities coming from foreign markets.

(3) Localization for the Implantation

There is a lack of foreign trading logistic for the State of Tocantins, specially for the north region of the State, a region that is receiving important investments. However, the lack of a logistic that may provide competitiveness conditions to the production destined for the foreign market and which may also facilitate the importation of products and industry inputs of the region may reject new investors.

According to the proposal presented in the Intermediate Report, were the North Region is set as the priority region for the implantation of the Regional Development Pilot Project, it became the area as the first place for the implantation of In-Land Port.

It also may be mentioned that the implantation of the ZPE - Araguaina is an important reference for the establishment of the In-land port in the north region, a meeting point of all exporter industries and foreign trading and of the major concentration of import and export charges.

(4) Advantages

1) Reduction of the exporter/imported costs;
2) Provide facility for exportation/importation;
3) Make possible the actuation of the small and medium farmers in the foreign market;
4) Create the possibility to turn the regional production to the foreign market.

1.3.2 Necessary Plans for Implementation

Elaboration of studies to define the foreign trading logistic of the State, taking advantage of the existing government infrastructure services and from the structure to be implanted with investment of the private sector for rendering of services necessary for liberation of commodities from foreign markets and/or to whom they are destined.

2 Program for Agricultural Modernization

Incentive to the Creation of Commodities Market

2.1 Introduction

The deficiencies in the structure of agricultural production show the lack of infrastructure (physical space) which allows the negotiation between the producer and the purchaser and the lack of prices formation and market information systems. In this context, some actions can be defined in order to serve the production and commercialization of grains and meat cattle. One interesting mechanism could be the participation of Tocantins producers in the commercialization through Commodities Markets.

2.2 Commodities Markets - operation

The Commodities Markets depend on the existence of physical space where the negotiations can take place. In these places, the supply and demand proposals are concentrated, establishing, as a consequence, the price.

Besides propitiating the encounter of sellers and purchasers, through brokers, the Commodities Markets are also useful to signalize the prices to the market.

Basically, a Commodities Market shall propitiate services infrastructure which allow the organized encounter between the products supply and demand. Above all, the Commodities Market shall secure competitiveness conditions, eliminating the possibility of prices manipulation.

Specifically, the objectives of a Commodities Market are as follows :

a) to supply to the users compatible places to the work development and the market increase;
b) to regulate the several markets and negotiations taken place within the market and carried out by its components;
c) to establish the contracts uniformity in terms of quality, quantity, period and delivery place of the commercialized product;
d) to apply punitive measures when there are transgressions of the established rules;
e) to offer to the participants a sellers cry system open to the public, in a determined hour, transmitting transparency and trustability to the negotiations;
f) to divulge the information, specially the prices quotations, to the various sectors of the economy, reducing the information cost and allowing the formation of

expectations with the consequent structuring of the "products future markets".

The importance of the future markets lays on the fact that the signaling of prices, indicated by the negotiations, can be utilized by producers, processors and traders to allocate resources to the activity. In this context, the future prices can influence the decision making as for the production and storage of commodities.

Additionally, the future markets propitiate the establishment of a protection mechanism against the prices variation through the prices risk transference among the participants. This mechanism, known as "hedge" is considered the most flexible and less costly way to give guarantee against price variations risk.

A very important factor is that the markets organization, plus the transparency and trustability propitiated by the negotiation system through the Commodities Markets, is very attractive to the ingress of productive capitals, representing significant source of financial resources.

2.3 Commodities Markets in Brazil - Agriculture and livestock case

In Brazil, more specifically in the case of grains and meat cattle, the number of participant producers is still very reduced. It is estimated that the agriculture and livestock negotiations represent a very reduced volume of the total negotiated in the main Commodities market in the Country, the Future and Commodities Market of São Paulo.

This reduced participation is the result, among others, of factors such as:

a) spatial scattering of the production;
b) high transportation and storage costs;
c) lack of uniformity in the offered products; and
d) quality and sanitation problems.

It must be taken into consideration that the negotiation mechanisms through the Commodities Market require from the producers more production capacity in terms of quality and quantity, as well a better qualification in dealing with market information.

In the attempt to modify this situation, the Future and Commodities Market - BMF, is trying to raise the volume of negotiated agriculture and livecommodities products participation, through the creation or modification of financial instruments negotiable during the sellers cry and destined to the agricultural sector. Furthermore, the BMF is widening its representation in the Country through regional offices (Gazeta Mercantil Newspaper, 10/11/97).

2.4 Commercialization Experiences through Commodity Exchange in Tocantins

Some data were collected by the commercialization experience through the Commodity Exchange already happened in Tocantins State.

In 1995, a Commodity Exchange called Cereals and Supplies of Tocantins was created in Gurupi. According to some reports, it was created through a private initiative of region farmers. However, due the lack of experience in the use of this instrument and administrative problems regarding the maintenance of that Commodity Exchange turning it unfeasible that oblige then closing.

However, one year ago some members of that association decided to reopen again the Cereals and Supplies Commodity Exchange of Gurupi but it started operating since two month ago, Since the creation to this time, the members are trying to establish an structure necessary to develop basic operation.

In terms of structure, the Commodity Exchange of Gurupi has computerized resources connected to the other Commodity Exchange of Brazil and overseas countries through STM 400 System of EMBRATEL and also a connection to the Internet is foreseen in order to enlarge the cover area.

In institutional terms, the managers are procuring the affiliation to the National Commodity Exchange Association, an organ in charge of the regulation and supervision of this kind of operation.

For the moment, the Gurupi Commodity Exchange is only operating with auction organized by the CONAB for the negotiation of rice. Therefore, according to the ex president, Mr. Vicente de Paula, several tentative and stimulation activities are being executed to join cooperatives and farmers in order to diversify the participation and increase the volume of stock handle.

2.5 Proposition

Considering the deficiencies in the agriculture and livestock commercialization in Tocantins State and the potentiality represented by the negotiation through the Commodities Market, it is proposed to evaluate the possibility to create or to establish a regional representation of the Commodities Market in the State, aiming the constitution and strengthening of future markets. It is worthy to mention that in these Commodities Markets mineral commodities are also negotiated which would also strengthen and structure these products commercialization.

3 Effective Utilization of Modern Inputs

3.1 Promotion of Lime Supply

The effective need to use agricultural correctives is also a reality in Tocantins. The present scenery shows that for a cultivated area of 365,400 ha (1997/1998) an average of around 535 kg/ha of lime is utilized, evidencing the low utilization level when compared to other states (Table XVI-1).

As foreseen in the Decennial Plan 2005/2006, the harvested area in Tocantins shall reach 1,552,600 ha, which represents a significant increase of 325%. In order to reach this goal, it will be necessary to fulfill two consumption increment indexes which, for

sure, will be important in the global demand: 1) the augment of the cultivated area, and 2) adoption of modern technologies which, without doubt, will propitiate a strong increase in lime and fertilizers demand by the farmers.

Table XVI-1 Utilization of lime / agricultural corrective – 1995

State	Harvested area (ha)	Lime Production (ton)	Average quantity of lime utilized (ton/ha)
Tocantins	365,400	195,662	0.535
Goiás	2,566,496	2,412,375	0.940
Mato Grosso	3,383,767	1,976,764	0.584
Minas Gerais	3,372,067	23,147,758	6.864
São Paulo	4,498,942	17,427,410	3.874

Sources: Statistic Year Book of Brazil - IBGE/1996
Brazilian Mineral Year Book - DNPM/1996

3.2 Promotion of the Supply of Organic Inputs

There are already organic manure factories (southern Brazil), utilizing excrement specially from small animals and other inputs, with reasonably competitive prices and assured quality due to its higher rate of retention in the soil. Such a fertilizer is more indicated for fruit and vegetable cultivation. The projects of small animals raising, by their turn, can complement the local supply of this type of fertilizer.

Without any doubt, the installation of organic or organic-mineral manure processing plants will have an important role in modernizing the inputs sector.

3.3 Promotion of Fertilizers Supply

Table XVI-2: Average Consumption of Fertilizers – 1995

State	Harvested area (ha)	Fertilizer selling (ton)	Average consumption of fertilizers (ton/ha)
Tocantins	365,400	17,386	0.047
Goiás	2,566,496	610,381	0.263
Mato Grosso	3,383,767	779,932	0.230
Minas Gerais	3,372,067	1,407,099	0.417
São Paulo	4,498,942	3,139,892	0.698

Source: Statistic Year Book of Brazil - IBGE/1996

As shown in Table XVI-2, the average consumption of fertilizers (ton/ha) in Tocantins State is very low when compared to other states. As a measure to promote the supply of fertilizers, it is recommended, among other measures, the creation of storehouses supplied with customs services for the importation of NPK (preferably installed in the Estreito zone). The ZPE and the dry port of Araguaína can be utilized for this purpose.

The product originary from Africa and Europe shall come through the Itaqui Port/MA and be transported through railway (Carajás/Norte-Sul railways) until Estreito, and from there by another way, including waterway, until the processing plant. This system will reduce the product final cost to the importer. It is estimated a reduction on the costs of the freight until the processing plant of about US$ 40.00 to US$ 50.00 per ton, in relation to the present freight prices paid until the ports on the south and east coasts of

the Country.

With such a measure, the installation of small processing plants which will purchase the NPK directly from the importer shall be stimulated, with the advantage of substantially reduce the input final price, through the elimination of avoidable costs such as the middlemen, customs procedures, formation of stocks. This will be possible once this operation system allows to program the acquisition of row material directly oriented to the roll of clients of the fertilizers industry. It is estimated that this reduction will be superior to 20% over the selling price, being possible to reach even 50% in the sum of economies.

It shall be considered that there are available technologies in other countries such as Israel and Australia, with similar soils as Tocantins (sandy ones), which utilize organic-mineral manure produced utilizing biotechnology. There is information about the availability of this type of fertilizer in Brazil, which could be produced and utilized in Tocantins after an adequate evaluation of the employed technology. This fertilizer could be produced by Cooperatives with the advantage of cost, availability, besides the creation of job opportunities and increase of local income.

4 Livestock Sector Modernization Program

The Animal Health project has been selected from among the priority project identified and formulated in the Master Plan study for the Secretariat of Agriculture. It is an important component of modernization of livestock industry in the Region.

Animal health support to livestock production system is the most vital segment of planning. Whereas farmers easily learn by experience the technic of breeding, feeding and management in which they become self-sufficient, they need expert's help in specialized health services. Prevention of disease is not easy, however, it has pay-off in the long run. It is clear that 80 per cent of the disease problems could be avoided by paying a closer attention to the sound basic principle of management which includes early and timely diagnosis of disease.

Rapid diagnosis and effective prophylactics play a crucial role in disease control system of the State, especially in viral disease control for which no treatment is available and which could be controlled through the effective vaccination.

This program is represented by an establishment of designs and hygienic standards of slaughterhouses for pigs.

4.1 Background and Justification

In order to support the increasing demand of meat, particularly pork, the role of slaughterhouse is regarded very important as infrastructure required for improving public services in the provision of adequate quality and wholesome meat.

While there are four federal registered beef packing plants in the state, but a high percentage of livestock, particularly hogs are slaughtered in non registered small

backyard or open yard. This is because most meat is sold warm within a few hours of slaughter (warm, fresh meat being preferred by most local consumers) with butcher preferring to slaughter their livestock in their own low cost facilities in as close proximately to the market place as possible to save on transportation and refrigerated storage cost.

With these small unregistered facilities, effluent disposal poses minimal health or environmental problems. As the meat is sold fresh and is well cooked before eaten, issues of microbial contamination during processing are of little relevance.

However, the health risks posed with the handling of carcasses infected with zoonosis such as brucellosis, tuberculosis or anthrax, at the consumption of putrefied meat or meat from septicemia or toxemic animals, are just as great as with animals slaughtered in the local slaughter systems.

Except large beef packing plants, most of the meat are an inadequate preparation for being able to identify all situations where meat could be unfit for human consumption.

Invest program for the development of slaughterhouses could create a wide prospective opportunities for both rural and urban economy.

4.2 Objectives

a) To construct new slaughterhouses for pig which slaughter capacity will be a 50 heads per day, and their supporting facilities according to national standard of designs and hygienic requirement.

b) To establish the management and operation of slaughterhouses to provide better public services for the production of high quality and wholesome meat.

c) To safeguard meat and meat products and to support the development of pig industries so as to stimulate the increasing income of farmers to ensure the provision of safely food for people who consume meat and meat products.

d) Governmental role in respect of the health and environment aspects of slaughterhouse construction and operation is to set minimum standards and provide incentives and technical assistance to encourage their adoption.

e) The recommended strategy with respect to meat processing relates to the extension of meat inspection to include ante mortem inspection, the use of slaughterhouses to provide a data collection point for disease monitoring and surveillance, and the improvement of hygienic slaughtering facilities and the enforcement of environmental legislation to waste disposal.

In addition to the food preservation aspects, the following factors encourage the operation of localized slaughtering facilities;

Organization - Government and administrative division into towns, cities, district, etc.

Technical - Lack of effective methods of meat preservation, storage and transport, and logistic difficulties involving geographic barriers of distance, terrain, water crossing, etc.

4.3 Project Implementation

It is recommended that a detailed feasibility study be undertaken into establishing a commercial slaughtering facility for each municipalities based on private sector operation under lease from the municipality.

4.4 Rough Cost Estimate

Around R$1, 500,000.00 per abattoir. (including waste disposal treatment)