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Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

133p.
tables,
diagrams

21873

Distr.
RESTRICTED

ITPD/R.13
21 April 1997

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ORIGINAL: ENGLISH

DEVELOPMENT OF POLICY, PROGRAMMES AND INVESTMENT IN SCIENCE AND TECHNOLOGY FOR NAMIBIA

REPORT*

Based on the work of C. Aguirre Bastos and L. Pinguelli Rosa, UNIDO consultants

* This document has not been edited.

V.97-22972

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ABBREVIATIONS AND ACRONYMS USED

ABN:	Agricultural Bank of Namibia
ADD:	Agricultural Development Division
CDI:	Centre for the Development of Industry (European Union)
CDM:	Consolidated Diamond Company
CMA:	Common Monetary Agreement
ECPPFF:	Employment Creation and Promotional Fund
EPZ:	Export Processing Zone
Fishcor:	National Fishing Corporation
GDP:	Gross Domestic Product
GSP:	Generalised system of preferences
ILO:	International Labour Organization
IMLT:	Institute of Management and Leadership Training
INSTANT:	In-service Training and Assistance for Namibian Teachers Project
ITC:	International Trading Centre
JCC:	Joint Consultative Committee for SMEs
LEDAs:	Local Enterprise Development Agencies
MHEVTST:	Ministry of Higher Education, Vocational Training, Science and Technology
MTI:	Ministry of Trade and Industry
NACP:	National Agricultural Credit Programme
NAMCOL:	Namibian College of Open Learning
NAMDEP:	Namibian Diamond Enterprise
Namfish:	Namibia Fishing Industries
Namsea:	Namibia Sea Products
NAMSEP:	Namibian Mathematics and Science Education Project
NBC:	Namibia Broadcasting Corporation
NDC:	Namibia Development Corporation
NDP:	National Development Plan
NHE:	National Housing Enterprise
NITA:	Namibia International Technology Association
NNCCI:	Namibia National Chamber of Commerce and Industry
N$:	Namibian Dollar (Exchange rate in June 96: 4.25 N$/US$)
Petrofund:	Petroleum Training and Educational Fund
R&D:	Research and Development
RSA:	Republic of South Africa
RTZ:	Rio Tinto Zinc
S&T:	Science and Technology
SACU:	Southern Africa Customs Union
SADC:	Southern Africa Development Community
SMEs:	Small and medium size firms
SWAWEK:	South West Africa Electric co.
TIPS:	Technology Information Programme - DEVNET -
UNAM:	University of Namibia
UNCTAD:	United Nations Conference on Trade and Development
UNESCO:	United Nations Educational, Scientific and Cultural Organization

UNIDO:	United Nations Industrial Development Organization
UNDP:	United Nations Development Programme
WIPO:	World Intellectual Property Organization

EXECUTIVE SUMMARY

Several studies have described the conditions under which science and technology (S&T) develops in Namibia. In 1995, UNIDO organized a seminar which discussed S&T issues and as a result, Government requested its assistance and a mission was deployed in late 1995. Further support was requested for more detailed recommendations, particularly on the institutional and policy framework and the definition of specific projects. In response, UNIDO deployed a new mission between June 3 and 15, 1996. This document reports its main findings and recommendations.

The Economic and Social Environment

Since independence in 1990, Government decided to provide its people with full benefits of development within a policy of national reconciliation. For this purpose, a National Development Plan was put into execution. The Plan recognises critical issues and defines strategies to face them: modest level of economic growth and rapid increase in population; an unusually highly skewed income distribution along racial lines, together with widespread poverty; existence of legal, regulatory and restraining practices that restrict competition in virtually all economic activities; rising unemployment; lack of trained human resources; high expectations of society and periodic drought coupled with a highly fragile ecosystem.

As part of its development effort, Government created in March 1995 the Ministry of Higher Education, Vocational Training, Science and Technology to: "give focus to the development of vocational training as a vehicle for socio-economic development and to enhance S&T for community empowerment, wealth creation and poverty reduction". This Report is set out to provide inputs to serve the Ministry to comply with its mission and complement it.

Sustainable Development, Innovation, Science and Technology

The role of S&T, to be effective, must be seen in the context of sustainable development strategies. Sustainable development has three basic elements: economic growth, social equity and conservation of the environment. In order that economic and social policies have any impact on these, a competitivity policy should be emphasised. Competitivity is reached by producing technical progress and innovations, and for this an "innovation system" must operate efficiently. The system is a space constituted by a mesh of relations involving public and private institutions that generate, import, modify and diffuse knowledge. One of its key elements, together with the educational system and enterprises is precisely the S&T system. If this system and its linkages to the "innovation system" are weak, the whole processes of creation of innovations and technical progress is slow and the economy cannot respond to the development challenges.

Situation of the Science and Technology System

The present situation of the S&T system and linkages shows:

(1) An important institutional development in science and technology has been the creation of the Ministry of Higher Education, Vocational Training, Science and Technology. No policy formulation exists as yet.

(2) The need to develop S&T is recognised, but there is still a lack of understanding on how to go about relating it with economic and social processes.

(3) There are few but solid applied science research organizations. These have some ties to technology development and the innovation system.

(4) UNAM is more developed in the social sciences than in natural sciences and there are few technological research programmes in course. The Polytechnic is more concerned with technical training than engineering. This policy is changing, favouring the development of engineering.

(5) There are few researchers and only about 100 engineers (and even less managers) who can contribute to transform scientific knowledge into technology, about 50% of whom are Namibians.

(6) There is a valuable network of vocational training centres and professional colleges. Several private and parastatal companies have their own facilities. There is practically no technical linkages between these with UNAM or the Polytechnic, which in turn only very weak cooperation with industry and other economic activities.

(7) S&T services' capacity is not large if one considers the problems of information, the inability of reaching out to users, weak maintenance workshops, lack of quality control laboratories, standards development, metrology, etc. Consulting capacities are not yet fully developed.

(8) Financial resources for R&D are scarce. A large part of the S&T infrastructure has been build by external funds. There are no specific financial mechanisms for innovation. An important development is the operation of the Namibian Development Fund by SANLAM, the private administrator of the pension funds.

(9) Industrial sector enterprises do not carry out any R&D activities, nor they contract them to universities or laboratories. There are some innovative firms. Many large firms are only beginning to subcontract in the local market. There is a large potential for subcontracting provided the competences of professionals and technicians are improved.

(10) The Investment Act does not recognise the need that investors should make some contribution to the technological advancement of the country.

(11) The Namibian Development Corporation and the Investment Centre are particularly important players in the S&T System, as they are well prepared to promote investment, draft feasibility projects and creating enterprises.

Social and Economic Empirical Observations

It is clear that one of the main problems facing Namibia arise from the contrast that exists between a modern side and the poverty of a majority of the population. However, the very existence of a modern part represents an enormous potential for contributing to the changes that are needed to improve the situation. In order to link the science and technology system to the development problems it has to be recognised that:

(1) A modern economy exists but it is concentrated socially and geographically.
(2) Only an elite has good education and scientific knowledge.
(3) The great majority of the population lives in very hard conditions of poverty, with little chance of improving the patterns of life because of high and rising unemployment.
(4) Namibia has a higher percapita income than other African countries (of the order of US$ 1,610 (1993)). It is recognised of course that income distribution is too skewed, since 5.1% of the population has 72.2% of GDP;
(5) The population is about 1.5 million inhabitants in an area of 824 thousand square kilometres. The country is rich in minerals, there is significative cattle farming and fishery has high potential for growing; a large part of the territory is desert and there is water shortage;
(6) There are more kilometres of road per capita than any other country in Africa and they are well maintained. The telecommunications system is one of the best in the continent. Electricity consumption increased in the past years and there is hydroelectric potential. The discovery of exploitable oil deposits could transform Namibia's energy position;
(7) The private sector is the most important in the economy and there is a fairly developed financial sector;
(8) The government has a dynamical role in the country's economy and in the social development. The political system is stable, based on democratic principles and concerned with racial integration as well as national reconciliation. International relations are very good.

A simple analysis of the above points allow to see that only point (3) is purely negative. Points (1) and (2) show the contrasts in Namibia, as well as (4) and (5) do. The last ones, from (5) to (8) indicate that there are possible ways to solve the problems of Namibia. In a very simple mathematical metaphor it is possible to classify the following as variables to be changed:

(1) Expansion of modernisation and market economy
(2) Education for all population and diffusion of science and technology
(3) Increase of formal employment and creation of jobs
(4) Income distribution to benefit the poor people

In the same way the following represent something like functions which act on the variables to change them:

(5) Natural resources exploitation and development of agriculture
(6) Infrastructure and energy supply to guarantee industrial development
(7) Private dynamics and modern sectors of the economy
(8) Role of government

There are no deterministic equations to solve socio economic problems and even in the more recent mathematical description of nature, the extreme sensibility to present conditions in chaotic systems allows to hope a future not predicted in the past. But the future can be improved depending on present actions, so it is necessary to look for the correct actions which will point in the direction of economic as well as social development of Namibia. The actors are entrepreneurs, workers, government, civil society and international organizations. These actors should manage potentialities (5 to 8) for changing variables (1 to 4).

Recommendations

Recommendations are addressed to strengthen the S&T System and its linkages. They derive from the analysis of the situation and from a theoretical approach and lead the way to a small but comprehensive plan of action and investment programme.

The direction of the recommendations and the investment programme is to identify possible ways to develop science and technology so as to impact on the variables: modernisation, education, employment and income distribution.

In the definition of policy it is not possible to agree with the separation, often done, between poverty alleviation strategies and modern sector development. Modernisation is to be understood as the expansion of the economy in such a way that poor people comes out of poverty from a degraded subsistence economy, to become a worker and a consumer, as well as a citizen with dignity in the society, without necessity of charity.

To the above purpose and to which S&T must contribute, two biases must be avoided: 1) it is not true that everything must be planned by government; and 2) it is also not true that nothing must be planned, waiting that pure market mechanisms in an open economy solve every problem. Government must take an active role in the promotion and guiding of the science and technology system. Its participation is needed to help remove many constraints and create an enabling environment for the public and private sector firms so they can later lead the innovation process as a response to the development challenges of Namibia.

For S&T to contribute, it is necessary to recognise two peculiarities underlying the formulation of policy: (1) S&T as linkage elements of the innovation system do not act independently in a social and economic process. The possibilities of their impact depend from elements of the social economic and cultural context where they operate and which do not control; (2) there is a great diversity of particular circumstances in the behaviour of the country that cannot be underestimated when considering a strategy for the development of S&T within the framework of an innovation system.

The lack of policy can seriously impair any effort towards the building up of S&T and innovation in the country. Policy formulation for its contribution is the key to development objectives. There are many policy issues that must be considered, some are of institutional nature such as decentralisation; others are in the realm of science such as the degree of academic freedom or the image of science; others deals with aspects of technology transfer and development and the construction of technology packages for the productive sector. Important issues arise when considering the interphase S&T - enterprises - human development.

The key recommendations to strengthen the S&T system and its linkages are:

(1) **Institutional and legal actions**: i) creation by the National Assembly of a National Action Board and standing committees for the coordination of specific tasks; ii) adoption of a Law on Industrial Property Rights; iii) creation of an institution to serve as an intermediary between the productive sector and the research, training and services community; iv) incorporation of the S&T system to the industrial parks scheme and initiation of immediate negotiations with the Development Fund (SANLAM) to provide resources for technology-based business in such parks.

(2) **Policy actions**: i) creation of financial mechanisms for research and for technology and innovation; ii) definition of fiscal credits, tax rebates and others; iii) development and strengthening of existing research capacities; iv) development of information services for science and for the business-technology community; v) further development of education at all levels, particularly creating engineering and managerial capacities and training of trainers at vocational centres; vi) phasing out of the welfare assistance vision to rural development and initiate a process by which rural enterprises are created.

(3) **Operative actions**: many of the recommendations must be followed by the MHEVTST and other bodies, specially in what concerns the institutional and policy frameworks. Others must be transformed into operative programmes and projects.

For demonstration purposes, it is very important to adopt a short term plan of action containing few programmes/projects. The execution and successful

completion of a small set of projects will give the S&T System the credibility it needs in front of decision makers to become an active part of the development strategy of the country. Once this credibility is built many other activities can be later be designed and executed.

In the execution of the proposed programmes, the international and bilateral agencies must be involved. Many already have ongoing activities and financial resources already allocated. One of the purposes of the Short Term Plan is to bring together dispersed capacities in universities and research laboratories with donor agencies and their experts. The MHEVTST has a key coordinating role to play in this respect.

The following proposal of 9 programmes are divided into two categories: 1) changes in science, education and training and 2) specific technological programmes. They are intended to create a positive feedback in the economy through a starting action by the government on education, job creation, income distribution and the running economy, with the goal that the poor can become a consumer in the modern economy. A most important aspect is the demonstration effect to fill people with enthusiasm. There is also ample experience in many developing countries on the programmes that are suggested. In particular in Latin America, important expertise has been built up in the past years. Namibia can well tap on it.

(1) Creation of an engineering course at BSc level involving UNAM (physics, chemistry, mathematics, computer-science) and the Polytechnic (electrical, computer science, mechanical and civil).
(2) Establishment of Joint Research Programmes
(3) Creation of a Foundation by UNAM, the Polytechnic for Research and Development under Contract with Industry, in Cooperation with the Namibia Development Corporation.
(4) Training Programme for Instructors of Vocational Centres using the Namibian Institute of Mining and Technology in Arandis and Envolving Professors from the University and the Polytechnic.
(5) Appropriate Technology for Low-Cost Housing with Local Materials, Local Job Creation and Participative Design
(6) Solar Energy for Isolated Communities in the Rural Areas
(7) Labour Intensive Technologies to Produce some Goods Locally and Selected to be Protected Temporarily through SACU Agreement Against Imports.
(8) Wood Industry Development through Plantation of Trees with the Support of the Joint Implementation Programme for the Abatement of Carbon Emission to the Atmosphere (Greenhouse Effect Conference in New Delhi, India, January 1997).
(9) Processing of Diamonds for Value Added Exports. Creating a Jewellery Industry.

DEVELOPMENT OF POLICY, PROGRAMMES AND INVESTMENT IN SCIENCE AND TECHNOLOGY FOR NAMIBIA

INTRODUCTION

Several studies and different seminars and workshops carried out in the past few years, have described some of the conditions under which science and technology (S&T) develops in Namibia. In 1995, under UNIDO's assistance programme, an important seminar took place, in which, issues of scientific and technological development were discussed. As one result, Government requested further cooperation. UNIDO responded by deploying a mission which took place between October and November, 1995. This mission after an analysis of the situation in S&T and closely related areas, made a set of recommendations. The Government requested UNIDO further support to prepare more detailed recommendations, particularly regarding the institutional and policy framework and the definition of specific projects. In response, a new mission was deployed between June 3 and 15, 1996. This document reports on its main findings and recommendations.

In the course of its work, the mission visited several institutions in government, public and private productive sectors, service organizations, research laboratories and universities. The mission initiated and concluded its work after a meeting with the Minister of Higher Education, Vocational Training, Science and Technology, and other high authorities of the Ministry.

Although it is not the purpose of this Report to repeat the body of knowledge that already exists, a short overview of the situation in the country and a brief description of the National Development Plan, as given in official documents and perceptions of the mission is given in Chapter I and Annex A. This description is particularly needed as science and technology cannot develop outside of the country's situation and in particular the framework of political and policy decisions that define development objectives and investments. Chapter I specifically points out to the main objectives of the current National Development Plan. The recommendations set out in the present Report have closely followed the National Development Plan (NDP).

As S&T should contribute to sustainable development, Chapter II discusses briefly, a simple causal model, identifying within it, the roles of the S&T and innovation systems. This Chapter also provides an overview of the situation of S&T and R&D in the country as well as an identification of policy issues and justification for the enactment of explicit policies. This overview is the result of the visits made by the mission, whose highlights are provided in Annex B together with a full list of persons and institutions visited, contained in Annex C.

As part of its work, the mission visited the city of Ohkahandja and the village of Avitoto (100 km from Windhoek), in order to have a more precise vision of the climatic, social and economic environment of the country. Also, a visit to the ARANDA uranium mine deposit, the Arandis Vocational Training College of Mining Technology and the Marine Research Centre in Swakopmund was carried out.

A Workshop on Science and Technology took place on June 13, a description of which is given in Annex D. It was addressed to present the findings of the mission and to discuss its main recommendations. A very positive evaluation of the Workshop was made by the participants. They pointed out that it served to clarify many ideas, develop new concepts and allowed the realistic definition of future courses of action under an integrated institutional framework. The Workshop was highly valued by the Ministry's authorities, including the Minister and the Permanent Secretary.

Particular importance in the mission was attached to the development of an institutional framework. After several discussions during the visits, those which took place during the Workshop and other consultations with UNIDO experts, and following the already existing recommendations, a Draft Proposal for the Establishment of the National System of science and Technology (the Action Board) is provided in Annex F.

Also, a radio interview took place, thanks to the initiative of the UN Information Service at NBC. A programme was recorded for broadcasting for 40 minutes and it dealt with the findings of the mission and other issues of more general interest.

Chapter III discusses an approach to the development of S&T, considering the country's situation, the empirical observations of the mission and other relevant information as well as the main objectives as set out in the NDP. The more theoretical basis for this approach is further developed in Annex E.

Because the country attaches great importance to the development of small and medium size enterprises, the Report has produced a brief overview of their situation and potential. This is given in Annex G.

Chapter IV resumes the main findings of the mission and the recommendations that derive from it. Both the conclusions and the recommendations, together with the theoretical approach, have led to suggest a small but comprehensive investment programme which could be carried out in the short term with the view not only of strengthening the S&T System, but principally for directing it to solve specific problems and thus creating the necessary credibility for its continuation and future action.

Because of their relevance to the situation in Namibia and the NDP objectives to strive towards decentralisation and to support micro enterprises and the informal sector, Annex H and Annex I includes the Law of Popular Participation and a description of the Solidarity Bank of Bolivia.

CHAPTER I

GENERAL OVERVIEW OF THE ECONOMY AND DEVELOPMENT OBJECTIVES

1. THE NATIONAL DEVELOPMENT PLAN

The major critical development issues as recognised in the NDP are:

(1) **A modest level of economic growth and rapid increase in population resulting in a small increase in per capita income over the last five years.** GDP grew annually at 3.5%, and population at 3.1%, resulting in an increase of 0.4% per capita GDP per annum. Per capita income is around 2 000 US$, one of the highest in Africa. Contributions of the main economic activities to GDP are: subsistence agriculture: 3%; commercial agriculture: 7% (90% livestock); mining: 17%; fisheries: 8.6%; government 27% and manufacture 10%. Exports were N$ 4,6 billion and imports N$ 4,1 billion (1994). Structure of imports cover all goods and services, with extreme dependence of RSA. The country exports capital. Legislation requires that registered pension funds and insurance companies to invest 35% of their portfolio in Namibia;

(2) **An unusually highly skewed income distribution along racial lines, together with widespread poverty. Inequalities are reflected in differences in access to health, education, land housing and other social amenities.** 5% of the population controls 72% of GDP. 4 200 commercial farmers (mainly white) control around 44% of the national land area. Human Development Index (1995) places Namibia in 108 place in the world. The highest 7% of the population account for 40% of national consumption. 47% of households are classified as poor (117 000 households). HIV - AIDS and alcohol and drug abuse are among the top health problems;

(3) **Existence of legal, regulatory and restraining practices that restrict competition in virtually all economic activities;**

(4) **Rising unemployment.** The work force is about 550,000 people, distributed as follows: government 72,000; trade 37,000; construction 20,000; manufacturing; 13,000; transport and communication: 11,000; social services: 10,000; finance and business services: 10,000; fishing: 7,000; fish processing: 5,000. Total formal employment: 205,000; Commercial agriculture workers: 37,000; Subsistence agriculture: 150,000 Informal & unemployed: 152,000. The structure of employment, specially among the senior and key managerial jobs shows that the upper echelons are mostly occupied by whites while the lower ones by blacks;

(5) **Lack of trained human resources to assist in the management of the economy and social institutions.** There is a considerable shortage of skills

also in the productive sector. Adult literacy is 77% and primary school enrolment stands at 83%;

(6) **High expectations of society, as to the economic and social benefits to be reaped after five years of independence;**

(7) **Periodic drought coupled with a highly fragile and degraded environment and ecosystem.** Overgrazing and destruction of vegetation constitute a critical problem.

2. DEVELOPMENT GOALS AND STRATEGIES

The long and medium term goals and strategies in the NDP are:

(1) **Reviving and sustaining economic growth to ensure a rising per capita income for the population**: public sector investment will increase and an enabling environment for private sector investment will be promoted. Renegotiation of membership in SACU and the CMA. Measures for economic growth will be accompanied by a population policy. Until the year 2000 the economy is projected to grow at 5%; internal deficit will be reduced from 4.1% to 3% of GDP and external balance maintained Inflation will continue at 11%. Development spending will increase by 6% in real terms. Fiscal policy includes the possibility of replacing tax breaks and tax exemptions by direct subsidies. The decision making process will be decentralised. There will be an increased popular participation and promotion of sustainable development. Protection and natural resource management have considerable prominence.

(2) **Creating employment opportunities with particular emphasis in the private sector**: by adopting appropriate labour market regulations, trade and industrial policies and the establishment of an Export Processing Zone. Lack of skills will be addressed through vocational and other training programmes. Labour intensive programmes are considered as potential sources of job creation.

(3) **Reducing inequalities in income distribution**: by expanding educational facilities. Health and the enhancement of the role of women are addressed as priorities. Human resource development is considered a strategic component of economic development. The NDP comprises action components addressed to strengthen the national economic management institutions, focusing on capacity building.

(4) **Eradicating poverty through the design of appropriate economic and social programmes.** A **Poverty Alleviation Strategy** has been given high priority. Envisaged are also land reform and resettlement policies.

For small scale industry, growth will be facilitated by: a) improved coordination supporting institutions; b) review and amendment of regulations and laws; c) support in the form of factory shells and incubator units and, d) introduction of a Vendor Development Programme aimed at securing market access for goods produced in the small scale and informal sectors.

In the agricultural sector, main emphasis is on: a) productivity of communal areas through improved extension services and research; b) diversification into production of non-traditional crops (e.g. grapes and dates) and game harvesting; c) mechanisms for increased access to credit for communal, particularly subsistence farmers, through the NACP.

In the natural resources sectors priority is given to: a) collection and analysis of information on types and location of natural resources; b) research into management techniques. In developing communal and commercial natural resources management activities, the Plan points out to the challenge of changing the legal and regulatory institutions to promote individual initiative and dynamism, while at the same time deregulate the formal sector to permit competition from emerging entrepreneurs and retain only those regulations which are socially or economically justified.

CHAPTER II

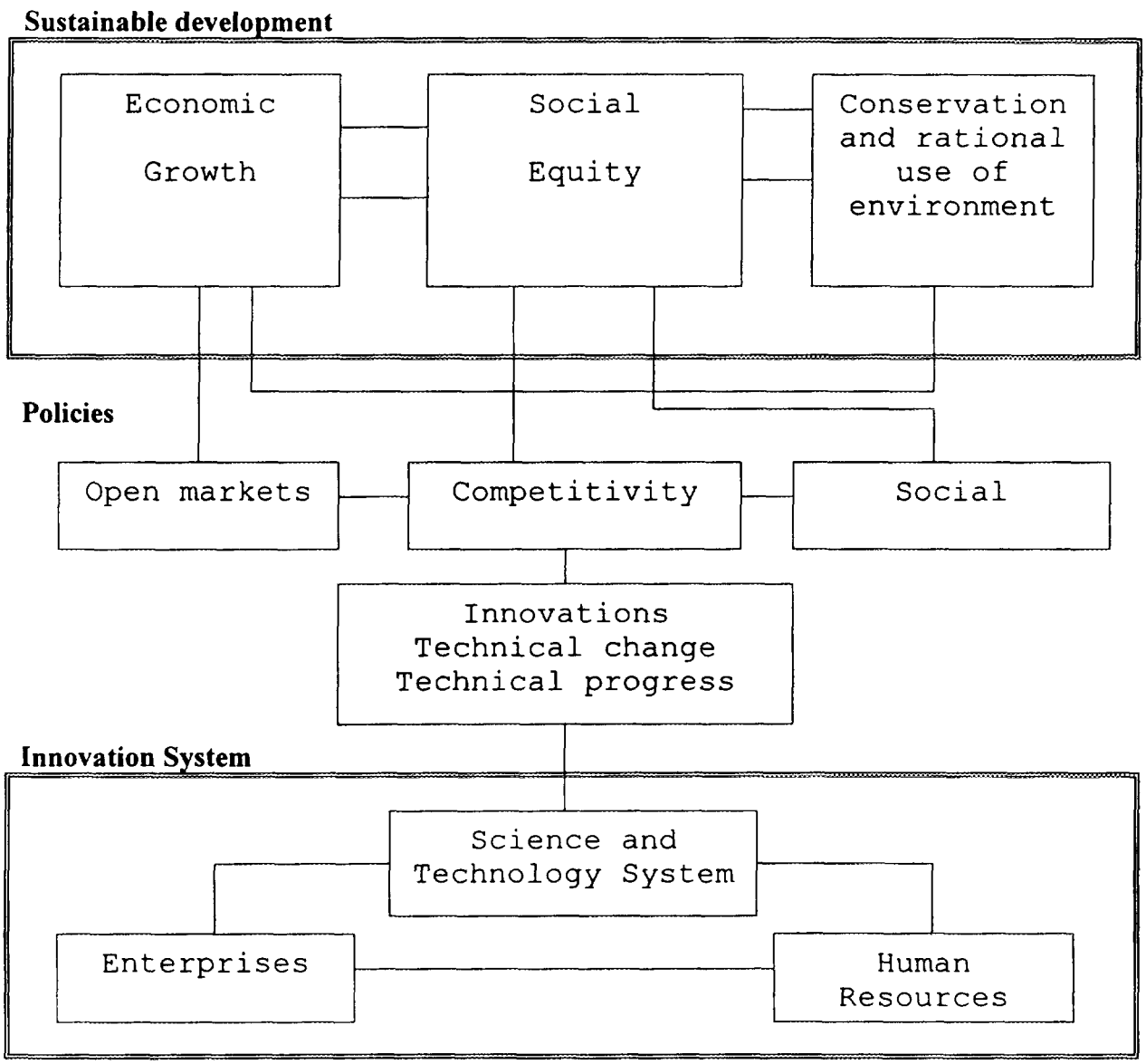
SCIENCE AND TECHNOLOGY IN NAMIBIA

1. A CONCEPTUAL BACKGROUND: CAUSAL MODEL FOR SUSTAINABLE DEVELOPMENT: THE ROLE OF THE SCIENCE AND TECHNOLOGY AND INNOVATION SYSTEMS

1.1 Causal Model for Sustainable Development

Before considering the institutional framework and policy issues, it is important that S&T be identified within a given development model. Figure 1 shows a simple causal model which addresses this issue.

Figure 1. Model of Causal Relationships



In the model, sustainable development is seen as composed of three basic elements: economic growth, social equity and conservation of the environment. In order that economic and social policies make impact, the need of a competitivity policy is emphasised. The latter is made up of competitive capacities in the national economy, the "clusters" of enterprises at sectoral level and the individual enterprises.

Competitivity is reached by producing technical progress and innovations, the latter defined as a process that identifies a market need and the constitution of a technological package that will satisfy it, under the form of a good or service. To attain technical progress it is a condition that an "innovation system" operates efficiently. The latter will be briefly described below.

1.2. The Science, Technology and Innovation Systems

Following the causal model, the S&T and the Innovation Systems can be defined as follows:

(1) The "Innovation System": a space constituted by a mesh of relations that involve public and private institutions that generate, import, modify and diffuse technology. Implies attitudes between its components and also towards the outside world. Implies the existence of institutional responsibilities that constitute a plural organization whose task is to integrate the capacities that from different angles contribute to processes associated to the creation, diffusion and usage of knowledge. The Science and Technology System, together with the Entrepreneurial and Educational Systems, is one of the key elements of the Innovation System.

(2) The Science and Technology System: understood as the physical infrastructure (laboratories, libraries, shops; human infrastructure (researchers, technicians, graduates); financial resources needed to carry out S&T activities, namely R&D, services , imports of technology (and exports), for example, information, consultancy, industrial property, and the linkages between all.

(3) The Human Resources System: the network of organizations dedicated to train scientists, researchers, managers engineers, technicians, etc who will operate the innovation system.

The linkages and operation the S&T System depends on policy decisions and its implementation.

1.3. Science and Technology Policy

The importance of a S&T policy framework in Namibia, has already been highlighted in many previous reports. Here it can only be added that the lack of policy can seriously impair any effort towards the build up of S&T and innovation in the country.

The absence of a science and technology policy can affect the system of S&T and its linkages very severely. If the country will exploit or develop its potentials in human and natural resources, its geographical location and other factors, while at the same time creates dynamical comparative advantages with original contributions to knowledge and production, it must formulate and apply sound S&T policies that involve not only the S&T infrastructure but links it with the human resource and entrepreneurial infrastructures as well. Science and technology development does not occur spontaneously and thus the public sector institutions have the obligation to formulate policies in these areas, in line with the country's development objectives.

S&T can contribute in a definite way to the building-up of competitive capacities which the country needs in order to participate in the dynamics of the world today, while at the same time confronts the internal development challenges. A S&T policy should thus give priority to the creation of competitive strengths throughout the productive system and in individual firms. It is through a competitive process that technology can be diffused and utilised in the economy.

Science and technology certainly contribute to development. However, as will be argued in more in detail in Chapter III, it is necessary to recognise two peculiarities of such contribution which are key for the formulation of policy:

(1) Science and technology as linkage elements of the innovation system (and of the economic - social and environmental components of sustainable development) do not act independently in a social and economic process. The possibilities of their impact depend from elements of the social economic and cultural context where they operate and which when do not control.

(2) There is a great diversity of particular circumstances in the behaviour of the country that cannot be underestimated when considering a strategy for the development of S&T within the framework of an innovation system.

2. THE SITUATION OF THE SCIENCE AND TECHNOLOGY SYSTEM

The situation of the S&T System that is described below is an overview of the findings of the mission. It is by no means exhaustive and it coincides, in general, with previous analysis made by missions of UNIDO, UNESCO the Commonwealth Secretariat and others. Further highlights of visits are given in Annex B.

2.1. Public Perception of Science and Technology

As is the case of many developing countries, stockholders in Namibia have difficulties in understanding the way the innovation system works and the very close role of technology development with economic growth. Science and technology are viewed mainly as research and development (R&D) activities.

2.2. Present Institutional Framework

The Government of Namibia has taken an important step towards utilising science and technology for development with the creation of the Ministry of Higher Education, Vocational Training, Science and Technology, in March 1995. The new Ministry took over some of the tasks which in the past had been vested in the Ministry of Education and in the Ministry of Labour.

The broad mission of the Ministry is: "to give focus to the development of vocational training as a vehicle for socio-economic development and to enhance science and technology for community empowerment, wealth creation and poverty reduction".

Further, the Mission Statement, defines a set of broad goals for the Ministry, which among others include: "... (c) enhancing the national human resource capacity; (d) harnessing science and technology in the service of rural and community development, improvement of quality of life, job creation and small-scale industry development; (e) coordinating the planning and development of a higher education system relevant to the needs of Namibia and individual students; and, (f) promoting the national research and development capacity."

The expected roles of the Ministry are to coordinate among institutions dealing with higher education, science and technology. To exercise this role, the Ministry is empowered to coordinate priority setting, financing, monitoring and documenting research and development activities. At the same time, the Ministry is expected to play a role of liaison with other government institutions. An important role for the Ministry is its catalytic function, so as to be able to create an enabling environment for problem solving, empowerment and community development. The Ministry is expected to develop programmes in the promotion of its mission.

The Ministry has undertaken the task of carrying out six main subprogrammes, all relevant to the development of science and technology. Subprogramme 5 is specifically addressed to "Science and Technology, Research and Development".

It recognises that research and development (R&D) is essential to solve social and economic problems and that there is no institution in the country through which to define priorities. It also recognises that the country has not developed a coherent policy which would serve principally to uplift village life, support the modern sector and create new technology-based business. Special emphasis is given to the diffusion of appropriate technology to rural communities and the development of linkages between the modern and informal sectors of the economy as well as using science and technology to improve the quality of life in rural areas. The Subprogramme, specifically contains the following goal:

> "To harness science and technology, research and development for the benefit of the community, for rural development, improvement of quality of life, job creation and the development of small scale and micro - industries through:

(1) Establishing a National Council for Science and Technology, Research and Development, to advise on policy, priorities and resources;

(2) Developing and maintaining a National Documentation Centre to serve as a clearing house and documentation centre;

(3) Establishing Regional Centres for Appropriate Technology;

(4) Enhancing links among researchers and users of research within and outside Namibia; and,

(5) Determining the state of science and technology, research and development with a view of defining an appropriate research agenda.

Besides recognising the Ministry's mission as complementary to that of the Ministry of Basic Education and Culture, it is of utmost importance that it is recognised also that it complements the missions of the Ministry of Trade and Industry and all other sectorial productive ministries of the country.

The present Report is set out to provide inputs which will serve the Ministry to comply with its broad mission and in particular the Subprogramme for S&T and R&D and when necessary reorient and provide a much sharper focus to its mission in the short term.

Since its inception, most of the activities of the Ministry have been carried out in application of its mandates in education. Only during the time of this mission, a public tender was being screened in order to provide a Director and one or two other assistants for the Directorship of Science and Technology. Once the Director is put in place and an Action Board, as suggested in this and other reports, is created, the acceleration of S&T activities will be greatly facilitated.

2.3. Policy Formulation

An earlier attempt to formulate policy in S&T was made by the University of Namibia through the Multidisciplinary Research Centre. In fact with the cooperation of UNESCO a fact-finding mission was deployed in February 1995 and visited several institutions. This mission found agreement as to the need of formulating policy, particularly at high levels of Government and several organizations were willing to contribute to such formulation. In spite of such agreement, no policy was formulated. At the time the UNESCO mission took place, the Ministry for Higher Education, Vocational Training and Science and Technology was being created.

The Multidisciplinary Research Centre at the University of Namibia was established, in part, to initiate the process of policy formulation, but when the position of Director of Science and Technology at the Ministry was filled, the responsibility of coordinating this process was transferred from the Multidisciplinary Research Centre to the Director of Science

and Technology. This Report recommends at the end that policy be determined by a national body, with the Ministry as its executive organ.

2.4. Research Capacities

Research capacities exist in a few but well organized and managed institutions. Government has made an important effort in some sectors by creating such capacities. Of relevance is the priority given to the resource management in the fisheries sector, where a major investment has been made in the National Marine Information and Research Centre.

Other important research institutions, visited by the mission were the Geological Survey, where the installed capacities are fully operational and constitute an important potential for linking it with productive activities and human resource development. Also of interest is the Veterinary Laboratory, where applications and research on new science and technology are being developed. The Centre publishes internationally and is contributing to the development of livestock production in the country to a great extent. It is already linked with the productive sector.

It is understood by the mission, and other reports have documented the existence of other relevant capacities in the areas of natural sciences, for example in the Desert Research Foundation. There are also some activities of relevance in the social and human sciences. All of these have already been documented in previous reports.

Research efforts are not well coordinated and as a result overlap and duplication are starting to occur. Policy formulation should avoid this duplication of efforts in the short term.

2.5. Science and Technology Services

2.5.1. Information

In the information sector, large firms have information access to their suppliers, mainly in RSA. Other enterprises and institutions are only starting to build up their services. One example of a recent development is at the NNCCI, which is operating the international programme TIPS as a complementary step in providing support services to its associates. The Chamber has been active previously as a forum, training, with support of ITC, and contributing to the access to finance.

As regards to information, INTERNET linkages are available but not yet widely diffused throughout a wider network of users. The linkage is recognised as efficient.

2.5.2. Intellectual Property Rights and Transfer of Technology

The development and appropriate transfer of technology, including the creation of an improved investment climate and the promotion of creativity and the production of

innovations, all depend on a strong system of intellectual property. Today, this system is very weak.

A patent law proposed by WIPO is taking a very long time to be analysed by the MTI before it is put for the consideration of the National Assembly. Meanwhile, Namibia is working under the "Patents, Designs, Trade Marks and Copyright Act of 1916 and The Patent, Designs, Trade Marks and Copyright Proclamation No. 17 of 1923.

On the other hand, the Office of the Registrar of Patents needs to be strengthened. It requires personnel, training and infrastructure. Today it is only a registry and does not provide examination, searches or other services. The small personnel at the Registry, knowledgeable in its business, is well aware of the existing limitations which exist within the Ministry of Trade and Industry. Patenting is made locally. Legal advisers for patent applications exist mostly as field offices of larger South African firms.

Technology transfer must be a component of the investment policy. The Investment Act does not recognise the need that investors should make some contribution to the technological advancement of the country. The provision that exists regarding training is not sufficient. A promotional policy for effective transfer to occur should be built in.

An important development during the time of the mission was the signature of an ample agreement between the Windhoek Chamber of Commerce and Industry (with 220 members) with the Paris Chamber. Such contacts are opening the way to future technology transfer schemes which will permit improving the general productive environment.

2.5.3. Consultancy

Consultancy capacities were not assessed by the mission, but from information gathered in the visits and interviews with users of such services, it can be concluded that consultancy requires protection to grow and can certainly contribute to the development of technology transfer.

2.5.4. Other Science and Technology Based Services

Informatics services are well advanced as, for example in the banking system. But the problem is access to software developers (even for adaptation). These have to be accessed in South Africa.

Today, much of the technical services are provided for by institutions South Africa, creating a situation and attitude of over-dependency. The situation of most large firms in general is that they provide their own services not only for training but for maintenance , information and consultancy. In case these are not available within the firm, the next option is their South African partners.

Laboratories for testing must be developed, in particular for developing and applying better standards and norms. The whole system for normalisation, metrology and standards

requires more attention from government and enterprises. In some countries, the systems are becoming mixed. This might be a line to explore in Namibia.

2.5.5. The Funding of Science and Technology and the general investment climate

There are no indicators on the investment being made in science and technology. Some funds have been created in the past years to promote research and training at different levels. Just as examples, a special tax in the fishing sector has allowed the creation and the operation of the Marine Research Centre and
Petrofund has donated the Namibian Mathematics Institute resources to assist in the upgrading of mathematics to benefit both teachers and students.

As the monetary and fiscal policies are set by CESU, it is not possible at the moment to provide fiscal incentives to create an enabling environment for technology development and innovation through such policies. The NDP recognises this difficulty and explicitly states that fiscal measures such as tax breaks or the like must be replaced by subventions.

Bank interest rates are very high. Between 20% and 27% and guarantees and collateral are required to access them. There is in short little or no long term financing which S&T and innovation need to develop.

Foreign investments are promoted since the adoption in 1993 of the Foreign Investment Act. Both foreign and national investment have a set of special incentives when the activity is related to manufacture and exports. These include tax abatements, deductions and also non tax incentives such as the access to concessional loans, cash grants and loans for exports, facilitating industrial studies. In the particular case of firms located in the Export Processing Zones, they do not pay corporate taxes, import duties on intermediate and capital goods, sales taxes, stamp and transfer duties on goods and services. Special tax incentives are provided for firms which undertake training of human resources. The larger investments are still however in mining and petroleum exploration. More recently foreign investment has flown in the manufacturing sector for the production of textiles (Italy) and car parts (Germany)

Investments applications are screened by the Investment Centre. The organization has little build in capacity for negotiation of technology transfer contracts and thus does not provide this support to either government or the private sector. Investors have indicated over time their difficulties arising from the lack of existing skills, particularly engineering.

The Research Department of the Bank of Namibia has been charged with the task of providing guidelines as to how a financial system could operate on behalf of micro and small entrepreneurs. An interesting and successful experience is that of Bolivia with the creation of Bancosol (Solidarity Bank). Annex I, contains a brief description of its operations.

An important development in the short term will be the operation of the Namibian Development Fund, with an initial capital of 10 million N$, addressed to fund productive activities by SANLAM, the private administrator of the pension funds. At present the company invests in equity, interest yielding instruments, property and cash. The interest

instruments yield approximately the same as the commercial banks, around 16% or higher. The Development Fund will be ready to provide capital resources in development projects (investment projects with the view of proving new investments opportunities for its managed resources).

It is possible that in time, the Fund could enter into risk or venture capital financing. The Fund may also be interested in initiating a process of funding which will be more promotional, for example at lower interest rates and longer term financing, with larger grace periods. This will be possible if Government puts into place well defined and stable technology development policies which will give priority to development of technology-based firms or new investments in high technology.

Many of the enterprises in the private sector contribute to science and technology in the way of fellowships and some structured bursaries programmes. In some cases donations have been made towards the improvement of the infrastructure of some research or training institutions. These enterprises however are still very much detached from a full-fledged technology development effort. For the latter to happen, the institutions supported by Government must show that they can offer quality outputs be in the form of highly trained human resources or research results. Experience shows that the involvement of the private sector usually occurs at a later stage of technological and scientific development, whose initiating effort must be made by Governments.

2.5.6. Linkages of the S&T System

The linkages between the S&T System and the other agents of the Innovation System are still very weak. There are only a few cases of linkages between UNAM or the Polytechnic with industry. The potential however does exist and needs to be brought to the forefront of policy.

One particularly weak linkage is that between the small and medium size enterprises (and informal) with the S&T, large firm and Human Resources System. Again, policy must formalise existing linkages and further develop new ones. In general, it can be concluded that educational institutions do not know the needs of the business community (and vice-versa). The two higher education institutions are only guessing as to what the productive sector needs. Everyone is really doing its own things.

3. THE EDUCATIONAL AND PRODUCTIVE ENVIRONMENT

Although it is not the purpose of this Report to deal with education and production, it is important that some relevant facts be mentioned, as these two elements of development make an active part of the "Innovation System".

3.1. Educational Infrastructure

An overview of the whole higher education and vocational training system shows that in general the level of education needs revamping to attain world class quality. Even the use of the Cambridge level examinations practised at the higher education schools is deemed as low level to be able to satisfy the needs of high quality professionals in production.

In part, because of the above, most of the larger private sector firms have their own training. SANLAM, for example, has short training in management, the same applies for mining firms, which have created their own schools and vocational colleges. Others like SWAWEK are starting their own. The creation of in-house facilities may be a duplication of efforts and resources which could well be used for other training practices in the firms than just doing what the formal education system should do.

The country has an extended system of four colleges of education and seven vocational centres which can be used as bases for the development of science and technology in a broader sense. Without changing their character, it should be possible to build in these organizations some expertise which would allow them to play an additional role of S&T regional centres. This could mean for example one S&T officer in each centre, knowledgeable in the operation of the S&T system.

It should be born in mind some of the problems affecting the educational system. Among them the lack of skills of many instructors in the vocational schools. A mutual distrust or lack of mutual knowledge exists between government - academiae - private productive sector. This is or has been a normal state of affairs in all the world. Only in the recent years many countries have been able to produce linkages after extended deliberate efforts.

3.1.1. Higher Education

There are only two universities in Namibia, the University of Namibia and the Polytechnic. For a country of small population and small markets, this is probably an adequate number and it is to be hoped that universities do not mushroom as has been the case of many developing countries, with serious quality problems. Efforts must now be made to transform these two institutions into highly competent organizations.

UNAM for example must build expertise and competence in science, which implies an important investment in faculty and research facilities, and not just in training laboratories. Many instructors are not accustomed to laboratory work.

Today, some duplication of efforts is evident among both the two existing institutions. With due respect to the necessary autonomy that universities must have, it is important that the MHEVTST induces some cooperation among the two. In the longer term, quality will define and drive programmes but at the start there has to be some planning inputs from government.

3.1.2. Vocational Training

An important note about vocational training must be made regarding the existence of several schools in the large private and public firms. In fact, many have made important investments in training the technicians and operators they need for their work. Vocational schools train people in skills needed by the larger income groups and other needed skills are not being introduced. One key point is to train trainers of vocational schools.

Many firms regard training as an important part of their policy, but of course they complain that once in-house training is provided, many of the trainees do not remain in the company and look for jobs outside.

3.1.3. Human Resources for Science and Technology and Innovation

The engineering base in Namibia is not well developed. While it is true that there is an appropriate number of engineers in many of the large firms, they are in high demand by all others including the government. The situation is such that in opinion of some experts, there are productive sectors which because of lack of engineering skills are working below capacity.

Neither UNAM nor the Polytechnic have an engineering school. Both have been discussing its establishment and the latter plans to phase out its vocational level education and become a full fledged engineering organization. It plans to start with the operation of electric, mechanical and civil engineering careers by 1997. However, the Polytechnic lacks full capacity to produce a final design of its careers and it urgently needs support for curricula design and laboratory acquisitions and will require the presence of instructors as well, at least during the initial phase of operation.

The decision of the Polytechnic to become mainly an engineering school should looked as an most important effort in the correct direction and should be supported both by the public and private sector institutions. It is important to note that the phasing out of the vocational training tasks of the Polytechnic will in fact solve a duplication problem that has already been discussed in several Reports.

It should be pointed out that several large production and service firms in the country are willing to share the time of its engineers with the Polytechnic or UNAM. Arrangements can be more or less easily be made for this key cooperation to take place. An important organization (not visited by the mission) for the support that both the Polytechnic or UNAM need could be the Engineering Council of Namibia. Additionally, across the board on-the-job programmes must be enhanced or put in place. This should be accompanied by assimilation and learning techniques built in the productive enterprises.

A general remark that can be made regarding science and technology and the educational system is the need for introducing science teaching as a pivotal element in triggering a more creative and innovative society. For this to occur, teachers must be highly motivated and not just knowledgeable.

3.2. The Productive Environment

3.2.1. Large Scale Firms

There are few but important private and public large firms in the modern sector of Namibia, which are definitely contributing to economic growth and employment. These produce goods mainly for export or are public service enterprises. Examples of the former are in diamond production (NAMDEB), examples of the latter are SWAWEK, the electric power utility, which is expanding its grid to the rural areas (although it has not considered independent solar energy alternatives in depth).

Design and technology is imported from RSA and other European countries. Maintenance is also made in the firms as these do have an authentic mistrust of other capacities installed in the country.

Many large firms are only beginning to subcontract in the local market. The main activities of procurement are addressed to the RSA. This also applies to specialised maintenance of equipment. There is a large potential for subcontracting within the country provided the competences of professionals and technicians are improved and some measures are taken by Government to facilitate the use of local capacities.

Most of the firms in the modern sector have their own training facilities and carry out specialised technical and managerial training abroad, mainly in RSA. Of importance is the fact that the largest percentage of engineers in the country are placed in these firms. Also, the fact that the human resources development programmes of these firms are geared to train black Namibians with priority. As already mentioned elsewhere, most of the large firms in the country have an important potential to contribute to the training of engineers in the Polytechnic or UNAM.

The larger companies have created a Private Centre Forum, dedicated to the execution of workshops and other tasks. The Forum could be an important stockholder in the S&T System.

The creation of an Export Processing Zone should contribute to the development of productive capacities, if specific policies are designed towards this goal. It should be avoided that EPZ become absolute islands, providing only employment and income. It is probably possible to negotiate contributions of firms setting in the EPZ to the built up of S&T capacities.

An important productive sector is mining. It has developed some strategies for human resources development at the vocational level. It is felt by the industry that a three-way strategy should be further developed, local, regional and international training.

3.2.2. Small and Medium Size Firms

SMEs can contribute in a definite way to sustainable development. Because of their importance, several studies have been made in the past years and many suggestions and recommendations have emerged. Annex G of this Report, resumes the main findings of this mission and previous reports.

The creation of the Joint Committee for SMEs by the MTI will contribute greatly to coordination of efforts on behalf of support agencies. However the Committee must involve many more enterprises than at present. Some government officials believe that a national association of SMEs should be established in the near future. Today there is also no regional representation at the Committee and it may not be the best candidate for the diffusion of technology.

Requirements of SMEs are varied: training, linkages with their immediate environment and other industries, in particular, large industries and exports. Of greatest importance is the creation of confidence of small businesses in front of larger ones.

3.2.3. Rural Development

The government is launching a strategy for rural development which is certainly a priority. The designed programme however might be too broad to be carried out in the short term that is needed. It is certainly necessary to carry out a rural development strategy, but it must concentrate on a few goals. Probably that of creating productive units would be the best choice.

3.2.4. Human Resources in the Productive System

There is in general weaknesses in the areas of technology management, except in the larger enterprises. As already discussed engineering capacities are concentrated in a small group of firms. In the technical areas, there is also a need for improving the technical capacities, especially in non- traditional areas, e.g. packaging, computing, etc.

3.2.5. Promotional Efforts for the Growth of the Productive Sector

A particularly important institution in Namibia is the National Development Corporation. It can play a key role within the S&T System. It works along two main lines: agriculture and industry and has been promoting and facilitating resources and other types of support for several projects in both.

For the more specific case of industry, it has a facilitating role by providing finance, equity and guarantees. It has developed a Business Advisory Service and provides also infrastructure support. One short term plan is the creation of industrial parks as strategic facilities, which would avoid unnecessary additional investments by prospective entrepreneurs. Its expertise also goes into the organization of trade fairs, small and medium size firms' promotional policies.

CHAPTER III

AN APPROACH TO DEVELOP SCIENCE AND TECHNOLOGY IN NAMIBIA

1. IDENTIFICATION OF PROBLEMS: METHODOLOGY AND POSTULATES

Previous sections have shown the general aspects of the country's economy and problems whose solutions could receive some contribution from the development of science and technology. A general description and issues regarding the science and technology system have also been discussed.

It should be quite clear that one of the main problems facing Namibia arise from the contrast that exists between a modern side of the country and the poverty of a majority of the population. However, the very existence of a modern part represents an enormous potential for contributing to the changes that are needed to improve the situation. The mission undertook the task of providing some answers to produce such changes by using science and technology and research and development as its instruments.

There are many reports and studies carried out by government, international organizations and NGOs which have produced many ideas and suggestions. The important issues now are: - how to select priorities among them to start?; - how to choose some short term measures to be taken ?; and most important - how to fill people with enthusiasm to implement the measures that can be suggested?

For the purpose of presenting a rational approach to develop S&T in Namibia, it is possible to start with a rather obvious method. It consists of the following steps:

(1) Identification of the problems to be solved and the goals to be achieved.

(2) Statement of the postulates that follow according to the first principles to be followed.

(3) Identification of empirical observations to select relevant data.

(4) Develop the analysis of data in the framework of a theoretical approach for understanding the present situation and the possibilities of change.

(5) Define the conclusions and proposals to be implemented.

The first step, the relation between the modern sector and poverty, has been achieved as discussed at the start of this Chapter. The postulates can be stated as follows:

(1) It is not possible to agree with the separation, often done, between the poverty alleviation strategies and the modern sector development.

(2) Modernisation is to be understood as the expansion of the economy in such a way that poor people comes out of poverty from a degradated subsistence economy, to become a worker and a consumer, as well as a citizen with dignity in the society, without necessity of charity or alms.

(3) To the above purpose, which is the most important, and to which science and technology must contribute, two frequent biases must be avoided, these are:

(i) It is not true that everything must be planned by government.

(ii) It is also not true that nothing must be planned, waiting that pure market mechanisms in an open economy solves every problem.

(4) Science and technology are different things. Science is linked to technology because frequently, scientific results are transferred to technology. On the other hand, technology changes very fast, while science fundamentals, on which it is based, remain valid over much longer periods of time (or forever in some cases). This does not mean submission of science to applications, because creativity works better in an environment of academic freedom;

(5) Technology cannot be seen as a goal in itself, but it must be useful to solve concrete problems of society and to develop the country. It must be clear, however, that technology is a tool and it is not enough to solve all problems, most of them depending on economic rationality, social equity and political decisions.

2. EMPIRICAL OBSERVATIONS AND SELECTED INFORMATION

The mission made direct observations by visiting a large number of institutions, both public and private, and interviewing many people. The prepare these visits as well as to analyse their results, the mission read and discussed an exhaustive list of documents. As there exist a quite impressive amount of studies in reports and other publications, here, those considered more relevant have been selected.

The first question that arises is why such an international interest in Namibia ?. A general answer would be that it is the youngest democracy in the world, which came into being after a long history of struggle against racial apartheid and political domination (see Annex A). But the choice of Namibia by UNIDO can be found in the Report and Programme Proposal on Prospects for Innovation in Manufacturing Management (UNIDO, 1994). According to it, Namibia presents "special factors" and "difficulties which make the country particularly interesting". These factors and difficulties, as recognised by the mission can be summed up, as follows:

(1) Modern economy does exist in Namibia, but it is too concentrated socially and geographically. The capital Windhoek is a very modern city that contrasts with most of the country.

(2) The elite has good education and scientific knowledge which were not available, in the past, to most of the non-white population, blacks and coloureds, which forms the largest part of the country's society.

(3) The great majority of the population lives in very hard conditions of poverty, with little chance of improving the patterns of life because unemployment is too high and it is growing. This majority is not integrated in the economy whose development has not benefited them in the past.

(4) However, Namibia has comparative advantages in relation to most other African countries, because its per capita GNP is of the order of US$ 1,610 (1993) or higher, while Zimbabwe had US$ 570 and Mozambique US$ 60. It is recognised of course that income distribution is too skewed, since 5.1% of the population has 72.2% of GDP;

(5) The population is relatively small, about 1.5 million inhabitants in an area of 824 thousand square kilometres, that means a low density of 1.82 inhabit/km^2. The country is rich in minerals, there is significative cattle farming and fishery has high potential for growing, although large part of the territory is desert and there is water shortage;

(6) Namibia has more kilometers of road per capita than any other country in Africa and the roads are well maintained. The telecommunications system is one of the best in the continent. Electricity consumption increased by 50% from 1980 to 1990 and there is considerable hydro-electrical potential. The discovery of exploitable oil deposits, could really transform Namibia's energy position;

(7) The potential for industrial development in Namibia is "much more promising than in other Sub-Saharan countries", because of Namibia's modern infrastructure and good energy supply. The private sector is the most important in the economy and there is a fairly developed financial sector;

(8) The government has a dynamical role in the economy and in the country's social development. The political system is stable, based on democratic principles and concerned with racial integration as well as national reconciliation. The international relations are very good, including those with South Africa and Angola.

The simple analysis of the above points allow to see that only point (3) is purely negative. Points (1) and (2) show the contrasts in Namibia, as well as (4) and (5) do. The last ones, from (5) to (8) indicate that there are possible ways to solve the problems of Namibia. The next step is to construct a theoretical approach for such solution, which is not easy to do.

3. THEORETICAL ASPECTS

There is no achieved theory to treat science and technology as a tool to solve the very problems of developing countries. Besides modern theory of science tends to consider pure theory much more as a way to justify new achievements than to discover them. To reach scientific results, the human mind mobilises already existing available information and new theories, free inventions, and wish. What is called a theoretical approach here is a way to put in a rational framework the findings of the mission that are to be confronted with reality.

In a very simple mathematical metaphor, it is possible to classify points (1) to (4) of the last section as variables to be changed:

(1) Expansion of modernisation and market economy

(2) Education for all population and diffusion of science and technology

(3) Increase of formal employment and creation of jobs

(4) Income distribution to benefit the poor people.

In the same way points (5) to (8) represent something like functions which act on the variables to change them:

(1) Natural resources exploitation and development of agriculture

(2) Infrastructure and energy supply to guarantee industrial development

(3) Private dynamics and modern sectors of the economy

(4) Role of government.

Going further in the analogy, it must be remembered that in mathematics the number of variables should not exceed the number of equations, and this is a necessary but not sufficient condition for the existence of solutions. In the case that is being treated, there is no theoretical functional dependence expressed in a mathematical form (see Appendix E). There are no deterministic equations to solve socio-economic problems and even in the more recent mathematical description of nature, the extreme sensibility to present conditions in chaotic systems allows to hope a future not predicted in the past. But, future can be improved depending on present actions, so it is necessary to look for the correct actions which will point in the direction of economic as well as social development in Namibia. The actors are entrepreneurs, workers, government, civil society and international organizations.

These actors should manage potentialities (5 to 8) for changing variables (1 to 4). This is represented in Figure 2, which can be interpreted as follows: (a) natural resource exploitation and agriculture are more related to job creation and income distribution; (b) infrastructure is more related to modernisation and income distribution (household electricity

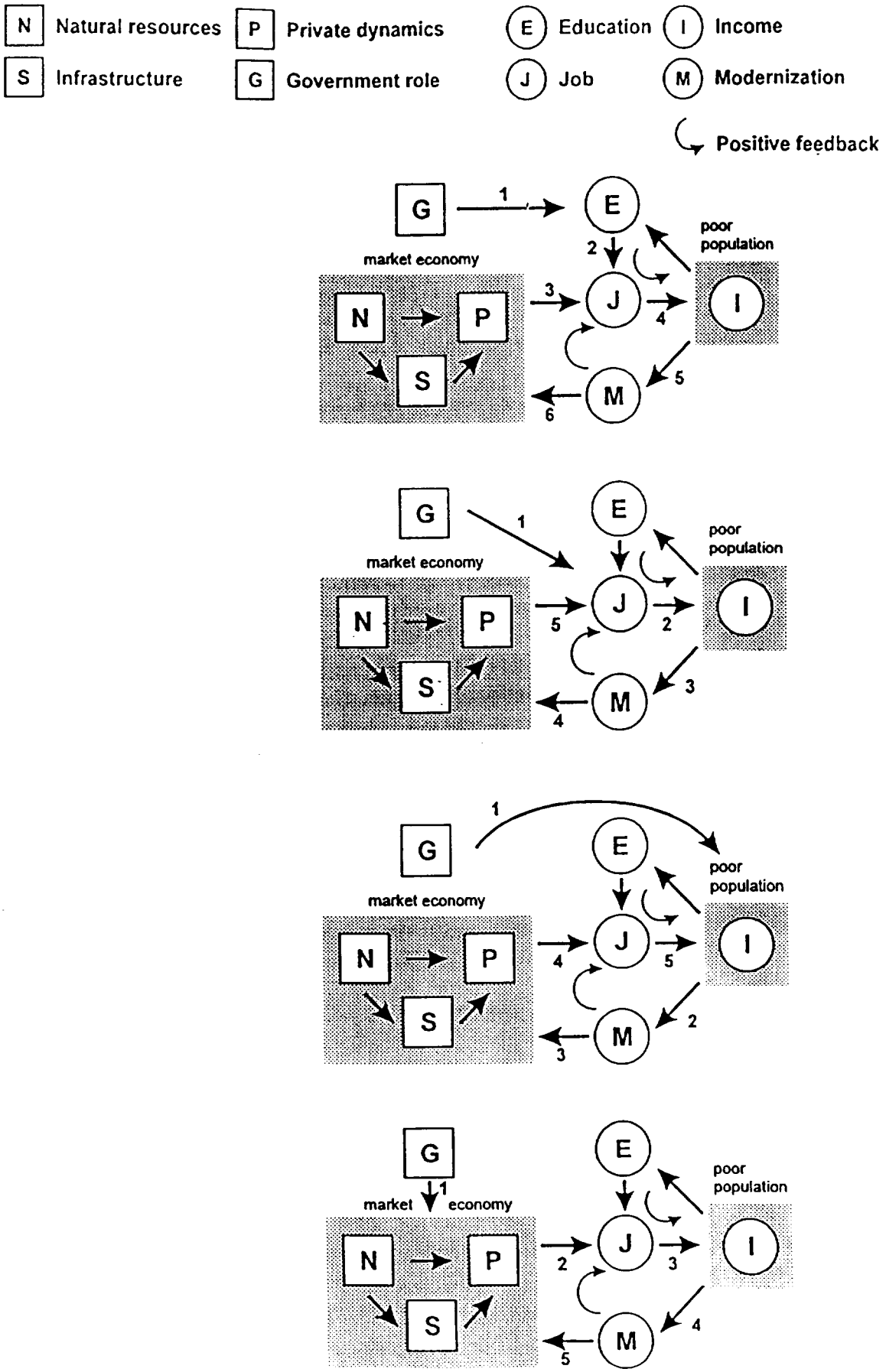
supply, water, cross subsidies); (c) private dynamics of the modern sectors of the economy is more related to modernisation and jobs; (d) government role is more related to education and income distribution (through taxes and social actions). Thus, for the purpose of managing potentials, actions need to be coordinated, through a social and democratic consensus, but with efficient institutional tools, that involve small and large firms, state, non governmental and multilateral organizations.

As an example, government must act on the state's role (8) for public education (2). But it must be done to increase skills of population and to improve the scientific and technological knowledge of professionals for better employment (3). Action on different sectors of the economy must be integrated into a network (5,6,7) for growth, but it must be done by creating employment (3), not only through direct formal jobs, but also, by subcontracting small enterprises or individuals. Education together with employment can improve income distribution (4) and integrate the poor people in the modern economy. In this way, consumers will expand the markets which in turn will allow the modern economy to grow. Figure 2 also shows, how the above mechanisms can work in a complex systems approach (Annex E).

There are possible (a,b,c,d) ways for government to start the process (see Figure 1) with the main goal of taking people out from poverty, by education (2), job creation (3) and income distribution (4), for incorporating them into the modern economy.

This approach does not consider separately the modern economy and the subsistence economy of the poor people's survival, but rather encloses both. The expansion of the modern economic sectors is to include all society, education, reduction of poverty, income distribution, involve scientific and technological knowledge, training and vocational skills. The main purpose of this Report is precisely identify actions on S&T that will contribute to the main goal of Namibia, to integrate all the country's societies into a developed modern society.

Figure 2: Government Starting Actions



CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

1. MAIN CONCLUSIONS

(1) An important institutional development in science and technology has been the creation of the Ministry of Higher Education, Vocational Training, Science and Technology. The Ministry is well placed to act as an efficient Secretariat of an Action Board. With the MHEVTST, the decision making capacities for S&T are already in place;

(2) The need to develop S&T is already recognised but, there is still a lack of understanding on how to go about relating S&T with economic and social processes. One commonly held view, in particular in the modern sector, is that technology is already available in more developed countries and it should be sought there. This view is very short-sighted and needs to be overcome;

(3) In spite of the above, it is recognised that there exists an extreme technical dependence from South Africa, and this is a situation that needs to be modified, recognising that Namibia cannot be technologically independent because of the size of its markets and capacities;

(4) There are few but solid applied science research organizations, for example: the Geological Survey, the Desert Research Centre, the Central Veterinary Laboratory or the National Marine Information and Research Centre. These have some ties to technology development and the innovation system. It is important to highlight the existence of such centers of excellence. They have high level scientists who can make important inputs to diffuse scientific and technical knowledge;

(5) For the time being it is not necessary to start new R&D institutions but to strengthen those which already exist. In particular, it is necessary to improve the infrastructure for research and services at UNAM and the Polytechnic. The existing one today is not sufficient to efficiently carry our R&D or services tasks for the productive sector;

(6) The University is more developed in the social sciences than in natural sciences and there a few technological research programmes in course. The science and technology subjects in the programmes have been introduced as a result of planning, but it is necessary that technical capability be developed to achieve the stated goals;

(7) The Polytechnic is more concerned with technical training than engineering. This policy is changing, favouring the engineering development. At present

there is installed capacities for training specialists in electrical, computer science, civil and mechanical areas;

(8) There are few researchers and both the University and the Polytechnic are only starting to make some headway into R&D. An enhanced fellowship programme for training high level postgraduate students abroad should be designed according to the country's needs;

(9) There are about 100 engineers (and even less managers) who can contribute to transform scientific knowledge into technology, 50% are Namibians. They are involved with the larger enterprises in the private or public sector. A limited number have postgraduate degrees. At present there is no engineering training at any level. Science and engineering are separated between the two higher education institutions;

(10) There is a valuable network of vocational training centres and professional colleges, some with reasonable workshops for practice. Several private and parastatal companies have their own training facilities and there is a well equipped centre at Arandis: the Namibia Institute of Mining and Technology;

(11) There is practically no technical linkages between these different training institutions with UNAM or the Polytechnic, which in turn have no cooperation with industry and other economic activities in what concerns technology. In general, the linkages between enterprises - S&T - human resources systems are extremely weak. For example, there is no effective linkage between the public research institutions and the University or Polytechnic for scientific and technological cooperation. Particularly weak are the linkages between the small enterprises (and informal) with the former three;

(12) In general, S&T service capacity is not large if one considers the problems of information, the inability of reaching out to users, the [small] maintenance shops, quality control laboratories, standards development, metrology, etc. The problem is further complicated if the payment capacities of the larger number of potential users, such as the small enterprises, are taken into account.

(13) Consulting capacities are not yet fully developed. Universities can fulfil this space in part. Many NGOs occupy consultancy spaces but are not able to create internal sustained capacities. Information systems are only starting and require further support. There is an INTERNET connection that is used in a limited way but is recognised as efficient;

(14) Financial resources for R&D are scarce. The University of Namibia is quite confident that resources exist to cope with present demand. Other organizations which carry out some R&D but mainly technology diffusion do confront limitations of resources. A large part of the S&T infrastructure has been build by external funds. There are no specific financial mechanisms for innovation.

Existing funds for innovation are those of the commercial market, with high interest rates and other difficult conditions to meet;

(15) The industrial sector enterprises do not carry out any R&D activities, nor they contract them to universities or laboratories. Normally they carry out routine tasks of maintenance. There are some innovative firms which are starting to grow carrying out some design activities and software development. Some firms provide financial resources to the science and technology system through small donations;

(16) Small and medium size firms do not have access to technology options or new developments occurring either locally or abroad.

(17) There is a proposed Industrial Property Law which has yet to be considered by the National Assembly. Its adoption can improve the general environment for investment and technology transfer;

(18) There is a small installed capacity for patent application, legal advice, technical advice in industrial property. Enterprises are dependant on the first supplier of equipment for further technological development. Little capacity for opening up options exist;

(19) Technology transfer must be a component of investment policy. The Investment Act does not recognise the need that investors should make some contribution to the technological advancement of the country. The provision that exists regarding training is not sufficient. A promotional policy for effective transfer to occur should be built in;

(20) The National Development Corporation and the Investment Centre can be particularly important players in the S&T System, as they are well prepared to promote investment, draft feasibility projects and creating enterprises;

(21) The creation of employment opportunities call for a search and assessment of potentials in all sectors of the economy, as well as influencing choices of technology, projects and products through suitable policies. In addition to encouraging further employment growth in the more promising sectors, the situation requires development of other branches of the economy having prospects for job creation. Small and medium size enterprises are vehicles of employment, as the small domestic market limits larger production units. If the country will embark upon a programme for small and medium size firms manufacturing, the cost competitiveness particularly of labour can hardly be ignored. The latter means better wages and better skilled people. It is important to point out that S&T will not solve poverty problems in a direct way, it can certainly contribute but only if other conditions are put into place.

2. RECOMMENDATIONS

The recommendations that follow are mainly addressed to strengthen the S&T System and its linkages. They derive from the analysis of the situation as resumed in the conclusions and with the theoretical approach, that was discussed in the previous Chapter, they lead the way to a small but comprehensive plan of action and investment programme described in Section 3.

In particular, the direction of the recommendations and the investment programme is to identify possible ways to develop science and technology so as to impact on the variables: modernisation, education, employment and income distribution. The success of this approach will depend on how far the recommendations can effectively be put in place.

2.1. Government Intervention and Policy

There is considerable debate not only in Namibia but throughout the developing world as to the type of policy intervention that governments should pursue for economic and social development. There are those that believe that government's role should only be enabling, leaving the rest to market forces. Others contend that direct and strong intervention is necessary to tackle serious economic and social ills.

The National Development Plan of Namibia has as one of its main principles that the role of Government should be to create an enabling environment. It is not always clear however to what extent should government act to create such environment.

Given the level of development of S&T in Namibia (as well as in many other activities), government should certainly play a pro-active role, not only by improving the policy environment but also by helping to remove many other constraints. Most sectors of activity in Namibia merit a stronger government intervention in a pro-active manner.

It is the first role of government to support education at all levels, in particular higher education and research. For many reasons that have been discussed throughout this Report, the country is not ready yet to depend on extensive private support to these activities, which are absolutely necessary to be carried out.

On the other hand, Government should not create firms but can promote and support them through appropriate measures. For economic reasons for example, it is important to create in Namibia stronger firms than providing protection by lowering or uplifting tariff barriers independent from South Africa, or detaching the country from SACU. Science and technology can certainly contribute to this former goal and it is under such conditions that its development becomes a priority.

The need to keep economic variables and trade regimes compatible with South Africa does not imply that the Government of Namibia is powerless to effect policy changes that will help to accelerate the growth of enterprises. There is in fact a large agenda of changes that are needed to be effected very urgently.

In the process of consultations with stockholders it became clear that it was necessary to define a course of action in science and technology, by adopting a national policy which would serve as a guideline to both public and private sectors. Following are some of the policy issues and guidelines which can be considered:

(1) Decentralise the S&T System while keeping close coordination;

(2) Technology growth can be attained through an intelligent combination of local research efforts and transfer from abroad. The acquisition of technology is only part of such transfer. The international market is an important option. However, not all technology that is offered can be adjusted to the requirements and sizes of the local industry. Therefore the search in the market must be accompanied through local technology efforts;

(3) Science policy deserves to be explicitly recognised and acted upon, the main issues being: the image of science, academic freedom, science cooperation and funding;

(4) Strengthening of technology at the enterprise level, does not only contribute to development, but it is a condition that such development can be sustainable. There is no possibility to diversify the productive base or to export products with more value added without technology;

(5) S&T can contribute in a definite manner to the build up of competitive capacities which the country needs in the dynamics of the world today. The policy of Namibia in S&T should thus prioritise the creation of competitive strengths throughout the productive system and in individual firms;

(6) The role of SME's within an innovation system must be further clarified. A specific project on this issue could be pursued. Such project should be addressed to understand the particular social and economic conditions that today accompany the scientific and technological revolution, the structures for social cohesion that it originates, and the transformations that are imposed, so as to define a better environment for the productive growth based on SMEs;

(7) Competitivity raises important policy questions. Examples are if the support to innovation by public funds must be addressed to individual private firms or rather to the linkages of productive sectors around mobilising programmes. Also how the pre-competitive research of interest to a given productive sector can be structured and administered to provide as a result improved competitivity. Other policy question that arises is that if the results of projects financed by public funds can be of general access or appropriated by one or a group of enterprises;

(8) Within the above policy issues and guidelines given just as examples, it is clear the necessity to create a capacity for policy analysis to facilitate decision making. An organization for science and technology research should become part of the normal activities: for example, the University of Namibia. This capacity should be closely linked with the Schools of Management and Economics or even be part of them. The main user of this capacity would be the Action Board and the MHEVTST.

2.2. The Institutional Framework

The UNIDO Report "Science and Technology Policy for Namibia" has recommended the creation of a S&T Action Board. This mission considers that this is a very important step to be taken immediately. Further to the previous recommendation, Annex F, of this Report proposes a detailed institutional arrangement, in the way of a draft of an Act of the National Assembly.

For its adoption, it is of utmost importance that the Minister of Higher Education, Vocational Training, Science and Technology initiates contacts with members of both the executive and legislative branches of government, to alert them of the importance of adopting a broadly based institutional framework in science and technology.

Some comments on the latter are in place here. First, the mission fully agrees with the previous UNIDO mission that a council strictly on R&D, is not appropriate as the country really needs to concentrate on both technology development and scientific research, the former being of extreme importance at this stage.

A second thought regards the proposed number of people in a S&T Board. While it is true that S&T cuts across all activities of a given society, it is not very practical to have a large number of representatives sitting on a Board. It is better to have the real decision makers and have the others be involved with the implementation of a development plan for S&T, for example in the standing committees. In this way all stockholders will participate. Those not sitting on the National Board should not feel as being left out.

It may be considered important to have a representation of the National Development Corporation in the Board, as a key implementation agency of the MTI.

Communications among stockholders and linkages must occur if S&T is to develop. The MHEVTST has the responsibility to assure that this actually happens. The Ministry should not execute programmes, except those relevant to its policy and planning functions.

Besides recognising the Ministry's mission as complementary to that of the Ministry of Basic Education and Culture, it is of utmost importance that it is also recognised that the former complements the missions of the Ministry of Trade and Industry and other sectorial productive ministries of the country. This latter recommendation must be built in the already stated missions of the MHEVTST. The recommendations that follow are set out to provide inputs which will serve the Ministry to comply with a much broader mission.

The new institutional framework has to be able to provide:

(1) Effective coordination of activities to avoid duplication of efforts;

(2) A framework around which the large number organizations that compose the S&T system or deal with it, can participate;

(3) Clear cut accountability for policies and programmes;

(4) Effective implementation of programmes at national level;

(5) Effective international and local technical and managerial support.

2.3. Decentralisation

In line with the national policy guidelines on decentralisation, it is important to consider also the regionalisation of S&T. This is key for employment generation and the linkage of the modern sector of the economy to the poor. However, although the S&T System can be decentralised as proposed in the draft act of the National Assembly (Annex F), a general decentralisation is an important aspect for the development and application of science and technology. For this reason a similar proposal as that of the "popular participation" scheme adopted in Bolivia, should be considered with priority.

2.4. Diffusion of Science

The popularisation and the formal teaching of science needs to be in place at the earliest possible date. It is important in Namibia to create a more scientifically and technically oriented society. The main player of this effort is the Ministry of Basic Education with the strong supporting role of the MHEVTST.

2.5. Development of Human Resources

Well-trained human resources are needed throughout the whole S&T System. To this end, it is recommended that:

(1) Science teaching in primary and secondary school levels be adopted as an active part of an educational policy. Specially important will be to introduce computer literacy at these levels;

(2) Engineering must be developed with urgency. To this end UNESCO could deploy an immediate mission to help design the engineering curricula at the Polytechnic and supply advice on the equipment to be installed for the laboratories;

(3) Further expertise in management must be developed. The creation of specific courses must be introduced to create not only traditional skills as are given today in the existing schools but also, for the management of innovation in firms, laboratories and government institutions.

(4) The two ministries of education have prepared a project proposal for "Consultancy to Develop a Human Resource Development Programme for Possible European Community Funding". The proposal aims at a consultancy operation which would prepare a programme dossier and a draft financing proposal regarding a potential EU- supported human resources development programme under the second financial protocol of the Lomé IV Convention. The successful execution of this project should be pursued actively. However, while the five chosen areas of work are important (- improving the teaching of mathematics and science; - staff development; - development of alternate modes of education; - skills development and vocational training; and, physical facilities), it should be taken into consideration that such a extensive human development programme must take into account the priorities in technology development and innovation, as these are the key linkages with the creation of wealth and employment opportunities.

2.6. Research and Development

It is important to continue strengthening areas of excellence. For example under SADC, Namibia is the leading country in fisheries and in that category it has organized courses and training activities for countries in the Sub-regional organization. The country must take advantage of this situation to develop other competences around the fisheries "axis". This can be done by looking and working very closely in the backward and forward linkages of the fisheries industry. These linkages involve not only scientific research but also a large number of industrial support activities such as metal mechanics, electronics and so on. UNIDO could run the methodological tool MEPS, acquired some years ago from the Andean Technical Secretariat, to identify such linkages in greater detail.

2.7. Support to Firms

An important advance has been the design and start up operation of "industrial parks" as centers for joint production and common services, which rent land at subsidised prices (although this policy is changing). S&T research activities are developed in laboratories and firms, so it has to be brought there. S&T organizations must take part in the development and implementation of such parks.

An important avenue to be explored at the earliest possible date is the creation of new businesses through technical entrepreneurship, incubation, venture capital, joint ventures and other mechanisms. In this respect the immediate possibility is to discuss the issue with the Namibian Development Fund, which is being put into place for precisely the purpose of productive investment.

The business community must participate in the S&T effort. For example the Windhoek Chamber of Commerce and Industry is well placed to lead the way at the regional level. This Chamber has good international contacts that can be used by the whole S&T System.

Also, deliberate assimilation and learning technology processes must be introduced in firms.

2.8. The Rural Sector

It is of utmost importance to initiate a process by which the welfare assistance vision to rural development is phased out. It is not possible to develop rural areas if local people will only feel as recipients of donations and relief programmes. This process will only enhance an already engrained cultural behaviour of "contemplation" that already exists in the rural communities.

In this context it is necessary to initiate a process by which rural enterprises are created. Although this is a long term process it is the way to produce incentives (and obligations) and provide better horizons to people. One advantage of this approach for example is that technology diffuses out better if enterprises really appropriate it for their own business. Extensive diffusion programmes without commercial interests have not worked in developing environments.

Also, under harsh environmental conditions, the creation of incentives is key to human development. It is not only a problem of job creation and income. It is also a problem of what to do instead of idleness and contemplation which only leads to more poverty and violence, drug, alcohol abuse and other ills.

It is not the purpose of the Report to recommend a rural development strategy, but it is possible to recommend some simple S&T contributions that might help the situation. For example the creation of "science corners" in schools, where children and parents collect local materials for further study, and thus provide some opportunities to do things. For this to happen it is necessary to train local school teachers. Colleges of Education and Vocational Training Centers could benefit enormously from a science-education driven effort.

2.9. Information

S&T information must be diffused to all productive and policy stockholders. However, the supply of information must be geared to the specific need of users. Large industries in the modern sector, SMEs, research centers all need different kinds of information. Particular attention must be drawn to the establishment of an information system which can provide evaluation of cost/benefit of alternative technologies and suppliers. This is particularly important for SMEs. Not only dissemination of information is important, but also at the same time the training of users. There is no point in creating information services if user development is not run as a parallel effort.

The creation of an information facility has been suggested already 1991. It is necessary to establish such facility as soon as possible. But, care should be taken as to the type of information the facility will manage and the users. One thing is scientific information and another technical. In any case, information services will have to be subsidised for some time.

In the case of scientific information, it should be considered that a good and extensively used INTERNET connection can go a long way. On the other hand, for technical information, it is possible, for example, to locate facilities in regional chambers of industry and commerce or at the Namibian Development Corporation.

2.10. Technology Transfer and Acquisition

Technology transfer (from internal and foreign sources) is an important complementary option for development. It has to make part of investment programmes and opportunities. For such transfer to take place, some important measures must be taken. Among them, it is necessary to adopt the law on industrial property rights which is currently in the hands of the Ministry of Trade and Industry.

Also, it is necessary to establish an institution with the purpose of serving as an intermediary between the productive sector and the research, training and services community. Such organization could be built up and operated by government - public enterprises, including financial organizations and the private sector. Its early main purpose would be to create favourable attitudes among stockholders for the mutual use of facilities, installed capacities and the development of potentials both individually and as joint ventures.

2.11. Technology Development and Innovation Financial Support Mechanisms

If a real technical progress is to be attained as a base for economic growth and social equity it is imperative that promotional regimes, that include fiscal credits, tax rebates and other such measures be facilitated for research and development activities. This is a policy that is being carried out principally in large industrialised developed countries. There is no reason why a developing country should not follow the same line of action.

What **cannot** be done is to impose new taxes on industry for R&D. In a developing environment such as Namibia, an excessive number of taxes would hinder rather than promote science and technology development.

Given below in the Table is an example of the type of financial support mechanisms for technology and innovation that could be considered.

DEFINITIONS OF STRATEGIC NATURE	
OBJECTIVE	To permit the development, adaptation, assimilation of technology embodied in products, processes and services of Namibian enterprises
STRATEGIC VISION	A) Gives preference to: - Technology based firms with basic productive processes in the country - Holdings or groups oriented to technology development - Projects and small and medium size technology based firms - Projects with impacts in productive chains (up and downward linkages) - Mobilising or cooperatives projects B) Joint ventures of the Fund with promotional institutions and leading firms for promotion of technology C. Optimising the joint venture with financial agents for decentralisation of operations D. Continuous follow up of projects
CLIENTS	Public organizations and private firms
OBJECTIVES OF FINANCING	- Development of a new product /process (innovation) - Development of product/ process (improvement) - R&D infrastructure - Early marketing

CONDITIONS OF FINANCING	
FINANCING ITEMS	- Project team - National/foreign equipment and instruments - Raw materials - International /National travel - Technical assistance and services - Project related civil works - Others
REPAYMENT	Maximum period: 7 years for - Product/process development (innovation) - R&D infrastructure Maximum period: 5 years for - Product/process development (improvement) - Early marketing
GRACE PERIOD	Maximum: 3 years
INTEREST RATES (R&D promotional or subsidised activities are permitted under World Trade Organization rules - of which Namibia is a Member)	International Libor rate(ILR) ILR-some%: innovation ILR-some%: improvement ILR-some%:R&D infrastructure ILR-some%: early marketing Further discounts can be made according to the Fund criteria and when project merits
PARTICIPATION OF FUND	Limited to 90% of the total project cost

3. AN INVESTMENT PROGRAMME FOR SCIENCE AND TECHNOLOGY DEVELOPMENT IN NAMIBIA: PLAN OF ACTION

Many of the recommendations of the last section must be followed by the MHEVTST and other bodies, specially in what concerns the institutional and policy frameworks. Others must be transformed into programmes and projects. This section deals with the second group of recommendations under an Action Plan.

3.1. A Short Term Plan of Action

For demonstration purposes, it is very important to adopt a short term plan of action containing few programmes/projects. This might imply that other important ones be left out, but, the execution and successful completion of a small set of projects will give the S&T System the credibility it needs in front of decision makers to become and active part of the development strategy of the country. Once this credibility is built many other activities can be later designed and executed.

It is of utmost importance that in the execution of the proposed actions, the international and bilateral agencies be involved. Many of them already have a plan or an on-going activity within the proposed actions. Some have large amount of resources already allocated. One of the purposes of the Short Term Plan would be precisely that of bringing together dispersed capacities in UNAM, the Polytechnic and many research laboratories with donor agencies and their experts. The MHEVTST has a key coordinating role to play in this respect.

The proposals of actions (programmes) to be included in the Plan are divided into two categories:

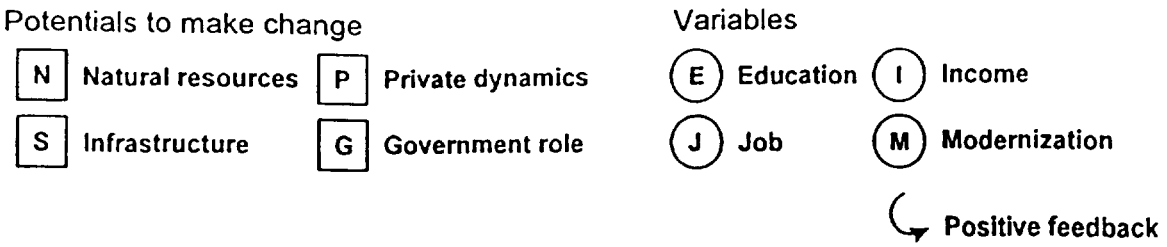
- Changes in science, education and training
- Specific technological programmes

All the programmes that are suggested, have been chosen according to the theoretical approach developed in Chapter III and the respective Appendix. They are intended to create a positive feedback in the economy through a starting action by government (see Figure 3), on education, job creation, income distribution and on the running economy, with the goal that poor people can become a consumer in the modern economy.

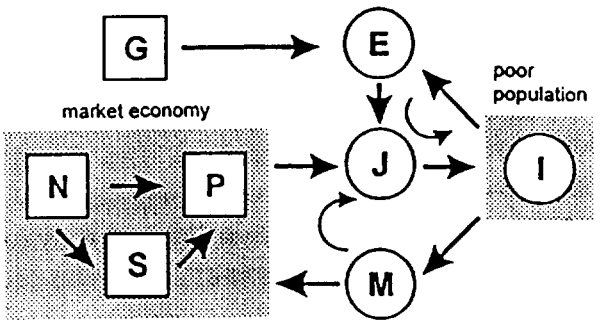
A most important aspect is the demonstration effect to fill people with enthusiasm. When considering the programmes, it is recognised that many ideas and proposals have already been suggested by many reports. Most of the suggestions presented in this report are extracted from them.

It should also be mentioned that there is ample experience in many developing countries on the programmes that are suggested. In particular in Latin America, important expertise has been built up in the past years. Namibia can well tap on such experience.

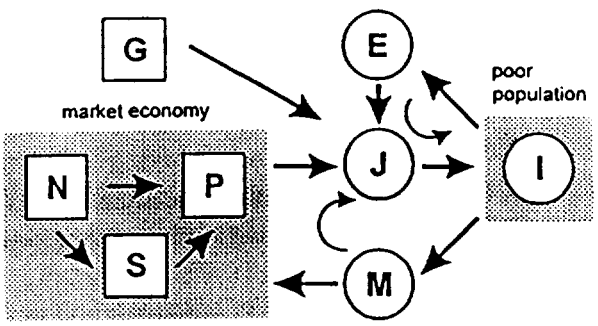
Figure 3: Examples of Government Starting Actions



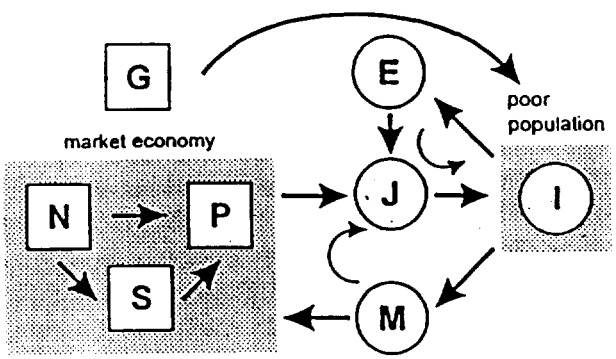
a) Improvement of University + Politech. + S + T Institutes + Vocational Centers + Basic School



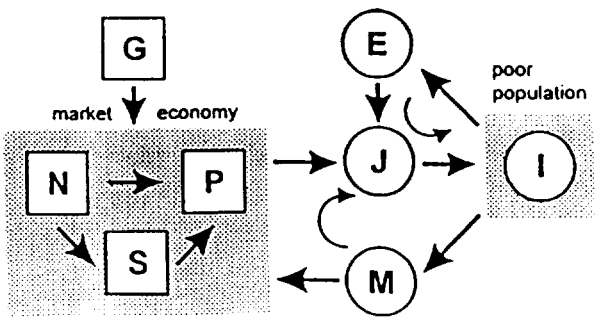
b) Appropriate technology for popular houses construction



c) Financing Solar Energy for Isolated Communities



d) Protection of few selected products by national industry with labour intensive technology



3.1.1. Changes in Science, Education and Training

(A) Creation of an Engineering Course at BSc Level Involving UNAM (physics, chemistry, mathematics, computer science) and the Polytechnic (electrical, computer science, mechanical and civil)

The creation of engineering capacities is key to the development of productive activities and the acquisition of innovative capacities of enterprises. Engineers must be trained locally in some disciplines, while in others it might be more reasonable to train them outside. Local training needs to be done in spite of the small labour market of Namibia. This latter limitation might be overcome through regional cooperation, for example creating a single school of engineering in only one or two universities throughout the region.

The policy to create engineering capacities in the Polytechnic should be supported, while at the same time UNAM and other research institutions should participate in its design and implementation. It would be a wrong policy to have engineering capacities in two institutions at the same time.

The main initial activities for the design phase are:

i) Assistance to the Polytechnic by one or two experts in engineering education to define the curricula and to design the laboratories;

ii) The experts should also meet with several of the public and private sector firms and laboratories to define a roster of instructors that can be used in the courses;

iii) Foreign instructors might have to be hired for the start up. The experts could identify them and provide terms of reference for their work;

iv) Regional cooperation, specially with South Africa, Botswana and Zimbabwe, can be sought. In some cases a regional engineering course might be preferable; cooperation with Europe will also serve the purpose of creating a high level engineering course.

(B) Establishment of Joint Research Programmes

If research will have any impact either on the advancement of knowledge or in the growth of the economy or provide solutions to social ills, it has to be carried out by very high level motivated people working in an appropriate academic environment, without bureaucratic traps, with sufficient financial resources for equipment, travel, acquisition of information, fellowships for training abroad (and in situ) and so on.

The above conditions impose severe limitations to countries which have a weak S&T system such as Namibia. It is therefore critical that any research activities that are to be carried out be conducted in the most ample scheme of interinstitutional cooperation and the decision

on the research topics be carried out with regard to what is really feasible to be obtained by the research teams.

One important condition that could be initially studied is to transform many of the very specialised public research institutes existing today in centres for science and technology development, thus covering a larger part of the innovation process. This has already been suggested by previous reports. For example, the Veterinarian Centre, could become a National Laboratory for Agriculture, carrying out not only research but also providing services.

The main initial activities could be:

i) Establishment of a joint working group between UNAM, the Polytechnic and research institutes, coordinated by the MHEVTST;

ii) Identification by the group of research topics (examples are public health, water supply, environment and desert, drought, fishing, mining, agriculture, theoretical subjects);

iii) Gathering of information on each topic, at both local and international level;

iv) Preparation of project profiles by specialists (both national and foreign). In some cases the projects must involve other countries of the region or outside;

v) Submission of proposals to donor (the National Fund, the European Union R&D Programme, etc.)

(C) Creation of a Foundation by UNAM, the Polytechnic for Research and Development under Contract with Industry, in Cooperation with the Namibia Development Corporation

The Foundation could be located either in one of the campuses or at an industrial park. The main initial purpose would be to bring the expertise of UNAM and the Polytechnic to the service of firms located at the park. It can also become a key player in the efforts to improve the whole educational system, creating awareness and diffusing expertise that can go from technical to managerial skills which are needed for the proper functioning of industry.

The NDC is key to this effort as it already brokers projects, projects management advice and facilitates business contacts. The Foundation could in time become one the Corporation's operators. The main issue here is that the presence of the S&T system must be established in the industrial parks.

The Foundation could well be the vehicle to improve and accelerate the use of the system for standards, norms, metrology and quality control that the MTI is developing with some difficulties.

The main initial activity would be the design of the Foundation, which will include location, ownership, definition of objectives, definition of an initial work plan, training, infrastructure and others

(D) Training Programme for Instructors of Vocational Centres using the Namibian Institute of Mining and Technology in Arandis and Envolving Professors from the University and the Polytechnic

One basic need of Namibia is to create a stronger technical work force, through improved vocational colleges. For this to occur trainers must be retrained or fully trained again. At the same time training must be diversified into many areas where expertise cannot be found in the country.

One possibility of developing an enhanced training programme is through the use of an already well equipped existing facility, so as to avoid high costs. This institution is the Namibian Institute of Mining and Technology.

Technical and vocational training, besides improving the abilities of technicians must introduce the concepts of maintenance and quality, if these will serve the productive sectors in their competence in both the national and international markets.

Main initial activities:

i) Determination of the present situation of demand - supply in skills training and vocational training for industry, but particularly addressed to rural communities;

ii) Definition of an appropriate curricula;

iii) Creation of a fellowship scheme to receive trainers at Arandis;

iv) Creation of a visiting professorship scheme to allow ample participation of university and other institution instructors;

v) Definition of equipment and other needs of the existing vocational colleges.

3.1.2. Specific Technological Programmes

(E) Appropriate Technology for Low-Cost Housing with Local Materials, Local Job Creation and Participative Design

This programme is the object of a very important cooperative project of the German Government with Namibia. It amounts to about 24 million Marks. UNIDO could propose a joint task with Germany applying the ideas of technology diffusion and participative design and construction by local people.

A scheme of this kind has been tried with success by COPPE (The Graduate school of Engineering of the Federal University of Rio de Janeiro). A possible strategy could contain:

a) The workers that will built the houses as well as to produce the bricks with local raw materials must be contracted in the local community, with salaries paid for that;

b) The Vocational Centres should participate in training the workers and artisans;

c) The University and the Polytechnics should cooperate in the design of houses and projects, including urban services for the houses;

d) A short term pilot demonstrative phase could include around 100 houses;

e) The final programme must have a pay back of roughly US$ 40 per month (this figure will vary according to the area) from each family, in such a way that the total amount of about US$ 500 per family year - could be reinvested in the programme.

The main initial activity of this programme on behalf of the MHEVTST would be to engage an expert who will produce the necessary linkages with the German cooperation project. This expert can be first a foreign national with expertise in low cost housing and immediately after a Namibian national, who may be the project leader.

(F) Solar Energy for Isolated Communities in the Rural Areas

Solar energy projects are quite common nowadays in many countries. Those which have worked the best are located in areas where the local communities have taken real and **commercial** interest in the project. A solar energy project can give way to many others not only in its specific area. For example, it could accelerate the plans of the Development Corporation for "planning for village level uplifting" or improve the Farmer Support Programme. The main idea is that many activities could be built around a single project.

In the experience of Bolivia, solar energy was introduced successfully after the government (and international cooperation) provided initial funding for introducing solar cells for low power electric supply. Panels were initially bought by farmers paying only 10% of the cost. After diffusion of the technique, farmers started paying up to 50% and today it is possible that this percentage will go up in a short time.

The project permitted the growth of small enterprises run by local people, which now charge the cost of maintenance and technical advice. Further a solar panel cell factory has been built, which imports only the basic cell. The mounting, construction of panels and installation is done by this factory. Accumulators (batteries) are purchased from a local manufacturing firm.

A solar energy project must consider the already on-going experience by the Ministry of Mines and Energy and that of the Norwegian cooperation under NORAD.

Main initial activities

i) Local expert (if necessary with outside support) provides an updated overview of plans and projects in the solar energy area in Namibia;

ii) An international expert (preferably coming from a successful experience) brings in new ideas and experiences and draws a pilot project;

iii) The pilot project is discussed not only with government but also with the communities and the private financial system. It is implemented as a joint venture of public and private capitals;

iv) On the experience of the pilot project a full project is designed.

(G) Labour Intensive Technologies to Produce some Goods Locally and Selected to be Protected Temporarily through SACU Agreement Against Imports

This programme can be divided into two parts which will then become one after initiation: the production of goods by the modern sector of the economy and the production of goods by small farmers.

The Farmer Support Programme and some NGO's are sensitising small farmers on the potential to grow some crops, for example vegetables, develop and retain a local market. This is part of an effort to break dependence on RSA on agricultural goods that can be locally grown.

Such effort must receive attention from many sides. First, farmers must be protected from low cost imports. Then they must have technology to produce efficiently and have support for the marketing of their products. It is just not possible to think of sensitising small farmers to grow vegetables if nobody will afterwards attend to their marketing needs.

A specific product can be tried at first. Through it, linkages with other products and services can be produced and in this way many people and groups of people will participate: those who will produce working materials and equipment (supported by, and in business with, the modern sector); vocational training centres (with a very specific mandate), educational colleges can support the effort in many ways; maintenance shops can be built and so on.

The main initial activities can be:

i) A workshop to define a small list of products both industrial and agricultural;

ii) Identification of market needs for those products;

iii) Identification of the technologies needed for the production of such products and its transfer to the productive enterprise;

iv) Identification of the productive enterprises and design of a scheme for cooperation, including financing, tax breaks, training, etc.;

v) Negotiations with SACU for creating small protective barriers for the initial phase of development of the list of products;

vi) Definition of the productive and marketing phases.

(H) Wood Industry Development through Plantation of Trees with the Support of the Joint Implementation Programme for the Abatement of Carbon Emission to the Atmosphere (Greenhouse Effect Conference in New Delhi, India, January 1997)

Namibia can take advantage of the Joint Implementation Programme by proposing a full-fledged project. With its support, the country can initiate a long term process for reforestation and the creation of a larger wood industry under conditions of sustainability.

Main initial activities:

i) Recruitment of an expert to design the project to be submitted to the Programme.

ii) Preparation of the proposal, consultation with government, approval and submission.

iii) Participation in the New Delhi Conference of a Namibian specialist (who would be in charge of leading the future project)

(I) Diamond Processing Technology for Increasing Value Added of Exports in Large Scale

Although mining is dominated by foreign companies, it should be possible to interest them in participating in the transformation of raw materials into more processed goods. One clear example is the possibility to create a real jewellery industry from diamond (and other minerals) processing.

The main initial activities can be:

i) Design of a strategy to create a jewellery industry in Namibia;

ii) Interest private mining companies in accompanying the strategy;

iii) Create the enterprises for processing jewels, in particular diamonds.

3.2. Investment Plan

The initial basic requirements for implementing the programmes as outlined given in the following table.

It should be born in mind that the costs given are only approximate. In the case of experts, some will have to be foreign but many can be local. Costs have been calculated considering that experts will be all foreign, so they are in practice overestimated. It should also be considered that some of the activities might have already taken place at least partially, so it is only necessary to complement or update them.

The main initial activities of most programmes are related to design. For this reason, these activities need to be undertaken as quickly as possible so as to implement the programmes no later than 1997 under a longer term plan.

The success of this Short Term Plan will depend on the decision of the MHEVTST to coordinate and oversee its programmes. The Ministry will have to negotiate with the Government institutions and international and bilateral cooperation agencies for the support of the initial activities. The implementation of the Plan can be greatly accelerated if the institutional framework and other recommendations contained in this Report are carried out.

COST ESTIMATES OF PROGRAMMES

PROGRAMME	COST (IN US$)	DESCRIPTION OF MAIN INPUTS
A. Engineering	18,000	- Expert: curricula and laboratory design (1m-m) - Expert: regional design and other tasks (0.5m-m)
B. Research	25,000	- Expert: assessing research institutions (1m-m) - Sectorial workshops - Information
C. Foundation	12,000	- Expert: institutional design (1m-m)
D. Training	45,000	- Survey demand-supply (2m-m) - Expert: curricula design (1m-m) - Expert: fellowship design (0.5 m-m) - Expert: infrastructure development (2 m-m)
E. Housing	12,000	- Expert: linking Namibian institutions with German project (1 m-m)
F. Solar Energy	160,000	- Expert: updating information (2 m-m) - Expert: pilot project design (1 m-m) - Cost of pilot project - Expert: final project design (2 m-m)
G. Labour Intensive Tech.	200,000	- Market surveys (6 m-m) - Technology survey (6 m-m) - Creation of conditions (policy) - Experts: production and marketing (12 m-m)
H. Woods	20,000	- Expert: design of proposal (1 m-m) - Travel to New Delhi Conference
I. Jewellery	36,000	- Expert: design of jewellery development strategy (3 m-m)
Total	528,000.-	

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ANNEXES

ANNEX A

GEOGRAPHICAL, HISTORIC AND ECONOMIC SURVEY OF NAMIBIA

I. Geographic Information

A not so long trip by car from the capital Windhoek, an agreable city at 1650 m above sea level, allows to understand that the name Namibia is related in indigenous language to desert or wild desolation. Some geographic highlights are:

1. Namibia's frontiers were established by Europeans with no regard as to either geographic or ethnic unities. The Orange River is in the border with South Africa and the Kunene River, 1400 km to the north, is in the border with Angola. At the north-east there is the thin Caprivi Strip as a kind of geographic appendix.

2. Along the coast there is the Namib desert 150 km wide on average. Part of it is rich in diamonds, present almost at the surface of the ground, where access is forbiden by mining companies. In the east of the country, there is the Kalahari desert, used for extensive small stock farming.

3. Large part of the central area, where a plateau is located, is used for cattle farming, but instead of green pastures, the area is semiarid and it is neccessary to use ten to fifteen hectares per head of cattle. Most of the human population is in the northern part of the country where there is more water to support agricultural activities.

4. Most rivers are ephemeral and the water supply is one of the country's largest problems. The northern rivers are used for limited irrigation and there is one hidroelectric plant in Ruacana.

5. The population density is low, about 1.5 million inhabitants in about 824 thousand square kilometers. White population amounts to 75 thousand people or 5% or the total; coloureds are about 80 thousand and 90% of the total are black Namibians, belonging to several ethnic groups. There is ample tolerance among all ethnic groups.

II. Historical Survey

Altough European navigators since the Portuguese Bartolomeu Dias landed in the Namibian coast, the interland was penetrated only in the 18th century. Germany spread its control over the earliest inhabitants. The following chronology provides a broad idea of the history of modern Namibia:

1. <u>The German Domination</u>

1890: Windhoek, the present capital was created by Germans as an strategic centre.

1904 to 1908: Expropriation of land and cattle provoked the great Resistance War by the indigenous communities.

1915: South Africa sent a military force to invade Namibia as part of the allied war effort against Germany.

2. The South Africa Mandate

1920: The League of Nations gave a mandate to South Africa on the territory of Namibia.

1925: A Legislative Assembly composed only by whites was created and considered the territory as belonging to South Africa.

1945: The recently created United Nations declared that the so called South West Africa had the right to self determination. This declaration was not recognized by South Africa.

3. The SWAPO Struggle for Independance

1950: A modern nationalist movement was developed in Namibian towns.

1960: SWAPO, the South West Africa People's Organization emerged from a movement which was for abolishing the contract labour system. SWAPO became multiethnic and eclipsed other movements.

1966: SWAPO launched the People's Liberation Army of Namibia (PLAN).

1966: The General Assembly of the United Nations decided to terminate the mandate of South Africa and ordered its withdrawal from Namibia.

1973: The United Nations General Assembly recognized SWAPO as the sole representative of the Namibian people.

4. The Long Negotiation

1976: The United Nations Security Council called for a national election in the territory under UN supervision. The permanent members of the Security Council: France, UK and USA, jointly with West Germany and Canada formed a group to negotiate with SWAPO and South Africa.

1978: The United Nations Security Council adopted Resolution 435 to provide for a ceasefire between SWAPO and South Africa, monitored by a United Nations Transition Assistance Group.

1981: The US government adopted an engagement mechanism to solve the problem of Cuban presence in Angola against the South African support of UNITA. The Namibian question was included in the negotiations.

1985: A transitional government was installesd by South Africa and it led to a polarization with SWAPO.

5. The Independence and the New Republic

1988: A formal protocol set 1989 as the year for starting the independance process according to Resolution 435, while providing for a progressive withdrawal of Cuba from Angola. The United Nations decided to send a peace force. The delay in the UN operation had tragic consequences with about 300 SWAPO soldiers dead by South African forces during demobilization.

1989: The interim government was dissolved and 43 000 Namibians returned home. SWAPO gained 57% of the popular votes casted in the election, while the main opposition party, the Democratic Turnhalle Alliance, ethnically based, obtained 29% of the votes.

1990: The government of the Republic of Namibia took office.

III. Some Relevant Economic and Social Indicators

A global overview of the economic and social situation of Namibia, shows the following main characteristics:

1. Gross domestic product (GDP) grew at an annual average of 3.5% in the past five years, while population increased at 3.1%, resulting in an increase of 0.4% per capita GDP per annum. Major forces, both positive and negative, behind the patterns of growth, have been: changes on the price of the mining output (17% of GDP); recent government growth; private sector investment and the ocurrence of drought.

   The following figures show the contribution of the main economic activities to GDP:

Subsistence agriculture	3% (constrained by arid climate and poor soils)
Commercial agriculture	7% (90% livestock and 10% of export earnings)
Mining	17%(Au, Zn, Sn, Ag, Cu, diamonds)
Fisheries	8.6% (exports of fish and its by products constitute 25% of export earnings)
Government	27%
Manufacture	10%

2. Exports (mainly mining products) amounted in 1994 to N$ 4.6 billion and imports to N$ 4.1 billion. The structure is:

Food, live animals, beverages and tobacco	998 million
Textiles, clothing and footware	255
Wood, paper and products, furniture	234
Mineral fuels and lubricants	510
Chemical, plastic and rubber	361
Metal and metal products	255

Machinery and electrical goods	488
Vehicles and transport equipment	722
All others	425

3. Imports of services amounted to N$ 1 675.6 million. The country is also a net exporter of capital. All Namibian investment institutions are subsidiaries of South African companies. Some steps have been taken to counter balance this situation. There is legislation requiring Namibian registered pension funds and insurance companies to invest 35% of their portfolio in the country.

4. Per capita income is nearly US$ 2 000, one of the largest in Africa. 5% of the population controls 72% of GDP. Human Development Index places Namibia in 108 th. place in the world. The top 7% of the population accounts for 40% of national consumption. Around 47% (117 000) of households are clasiffied as poor. Health indicators show low levels. HIV - AIDS, alcohol and drug abuse are among the top health problems. Social development is at the top of the political agenda of government.

5. Adult literacy is 77% and primary school enrollment is rising; it stands at 93%. accesibility to housing, land and water remain limited. 4 200 commercial farmers, mainly white, control around 44% of the national land area.

6. There is considerable shortage of skills in all areas. The employment situation shows a work force of about 550 000 people, distributed principally as follows:

General government	72 000
Trade	37 000
Construction	20 000
Manufacturing (except fishing)	13 000
Transport and communications	11 000
Social services	10 000
Finance and business services	10 000
Fishing	7 000
Fish processing	5 000
Total former employment	205 000
Commercial agricultre workers	37 000
Subsistence agriculture	150 000
Informal and unemployed	152 000

The structure of employment, specially among the senior and key managerial jobs is also important to note. In government, 41.9% of the latter jobs correspond to whites, 36% to black and 18.4 to coloured. In parastatals, 70.3% are whites, 15% blacks and 6.7% coloureds. As the job ladder descends, blacks start to occupy larger percentages of the structural distribution. In the lower scale of elementary occupations in government, blacks occupy 84.4% and whites 1.1%. The distribution is similar in parastatals.

While considering the job structure, it is important to note that an aspect of the poverty situation is related to the use of the fragile ecosystem, overgrazing and destruction of vegetation. They all constitute critical problems.

ANNEX B

HIGLIHGHTS OF VISITS, INTERVIEWS AND SELECTED INFORMATION

I. Education in Namibia

The country has given education a very high priority. After independance in 1990, the main thrust has been the creation of a new system which would contrast with pre independance apartheid, by providing vocational and skills training and the development of higher education. An important result of this eduactional effort has been an increase, since independance, of 90% of people entering the educational system. The present number of students in the formal educational sector has increased from 382 000 in 1990 to 474 000 in 1994, an annual growth of 5.5%.

One of the reasons behind this effort is to improve the opportunities for employment, specially for the younger age brackets, between 15 and 30 years, one of the largest unmemployed groups.

I.1. Professional Training, Vocational Centres and Alternative Education

There are 4 public colleges of education and 7 vocational training centres in the country. These were transfered for their administration to the MHEVTST by the Ministry of Basic Education and Ministry of Labour, when the former was created. A list with addresses of these institutions is given at the end of this Annex.

Previous to the creation of the vocational centres, training was very theoretical but now, there is a large effort to provide practice as well. Along this line, there are two types of training practices today:

(a) On the job training, consisting also of theoretical classes in the training centre;

(b) Full time in the training centre which have workshops and equipment and some short periods of stay at local industries.

It is neccessary 4 years for complete training but some institutions offer 1 year skill training as well. Some of the problems affecting the vocational centres, whose present enrollment is of 500 students are[1]:

(a) Lack of skills of the instructors: To fill gaps some foreign instructors are being hired. The low salaries offered to local instructors is one reason for this problem. It it should be mentioned that only by 1998, the first graduates will have completed their studies, therefore the full quality of training as well as the degree of absorption by the industry and other productive or service activities, can only be judged at that time;

[1] Enrollment in high school is of the order of 25 000 students.

(b) Attitudes between the centres and private industry. The latter have created their centres for distrust of the former;

(c) Salaries for technicians are low and thus there is little incentive for attending such institutions among the better students of primary levels. In general public attitude is of low esteem of technitians and in consecuence there is growing pressure on the universities for accepting more students; present enrollment of universities stands at around 5 000 (3 000 at UNAM and 2 000 at the Polytechic).

For alternative education, the Namibian College of Open Learning was established. In 1995, NAMCOL involved 6 500 persons for courses at secondary level. It is now considered the possibility of "education at distance" by radio broadcasting.

I.2. Higher Education

There are two institutions of higher education in Namibia, the University of Namibia and the Polytechnic. Altough based on previously existing educational institutions, they can be considered as created after independance.

UNAM has been offering a growing number of career opportunities but these are still centered in the social and human sciences. The natural science component is being developed. There are few research groups and funding is provided through a budget committee. There is some support from the United Nations University to specific programmes. There is a very optimistc view that its relations with the productive sector and governmemnt are well developed. The mission has in effect established some indications of such linkages but in general these are still very weak to produce important results of benefit to the productive sector (or to the University itself).

The Polytechnic was separated from UNAM to provide some technical and professional courses. As with UNAM, there is no engineering training at any level as yet. However, the institution has some basdic technical laboratories and on them, it is planning to start in 1997 with full fledged engineering courses. At present, the technical courses are given in: electric, electronic and computer science, civil and mechanical.

I.3. International Cooperation in Education

An importante partner of Namibia in the educational sector has been the European Union. Under a resolution of its Council of Ministers of December 1994, education and training are considered as key factors in ensuring long term development sustainability. Within such resolution and under the Lome IV Convention, 12.2 million ECUS (around N$ 60 million) have been allocated to education and training. These resources have gone into programmes which included: - mathematics and science education; - staff development in management planning and in service teacher training; - alternative education; - vocational training and youth skills; - primary and secondary schools facilities. The support included UNAM , NAMSEP, NIED, teachers associations and others. The effort to improve education in science and mathematics, because teaching in these areas was previoulsy neglected, has involved the In Service Training and Assistance for Namibian Teachers (INSTANT) with European cooperation. NAMCOL has

received some support from the British cooperation.

A new project has been proposed to execute a human resource development programme for possible funding by the European Union, the terms of reference of which are limited to planned activities within the Ministry of Basic Education and the MHEVTST.

II. Technology and Human Resources in the Productive Sectors

II.1. *Mining*

As is the case of all productive sectors, qualified human resources in mining are scarse, specially in institutions with tuition over the productive sectors such as the Ministry of Mines and Energy. The priority of Government is precisely to train Namibian people for working in qualified positions. Some enterprises, for example in the diamond and uranium sectors have sensibility for the government priority, but have yet to take action for hiring black Namibians to more executive posts. In time, as the latter become better qualified, enterprises will probably start hiring them.

The mining sector is key to the development of the country, not just for income generation but for employment as well. At present around 10 000 people is employed in the sector. The potential for expansion is high in diamonds, reasonable in uranium, depending on its price at world markets, and other minerals such as copper, zinc, lead and silver, whose prices are improving.

Mining is dominated by foreign companies. These could implement some efforts in the transformation of minerals such as processing of diamonds. All companies require expertise in mining, mineral processing and mining survey. At present they hire experts mainly from South Africa. There is no faculty of geology in the country.

II.2. *Agriculture and Livestock*

The physical conditions of the country make agriculture activities very difficult. The main problem is the lack of water. Underground water pumping is expensive and is not sustainable in the long run. Altough a large fraction of the population still lives in rural areas, these are not engaged in commercial agriculture. One of the key issues for rural development is precisely how to involve this large part of the population in productive activities while deterring it to migrate to the cities. Agroindustry or others should be then explored. The country exports some grapes, which are under strict phitosanitary controls. Dates are also of potential importance for exports.

At present the Brazilian firm EMBRAPA is cooperating in the area of agriculture. A team of 6 to 8 experts are in the ground for cooperation, which includes food production. Cooperation is addressed to look into diversification of food products, project design, technology development, specially post harvest lost and food technology for mango and horticulture.

The country lacks phitosanitary infrastructure. The Ministry for example does not have a laboratory and has a staff of only 3 people. One other area where expertise needs to be further built and enhanced is in drought management.

Cattle farming is a very important activity. Namibia is exporting meat to the European

markets under their zoosanitary standards. Ostrich farming is being developed for leather exports and holds opportunities of importance for the future. Because of the sectors importance, cattle deseases are kept under control and extensive research activities are carried out.

Cattlemen are starting cooperation with the University and a new curricula for agricultural teaching is being discussed. There are also some vocational colleges for agriculture providing training in several fields.

At present, there are unfilled positions in the institutions managed by the Ministry of Agriculture. This institution is looking fordward in cooperating with UNAM.

II.3. *Industry*

By 1990, only fish and meat processing constituted Namibias's manufacture effort of some importance. In the past five to six years further efforts have been made in other areas but still are in very embrionary stage. Today's main investments in the country are concentrated in mining, crude oil and gas field exploitation, and fishing.

The most important sector for employment generation is fisheries. The total investment in this activity has been N$ 1.1 billion in 3 years, generating around 10 000 jobs. Further, a government owned National Fishing Corporation (Fishcor) is to provide support to small fishing concerns. In April 1993 it acquired cheaply a Lüderitz-based company, from the two largest fishing companies, Namibia Sea Products (Mamsea) and Namibia Fishing Industries (Namfish), which are both Norwegian controlled. UNIDO has proposed that Fishcor manages an ambitiuos N$ 2 billion investment programme.

Opportunities exist for industrialization in sectors such:

- Millet milling
- Sugar mills
- Vegetable and fruit processing
- Textiles (karakul wool)
- Forestry products (not extensive)
- Natural fertilizers
- Metal works
- Some electric appliances
- Jewellery

Problems facing the realization of growth of these potential investments relate to:

- Market penetration
- Skilled manpower
- Input costs
- Management
- High cost of local capital finance

International assistance will still be needed to aliviate the problems related to management

and skills. Addressing problems will be crucial for the promotion of foreign investment. For the moment not many foreign investment proposals have materialzed into real projects. Nonetheless, some of them were effective enough to generate desirable spin-offs.

An early report on industrialization (Ministry of Trade and Industry, 1991) identified a large number of investment projects. Very few have taken place. Some might have not very realistic from market perspectives, others from local strengths or yet anothers because of technology not being easily available to Namibian investors.

Namibia manufacturing industry faces well known disadvantages: a small domestic market with limited purchasing power, distant export markets, need to import many inputs, competition (in occassions unfair) from much larger enterprises within the customs union, a labour force that does not compensate lack of skills and knowldege with low cost. It is also important to note the following characteristics of industrial management:

(a) Entrepreneurs which have started their own factories generally have no management training and no previous experience;

(b) New generations are becoming aware of the need of more formal training, but they are not generally aware as to the direction this new training might take place. Present training schools offer a very traditional curricula and thus do not contribute to clear this issue;

(c) Many companies still work under a very vertical type of management altough because of the national policy of reconcialiation, squemes exist by which there is more ample communication between managers and workers. This effect which was brought not by a management policy but for political reasons should have a lasting effect, and for that to hapen it is neccessary a longer term and deliberate programme of organizational development.

(d) Many managers are not specialized in the technical product of their firms, but are generalists or accountants.

The investment climate in industry should improve with the creation of the Namibia Development Corporation and the establishment of incentives, including the creation of a export processing zoner.

Chambers of Industry and Commerce are important vehicles for development of the sector. The Windhoek Chamber is the largest and the best organized of the provincial chambers. It has plenty of contacts with other countries. During the time of the mission it had signed an important agreement with the Paris Chamber of Commerce, which can be fully exploited for technology transfer, information and export purposes.

Enterprises need to understand that colaborating among them and providing information works for their benefit and not against them. In this context, The National Chamber is still in the process of strengthening its capabilities but has already contributed to te improvement of the development climate.

II.4. *Infrastructure: The Case of Telecommunications*

TELECOM Namibia is mobilising all its resources to obtain a modern and highly reliable telecommunication service. To this end, the enhancement of local, national and international infastructure, to improve customer service and strengthen its competitive edge, is continuing.

TELECOM is presently providing telephony, data and telex services including customer premises equipment to its customers, and is fully committed to developing its network. The telephony services are presently providing to approximately 72 000 customers, which is a penetration figure of about 5%. However, this capacity is mostly provided with obsolete electromechanical exchanges, which are unable to cope with the load.

The company's policy is to double the present customer base in the process of providing a modern technology network. With a new strategy on marketing and business development for a customer oriented company, this implies that the network should keep track and always be a step ahead of the demand in capacity and related developments.

The present strategy is to digitise the network through a carefully planned, step by step integrated approach, while constantly monitoring the:

- Technological developments and standarization
- Market demands and network traffic
- Economic and financial developments
- Development and strategy of competitors
- Development of regulations
- National development.

One of the critical strategic decisions taken was to implement and operate its own international communication facilities, achieved successfully in September of 1995, with the completion of the Standard "A" Satellite Earth Station and the International Switching Centre. The acquisition of this infrastructure at a cost of N$ 20 million has placed TELECOM Namibia in a favourable position to, as far as possible, set tariffs and operating policies more independently and thereby insuring better services to customers.

II.5. *Productive Activities: The Case of Uranium Mining*

The Rössing uranium deposit is situated some seventy kilometers east of Swakopmund. It was discovered in the late 1920's by Captain Peter Louw, a mineral prospector working in the Namib Desert, the oldest desert in the world.

It was only in the mid 1960's that a subsidiary of the Rio Tinto Zinc Corporation took an option on the prospcet and began a long promgramme of geophysical and geological surveys, drilling and evaluation. The orebody was found to be an enormous deposit of low grade uranium embedded in tough, abrasive granite known as alaskite. In 1973, it was decided to go ahead with the mining of the orebody and when the operation came into full-scale production in 1979, it was the largest uranium mine in the world.

Due to the enormous costos involved in establishing a modern mine, and the advanced technology that is needed to sustain it, maining development is commonly conducted as a joint venture with other companies. Rössing Uranium Limited was thus founded in 19790 with RTZ as the largest shareholders. It currently owns 68,47% of Rössing's equity.

The first stage of recovery is the continuous ion exchange process. In it, millions of tiny ressin beads are suspended in the uranium solution. The beads absorb uranium from the solution, and in the next step it is stripped from the beads. The solution from this process is pumped to a solvent extraction plant. Here, similar concentration and purification process occurs but this time the uranium is extracted into an organic solvent. The solvent is stripped of its uranium and gaseous ammonia is added to the resulting solution, causing a precipitate of ammonium diuranate or yellow cake. This is dried and roasted at temperatures in excess of 600° to produce Rössing's final product, uranium oxide (U_3O_8), which is packed into steel drums ready for delivery to the company's customers.

Where uranium occurs there will be higher radioactivity. An Environmental Health Section continously monitors radiation and dust, sepage, gaseous emission and noise levels. Standards have been set, and are mantained, well inside those stipulated by the International Commission on radiological Protection and other recognized bodies.

The Rösing mine is currently operating with a manpower of approximately 1 200 employees of whom 91% are Namibian citizens. The company, however, permanently demands professionals in engineering, metalurgy and geology, thus, it is enthusiastic with the idea of linking the university to its concrete problems. This is one of the reasons why the Mission was invited to visit the mine. This visit, gave a broad idea of the technology that is involved in this activity. At present, the company has 53 engineers of whom 33 are Namibians.

In 1987 the company signed a recognition agreement with the Mineworkers Union of Namibia. Of the total, about 70% are members of this union. Officials of both the union and the mine meet on a regular basis to discuss and negotiate matters of mutual interest. Also, the Rössing Foundation was created by the company to: "further the practical education of Namibians in order to achieve greater national productivity".

Due to a deterioration in the international uranium market, resulting partly from more efficient use of energy and partly from large-scale sales of uranium at exceptionally low prices by forner Eastern bloc countries, Rössing is currently operating at a little above half its installed capacity. In spite of this, its production represents 9% of the western world production.

III. The Research and Services Institutes of Science and Technology

III.1. *The Geological Survey*

The Geological Survey is one of the country's most advanced research and service

institution in the public sector. It has 8 professionals[2] and in general finds it difficult to recruit black Namibians because they had little scientific education in the past. It holds working relations with European countries, in particular, Germany.

The growth potential of the Geological Survey is important. Today, however, in spite of Namibia's rich mining grounds, there is an over supply of minerals in the world, which difficults further exploration and investment. This is to be contrasted with the oil potential, which is being explored by several companies.

The infrastructure is very modern. Its building and laboratories are at world level, having new equipment, computer scanning system. Some improvement maybe neccessary in the laboratories such as the chemical one, but in general the Survey has all it needs for its work.

Main capacities are in the production of geological maps. Also there is capacity to develop software. It uses local companies for computer maintenance, with Namibian technitians

III.2. *The Central Veterinary Laboratory*

The operation of this Laboratory is vital to one of the country's most important products. The result of its work can be judget from the fact that cattle deseases are well under control. It follows international standards in quality control for exports. The Laboratory is leader in Africa in its field. The work in the laboratory is complemented with measures such as the existance of a "red line" near the Angolan border to bar other cattle to come further south.

About 90% of the work done in the laboratory is addresed to commercial farmers. These pay only some of the services. There is also a network of veterinarian centres linked to it.

The staff comprises 14 technitians, 6 assistants and 6 scientists with PhD and MSc degrees. They have graduated in schools in Germany, the United States, Great Britain, Cuba and South Africa. The latter group has a modern molecular laboratory at its disposal and results of research are published in the best international journals.

The Laboratory has an important potential to be transformed into a full fledged national institution/agriculture centre. Should this step be taken it could link better with the University and thus overcome the fact that training at the higher eduaction institution is not so good for scientists as these need more experimental work.

III.3. *The National Marine Information and Research Centre*

This Centre was created by funds collected from proceeds of the fishing industry. It has modern well equiped laboratories. The results of its work are applied to support fishery and they include sea biology and processing of satellite information. The Centre has a staff of 22

[2] Out of about 80 geologist and mining engineers in the country. Others can be found in the Ministry of Mines and Energy (10) and private companies.

biologists, from which 5 hold MSc and 2 PhD degrees, most graduated from South African and European schools.

III. 4. *The Namibian Institute of Mining and Technology in Arandis*

It is quite impressive to arrive to the Arandis airport, near the Rössing uranium mine in the middle of the dessert, after flying from Windhoek, and finding there the modern building of the Institute. It was established by Rössing as its contribution to the built up of the country after independance.

It is today recognized that a technical institution naturally benefits from having the long term support of a major company. Locating it near the company enables an important interaction between the two, particularly regarding the provision of practical training.

The Institute is well equiped, with workshops, for training middle level technitians in several professional skills. It holds an important potential as the demand in the country is still growing for artisans, technitians and suprevisors in the mining, metallurgy, geology and engineering disciplines. This potential is further enhanced with the need to train black Namibians so they can take up many more skilled jobs.

With the relatively few numbers of more technical graduates required in industry, it is unlikely that the country could support graduate higher education in the mineral extraction disciplines. It is here that a gap is perceived in the education facilities within the country, which needs to be bridged for the benefit of the mining, engineering and other industries.

The Institute offers classes to both full time and day-release students, the latter being mainly Rössing employees and Arandis, Swakopmund and Walvis Bay residents. Itsmain objective, as mentioned above, is to equip Namibians with the skills that will enable them to take up positions within the mining and engineering industries. Training is presntly provided for:

- Fitting and Turning (including Machining)
- Boilermaking/Plating
- Diesel Machines
- Auto mechanics
- Welding
- Electrical
- Instrumention

Theoretical studies are complemnented by courses in mathematics, engineering science, drawing, industrial electronics and applied trade theory. All training takes the two modalities of apprenticeship or skills training.

The Institute is managed by a Director appointed by the Board of Governors who is responsible for both academic and financaial performance. It is envisaged that the Institute will be partly self financed for both capital and operational costs, obtainig funds from tuition and

residential fees, central government and private support and other benefactors. For this purpose a Trust, known as the "Namibian Institute of Mininig and Technology" has ben created.

In Arandis, there exists a town with good infrastructure and sporting and other recreational activities. The existing schools in the town are of good standard and already attract puplis from other areas of the country.

COLLEGES OF EDUCATION

1. CAPRIVI COLLEGE OF EDUCATION
   PRIVATE BAG 1096
   TEL.: 0677 - 3422
   FAX : 0677 - 3422

2. RUNDU COLLEGE OF EDUCATION
   PRIVATE BAG 88
   TEL.: 0671 - 55699
   FAX : 0671 - 55564

3. ONGWEDIVA COLLEGE OF EDUCATION
   PRIVATE BAG X5507
   TEL.: 06751 - 30001
   FAX : 06751 - 30006

4. WINDHOEK COLLEGE OF EDUCATION
   PRIVATE BAG 13317
   TEL.: 061 - 211228
   FAX : 061 - 212169

VOCATIONAL TRAINING CENTRES

1. ARANDIS SKILLS TRAINING CENTRE
   P.O.BOX 376
   TEL.: 064 - 510276
   FAX : 064 - 510309

2. RUNDU VOCATIONAL TRAINING CENTRE
   PRIVATE BAG 2081
   TEL.: 0671 - 55211
   FAX : 0671 - 55702

3. ZAMBESI VOCATIONAL TRAINING CENTRE
   PRIVATE BAG 1064
   TEL.: 0677 - 3264
   FAX : 0677 - 3760

4. VALOMBOLA VOCATIONAL TRAINING CENTRE
   PRIVATE BAG X5516
   TEL.: 06751 - 30033
   FAX : 06751 - 30277

5. WINDHOEK VOCATIONAL TRAINING CENTRE
   PRIVATE BAG 13334
   TEL.: 061 - 211742

FAX : 061 - 212379

6. KAI//GANXAB SKILLS TRAINING CENTRE
TEL.: 0611 - 808
FAX : 0661 - 2511

7. OKAKARARA VOCATIONAL TRAINING CENTRE
PRIVATE BAG 2112
TEL.: 06522 - 62
FAX : 06522 - 69

ANNEX C

PERSONS INTERVIEWED AND INSTITUTIONS VISITED DURING MISSION

(Phone Country code 264, Windhoek code 61)

1 Mr. Abdool Sattar Aboobakar, Chief Executive Officer
Offshore Development Company
Ministry of Trade Bldg.
Private Bag 13397, Windhoek
Phone 239 032; Fax: 231 001

2. Mr. Stephen Adei, Resident Coordinator of the UN System in Namibia and Resident Representative of the United Nations Development Programme
Salam Centre, 154 Independance Avenue, Windhoek
Phone: 200 1210; Fax: 229 084

3. H. Nahas Angula, Minister of Higher Education, Vocational Training, Science and Technology

4. Mr. P.H. Bezuidenhout
Manager, Corporate Business Development
Namibia development Corporation
Private Bag 13252, Windhoek
Phone 206 911; Fax: 233 943

5. Mr. de Clerk, Ministry of Agriculture, Water and Rural Development

6. Mr. C. Finjap Njinga, Director
United Nations Information Center
Private Bag 13351, Windhoek
Phone. 233 034; Fax: 233 0366

7. Mr. Sam Geiseb, Bureau Director
Technology Information Programme Service TIPS
National Chamber of Comerce and Industry
PO Box 9355, Windhoek
Phone 228 809; Fax: 228 009

8. Mr. C.E.F. Havemann, Senior Manager
Rolling Stock, TRANSNAMIB Rail
Private Bag 13204, WWindhoek
Phone: 298 2022; Fax: 298 2288

9. Mr. Vetira Hijamita, Chief Economist
Investment Centre
Ministry of Trade and industry

Private Bag 13340, Windhoek
Phone: 283 7111; Fax: 220 278

10. Mr. Chris Hoveka, Director Research Department of the Bank of Namibia
3rd Floor, Capital Centre
Independance Ave. Windhoek
PO Box 2882, Windhoek
Phone: 22 4067; Fax: 23 4862

11. Mr. Ken Kwaku, Advisor to the Minister
Ministry of Trade and Industry
Government New Developmentr, Block B
Private Bag 13340, Windhoek
Phone: 283 7111; Fax: 220 148

12. Mr. Willem Kruger
Civil Engineering Department, Polytechnic of Namibia

13. Mr. Festus Lameck, Human Resources manager
SWAWEK, SWAWK Centre
PO Box 2864, Windhoek
Phone: 205 2323; Fax: 232 805

14. Ms. Carrie Marias, Subregional Advisor for Social and Human Sciences in Southern Africa
UNESCO
Private Bag 24519, Windhoek
Phone: 200 2140; Fax: 223 651

15. Mrs. Mayne
Namibian Diamond Mining co.
CDM Building, Windhoek

16. Mr. S. Motinga, Director
Industrial Development
Ministry of Trade and Industry
Private Bag 13340, Windhoek
Phone: 283 7111; Fax: 220 227

17. Prof. Mshigeni, Pro Vice Chancelor, University of Namibia
Private Bag 13301, Windhoek
Phone: 206 3934; Fax: 206 3936
e-mail: keto@pvc.unam.na

18. Mr. Asser Mudhika, Deputy Director, Mining Directorate
Ministry of Mines and Energy
Trust Center Building

Independance Avenue
Private Bag 13297, Windhoek
Phone: 226 571; Fax: 238 643

19. Ms. Gida Nakazibwe-Sekandi Head of Corporate Affairs
Rossing Uranium Limited
Sanlam Centre
Independence Avenue
PO Box 22391, Windhoek
Phone: 236 760; Fax: 228 147
e-mail 100076.3721@compuserve.com

20. Mr. Immanuel Nambahu, Ministry of Higher Education, Vocational Training, Science and Technology
Phone 453 670

21. Mr. C.S. Narula, Advisor
Ministry of Trade and Development
PO Box 13340, Windoek
Phone: 283 7349; Fax: 243 065

22. Mr. Hafeni Nghinamwwami, Head Corporate Affairs
Namibia National Chamber of Commerce and Industry
PO Box 9355, Windhoek
Phone: 222 8809; Fax: 228 009

23. Mr. David Nuyoma, Manager
Small Enterprise Development
Namibia Development Corporation
Private Bag 13252, Windhoek
Phone 206 911; Fax: 233 943

24. Mr. Tim D. Parkhouse, General Manager
Windhoek Chamber of Commerce and Industries
PO Box 191, Windhoek
315 SWA Building Soc. Bldg., 7 Post Street Mall
Phone: 222 000; 221 078; Fax: 61 233 690

25. Mrs. Schneider, Geological Survey

26. Mr. Schutte, Registrar of Patents
Ministry of Trade and Industry

27. Mr. Attie Stadler, Technical Manager
TRANSNAMIB Rail
Private Bag 13204, WWindhoek

Phone: 298 2200; Fax: 226 226

28. Ms. Monika Steinlechner, Programme Officer
United Nations Development Programme
Sanlam Centre, 154 Independance Ave., Windhoek
Phone: 200 1150; Fax: 229084

29. Mr. Blackie Swartz, Branch Manager
Financial Advisory Service
SANLAM
Private Bag 13368, Windhoek
Phone: 221 788; Fax: 225 082

30. Dr. Kuiri Tjipangandjara, Multidisciplinary Research Center, University of Namibia
Phone 206 3690

31. Dr. Tkivikua, Rector
Polytechnic of Namibia

32. Ms. Anne Schoun, United Nations Development Programme

33. Mr. Pieter Wasserfall
Electric Engieneering School, Polytechnic of Namibia
Phone: 207 2330

A visit to the city of Ohkahandja and the village of Avitoto (about 140 km from Windhoek) and the sorrounding country side was carried out on Saturday 8, in order to provide an overview of the climatic, social and economic environment of the country. A visiti to the ARANDA uranium mine deposit and the Marine Research Center in Swakopmund was carried out on Tuesday 11.

ANNEX D

WORKSHOP ON SCIENCE AND TECHNOLOGY POLICY
(Windhoek, June 13, 1996)

Conducted by:

Carlos Aguirre Bastos
Luis Pinguelli Rosa
Kadress Vencatachellum

Organized by:

Ministry of Higher Education, Vocational Training, Science and Technology
(Coordinator: Mr. Nambahu)

The Seminar was conducted between 09:00 am and 12:30 pm, and was divided into the following parts:

09:00 - 09:30:	K. Vencatachellum. The role and experiences of UNIDO in science and technology policy and implementation.
09:30 - 10:00:	C. Aguirre. Science, technology and innovation: their role in sustainable development. Some policy issues in Namibia; the creation of an institutional framework and the implementation of a short term plan of action.
10:00 - 10:30:	L. P. Rosa. An external view of the situation of the Namibian S&T system. Experiences in the linkages between university and productive sectors.
10:30 - 10:45:	Break
10:45 - 12:30:	Discussion

1. Objective and Structure of the Workshop

The Workshop on science and technology policy was held on June 13. It was attended by around 35 professionals from government, universities, research centers, enterprises both public and private. The Minister of the MHEVTST and the Permanent Secretary of the Ministry also attended. The former inaugurated the event. A full list of the participants has been compiled by the Ministry, who will also prepare the formal Minutes.

The main purpose of the Workshop was to discuss the preliminary findings of the Mission and discuss some of proposals for action. Mr. Vencatachellum from UNIDO, presented the organization's programmes with emphasis of those being carried out in Africa. He also provided the necessary background information on the science and technology component of the programme in Namibia and the justification for the Mission.

2. Contents

The main contents discussed by C. Aguirre were:

1. Definitions. Science, technology and innovation. Actors involved. The need to build up a common language and to define appropriate policies, instruments and define projects. The purpose of this introduction was to initiate the development of a common language in science, technology and innovation.

2. How does S&T and innovation contribute to economy. The causality relationships in a development model - strategy. The contribution of competitive capacities for sustainable development. A model of causal relationships to help clarify the situation and role of S&T in a development process was amply discussed. The understanding of this role is key to the formulation of policies and particularly in the understanding on the potentials and limitations of S&T in sustainable development.

3. The "innovation system"/"the science and technology system". The situation of the systems in Namibia.

4. The role of public policy and policy issues for Namibia

5. An institutional arrangement for Namibia

6. Short term action plan for Namibia: project design, costs and implementation.

Mr. Rosa presented a detailed view of the situation of the Namibian S&T System and also discussed at length the experiences in the linkages bewteen university and productive sectors.

He further discussed the theoretical approach to the development of an action-oriented programme for science and technology and proposed as the way of examples, a set of specific projects that could be undertaken iun the short term.

The evaluation of the Workshop was made by the participants. They pointed out that it served to clarify many ideas, develop some new concepts and allowed the realistic definition of future courses of action under an integrated institutional framework. The Workshop was highly valued by the Ministry's authorities, including the Minister and the Permanent Secretary.

ANNEX E

THEORETICAL APPROACHES TO DEVELOPMENT

I. Causal Deterministic Approach

A theoretical approach to development can consider two cases:
- A Causal Deterministic Approach

- A Complex System

In the first case, it is possible to start from the linear deterministic system of mathematics, where there are 4 variables, x_i, x_2, x_3 and x_4 and 4 equations to relate them. It is then possible in principle to solve the problem:

$$y_i = f_i (x_i, x_2, x_3, x_4) \quad i = 1,2,3,4$$

The mataphore adopted in Chapter III provides the following variables:

x_i - modernization
x_2 - education
x_3 - jobs
x_4 - income distribution

and the functions are:

f_1 - natural resources explotation and agriculture
f_2 - infrastructure facilities
f_3 - private dynamics
f_4 - government role

These four functions in the linear approach can be represented by the coefficients a_{ij}, i = 1 to 4, j = 1 to 4:

$$y_1 = a_{11} x_1 + a_{12} x_2 \ldots\ldots + a_{14} x_4$$

$$y_2 = a_{21} x_1 + \ldots\ldots\ldots\ldots + a_{24} x_4$$

$$y_3 = a_{31} x_1 + \ldots\ldots\ldots\ldots + a_{34} x_4$$

$$y_4 = a_{41} x_1 + \ldots\ldots\ldots\ldots + a_{44} x_4$$

The above relations can be interpreted as a matrix of transformation A acting as an operator on a vector x, formed by the present variables x_i, ... x_4, to transform them in y_1 ..., y_4, expressed by a new vector y

$$A: x \text{ -- } y = Ax$$

It should be possible to accomplish a considerable effort to try to establish the matrix A from data on the contribution of natural resource explotation, infrastructure, private sector amd government involvement, to expand the modern market (modernization), education, job and income distribution.

However, the result could be limited by available data and model dependence, and as time is involved a forecast of the future behaviour of the coefficients would have to be made.

A simpler way to deal with te problem is to consider only the dominant relationships between x_i and y_j, by constructing a matrix in which the coefficient is 1 for the strong relations and zero for the weak ones (see figure 2 in Chapter III)

		Modern x_1	Education x_2	Job x_3	Income x_4
Natural resources	f_1	0	0	1	1
Infrastructure	f_2	1	0	0	1
Private Dynamics	f_3	1	0	1	0
Government	f_4	0	1	0	1

The obvious meaning of this matrix is that:

(a) Natural resource exploitation is more related to job and income distribution;

(b) Infrastructre is more related to modernization and income distribution (through household electricity, water supply, class subsidies, etc);

(c) Modern dynamics of the private sector is more related to modernization and jobs;

(d) Government is more related to education and income distribution (through taxes and social actions).

As Figure 2 of Chapter III shows, the problem is complex even without considering the interactions among government and different sectors of the economy. The issue is then how to use the above conclusions to define actions?

II. Complex System

At this stage complex system theory must be considered. Deterministic models are too limited. These have arisen from classical mechanics, developed since the XVII century and economic models based on neoclassical theory in the XIX century. These provide only one path that comes from the past to the present and to the future, what seems not very appropriate to describe any social process.

On the other hand, uncertainty has been introduced in physical theory in the statistical thermodynamics of the XIX century. It became fundamental in the quantum mechanics developed in the XX century. However it is in the context of classical mechanics that modern chaos theory has been developed. Non linear systems frequently exhibit high sensibility to present conditions. Small changes in the present can produce very big effect in the long term.

Complex systems are in the edge of chaos, in the border line between chaos and regularity. They have many components and interactions and they can form organic systems much as biological structures do. It allows for the emergence of new structures which are not well predictable. The distinguished biologist S. Kauffman [1995] has structured a book in which he puts forward the conjecture that this theory can be applied to both the economy and society.

The application of complex system theory to science and technology diffusion has not been considered in depth here. What has been considered in the case of the Namibian situation as a simple game, as shown in Figure 1 of this Annex. The balls (M,E,J,I) represent the variables modernization, education, job generation and income distribution, respectively. The boxes (N,S,P,G) represent natural resources, infrastructure, private modern sector and government respectively. Market economy runs with strong interaction betwen N, S and P, but without enough employment generation, income distribution, expansion of modern sector. Government is the triggering switch. The game is: how to move the system to take poor people out of the square of poverty through income distribution. The possible solutions are shown in the same figure, where positive feedbacks are generated to assure the sustainability of the process.

ANNEX F

DRAFT PROPOSAL FOR AN ACT BY THE NATIONAL ASSEMBLY ESTABLISHING THE NATIONAL SYSTEM OF SCIENCE AND TECHNOLOGY

Title: **ESTABLISHMENT OF THE NATIONAL SYSTEM FOR SCIENCE AND TECHNOLOGY**

BE IT ENACTED by the National Assembly of the Republic of Namibia

PART I
THE NATIONAL SYSTEM OF SCIENCE AND TECHNOLOGY

1. The Government recognizes that the development of science and technology constitute a national priority as it conditions the economic, social, political and cultural development of the Nation. The Government is a privileged actor of such development and an effective progress in these areas can only be achieved as a result of a concerted effort with all the components of a national system of science and technology.

2. The National System of Science and Technology is defined as the set of persons and institutions in both the private and public sectors, which are dedicated to generate, develop, diffuse, intermediate, transfer and apply scientific and technological knowledge.

3. The principal executive organs of the National System of Science and Technology are:

   a) The National Action Board (or National Council) of Science and Technology;
   b) The Regional Action Boards of Science and Technology;
   c) The Executive Secretariat of the National Action Board;
   d) The National Fund for Science and Technology.

PART II
THE NATIONAL ACTION BOARD FOR SCIENCE AND TECHNOLOGY

4. The National Action Board for Science and Technology is the main organ of the System. It operates under the Prime Minister's Office and has the following functions:

   a) Promote and guide the development of science, technology and innovation;
   b) Propose and adopt policies, strategies and programmes for the development of science, technology and innovation;
   c) Coordinate the activities of the executive organs of the National System of Science and Technology and its components.

5. For the purposes of achieving its functions, the Board will:

   a) Implement policy decisions and the strategies leading to the generation,

development, diffusion, intermediation, transference and application of scientific and technological knowledge;

b) Provide guidelines for the development of regional or sectorial plans and projects and facilitate their coordination and execution;
c) Create institutional networks, working groups, committees and commissions which are considered necessary to acheive policy and strategic goals;
d) Define the policies and operational mechanisms of the National Research Fund;
e) Contribute to the definition of policies of international cooperation and define the modalities of use of international funds specifically addressed to science, technology and innovation;
f) Contribute to the definition of external relations of the country which have a science and technology component;
g) Delegate in the institutions and organizations of the National System for Science and Technology the execution of specific tasks and coordinating activities;
h) Prepare and propose legal and other operative projects necessary for the development and strengthening of the National System of Science and Technology;
i) Promote and support the training of high level human resources for science and technology

6. The National Action Board for Science and Technology will be constituted by:

a) The Prime Minister of the Republic of Namibia, as its Chairman;
b) The Minister of Higher Education, Vocational Training, Science and Technology, who will act as the Board's Secretary;
c) The Minister of Finance;
d) The Director of the National Planning Commission;
e) The President of the National Chamber of Commerce and Industry;
f) The Chairman of the Joint Consultative Committe for the Small and Medium Enterprise;
g) A Representative of the Regional Boards for Science and Technology;
h) The General Manager of the National Research Fund (a non-voting member of the Board)

When the agenda of the Board calls for the discussion of specific issues that merit the participation of other ministries, the respective Minister will participate in the Board as a Member, with all rights and privileges of the permanent members.

PART III
THE REGIONAL ACTION BOARDS FOR SCIENCE AND TECHNOLOGY

7. In each region of the country there shall be a Regional Action Board for Science and Technology. These will have an autonomous character within the National System of Science and Technology and will be in charge of guiding, promoting and executing, science, technology and innovation activities, taking into account the national policies and

strategies. The structure of each Board will vary according to the characteristics of each Region. They will be constituted by institutions of the private and public sector.

8. The creation and initial structure of the Regional Action Boards will be suggested by the National Action Board and the President of the Republic will appoint each one of the Chairmen/women, for a period which will be determined in a specifc regulation to be approved by the National Action Board. Such regulation will also indicate the financial arrangements for the operation of each of the Regional Action Boards.

9. The Regional Action Boards will meet at a national level at least once a year at a meeting presided by the Prime Minister of the Republic. The modalities and objectives of the meeting will be set out in the specific regulation. The meeting will elect the Regional Action Board which will represent the other regions in the National Action Board.

PART IV
THE SECTORIAL (STANDING) COMMITTEES FOR SCIENCE AND TECHNOLOGY

10. In application of the policies and strategies adopted by the National Action Board, there shall exist Sectorial Committees composed of researchers representatives of public or private research institutions and enterprises and government.

11. Each Committee will be organized by the National Action Board, and its main function will be to propose sectorial policies to be integrated into the national policy; strategies, programmes and projects. The Committees will support the coordinating function of the National Action Board.

12. The operative budgets of the Committees will be provided by the institutions participating in them with a small contribution from the National Board.

PART V
THE EXECUTIVE SECRETARIAT OF THE NATIONAL ACTION BOARD

13. The Ministry of Higher Education, Vocational Training, Science and Technology will act as the Executive Secretariat of the National Action Board. In that character, its functions will be to:

a) Execute the resolutions of the National Action Board;
b) Propose to the National Action Board general policy guidelines, programmes and projects for science, technology and innovation and identify the executing institutions and financing sources;
c) Propose to the National Action Board participation in regional and international development and cooperation projects, identify financing requirements as well as the executing institutions.
d) Coordinate the National Action Board's operations with the Regional Boards, the

Sectorial (Standing) Committees and other components of the National System for Science and Technology;

e) Prepare the National Action Board's budget proposal which will be integrated into the budget of the Ministry of Higher Education, Vocational Training, Science and Technology after the Board's approval;

f) Receive proposal for action from the Sectorial (standing) Committees and transfer them to the National Action Board for approval.

14. The Ministry of Higher Education, Vocational Training, Science and Technology will accomodate its internal structure to fully provide the National Action Board with the appropriate supports as its Secretariat.

PART VI
THE FINANCIAL MECHANISMS FOR SCIENCE AND TECHNOLOGY

15. There shall be created a National Research Fund, destined to promote scientific and technological research, by providing capital resources to projects which contribute effectively to the advancement of knowledge and its application for economic and social improvement. The Fund's operative mechanisms will be determined by specific regulations approved by the National Action Board. The Fund's resources shall be provided by the National Treasury and other donations.

16. There shall exist a network of institutions, both public and private, which have the potentials to provide capital resources to technology development and innovation projects and for the creation of technology-based enterprises.

17. The National Research Fund will be constituted by a Board. A General Manager will be appointed for the Fund by the President of the Republic. Other functions and modalities of operation of the National Fund will be set in a specific regulation to be approved by the National Action Board.

18. The Minister of Higher Education, Vocational Training, Science and Technology will Chair the Board of the National Research Fund.

PART VII
TRANSITORY PROVISIONS

19. At the time of adoption of this Act, and under provision 10, the following Sectorial (Standing) Committees are created:

a) Committee for Higher Education and Research, to oversee the creation of a research environment within the University of Namibia, the Polytechnic and other institutions of higher learning and establishing an engineering base;

b) Committee for Information Development, in charge of establishing a non-centralized information network and identifying specific projects to strengthen and

create effective information services;

c) Committee for Technology Transfer, in charge of overseing the approval of the Patent and Trademark Act by the National Assembly and contributing to the strengthening of the Registry of Patents and the enforcement of the copyright laws and other instruments of protection of intellectual property and technology transfer;

d) Committee on Financing, in charge of defining the financial mechanisms as set out under provisions 15 and 16. The Committee will have the participation of the public and private sector.

e) Committee of Standards, in charge of supporting the development of standards, quality control schemes and metrology.

ANNEX G

SMALL AND MEDIUM SIZE ENTERPRISES (SMEs)

I. General Overview

One important avenue for development of the productive sector in the country and the generation of employment is the growth of SMEs. Several studies have examined their situation and produced recommendations, some having been implemented. This Annex highlights those which can provide inputs to the definition and implementation of S&T policies. The two main studies from where this recomendations are drawn have been prepared by ILO (1993) and by the Commonwealth Secretariat (1994).

SMEs is one the largest sector of employment in Namibia but its share in the GDP is very low. SMEs in the industrial activities constitute only between 5-10% of the total, the rest being in retail trade (around 50-60%), catering (20-30%), repair and other personal services (10-15%). The sector faces major constraints arising from structural problems, in particular, they face difficulties in accessing markets and resources. The policy environment has been improving in the past year.

Some of the more specific problems faced by SMEs, which severly constraints their growth and which permits them simply to operate at subsistence levels for survival purposes are:

a) The main sectors of the economy are more suited for large businesses;
b) Key sectors are connected to suppliers and/or markets outside the country making internal linkages difficult;;
c) Competition from stronger and more developed industries in RSA, which provides incentives and subsidies to its firms;
d) The purchasing power in the country being concentrated in hands of a small part of the population and therefore there is very little or no market for SMEs production.
e) Little or no savings, hence insufficient and inadequate investment capital;
f) Lack of basic infastructure; and
g) Acute shortage of skilled labour.

On the other hand, SMEs face major problems in securing finance, marketing, sourcing, technology, entrepreneurship and training.

For years, there has been a large number of institutions involved in the development of SMEs, leading to duplication of efforts, lack of clear accountability for performance and ineffective support for their growth. Also, the skills available for providing training and support has been low. These problems have been addressed, in part, by the establishment, on April 1995, of the Joint Consultative Committe (JCC), an umbrella organization made up of 28 NGOs and parastatals under the leadership of the NDC.

JCC's main objective is to establish and advocate a synergetic institutional framework in a coordinated effort through effective networking to foster cooperation and communication. It is also addressed to share experiences and when possible allocate responsabilities between

stakeholders with the view of maximizing the effectiveness of the utiization of their respective competences. JCC, which tries to expand its membership base to all promoters of SMEs in Namibia, should also act as an advocacy group to advance an appropriate enabling framework in which SMEs can operate and grow and, in particular, in modifying legal provisions.

It is important to note one of the key conclusions of the Report by the Commonwealth Secretariat is that the small formal sector will have to play an important role in economic development whilst the informal sector will have to play the crucial role of providing income and employment to an increasing proportion of the workforce. This is particularly important for science and technology policy as it will have to consider both sectors in a rather independent way, in particular, providing means and incentives to create opportunities for small firms which can dedicate their efforts to manufacturing and to become suppliers of larger firms and the informal sector, which in a more gradual manner should become part of the formal sector in the medium term.

In Namibia, opportunities for small and medium size firms stem from various factors:

a) Lower overheads and greater flexibility
b) Present structure with a small number of small firms than medium and larger. Establishing small businesses could susbtantially deepen the manufacturing base;
c) Small manufacturing businesses are more labour intensive than larger businesses

It should also be considered that small firms can be developed in sectors such as mining and construction, and further many related to the more recent developments in the fisheries industries.

As already noted in the Report of the Commonwealth Secretariat, the success of small business development will depend on achieveing three linked objectives:

a) Capturing a higher proportion of the expenditure of the formal sector - business and consumer expenditure - to establish new business and increase output, while at the same time improve sector linkages;

b) Competing successfully against business in South Africa in processing local raw materials into finished products and supplying Namibian business and consumers;

The strategy will include the identification of new opportunities. One of such opportunities lies in the fact that South African industry is structured for a larger market and use technology developed for the 70's. The country's business are only protected because of high tariff barriers.

c) Reducing the competitive disadvantage faced by the informal sector in terms of access to inputs and markets so that it can meet consumer needs in the black part of Namibia's economy more effectively and start to capture a part of the expenditure of "white" Namibia.

From the technology perspective, if Namibia can harness new technology that is today available and develop a modern structure of manufacturing which links large business to small suppliers, it can challenge imports, especially from South Africa.

II. Policy initiatives

Several policy initiatives have been suggested by the previous studies. A very important one is that any policy to be adopted should give priority to the creation and strengthening of manufacturing SMEs. Other recommendations have been to:

a) Investigate ways of implementing an effective competition policy using either existing legislation of the introduction of new legislation.

b) Evaluate how far and for which industries, existing provisions within SACU could be used to provide infant industries protection for Namibian industry.

c) Effect the deregulation of trade licensing, health, safety and zoning regulations, hotels, tourism, liquor and transport applications.

d) Amend laws affecting the ownership and disposal of property by women and the opening and closing of bank accounts without consent of husbands.

e) Raising the threshold for registration with the Receiver of Revenue to a larger figure than at present, to granting 5 years' tax exemption to newly registered businesses and provide 50% of the cost of capital to new small manufacturing firms located in communal areas.

Both mentioned Reports have recommended the design and implementation of several programmes dealing with: informal markets, vendor development, finance sourcing, sites and premises and also an appropriate institutional structure.

In the case of technology, the Reports point out "to improve the knowledge and familiarity with technology and to start to access the types of technology that would provide small firms with a competitive edge a technology demonstration center should be created, complemented with regional centers for business purposes; and also sell plant and equipment to entrepreneurs and revolve funds to acquire further new technology."

Other suggested policy initiatives include include access to credit and other financial services. Informal finance organizations are under developed and access to formal financial institutions' credit is near impossible and aggravated by limited branch network. Experiences have failed due to poor recovery rates, due in turn partly to NGO's lack of capacity to assess risks, administer loan schemes, etc.

For long term sustainability of various initiatives and programmes, it is important not only to design and implement appropriate entrepreneurship and skills training programmes but also to incorporate these into formal and non formal training and educational schemes, through a) the strengthening capacity of NGOs through training of trainers' programmes and b) setting up procedures for hands-on training.

ANNEX H

THE POPULAR PARTICIPATION LAW OF BOLIVIA

In April 1994, the Law of Popular Participation was adopted. Because of its reach and content, it constitutes in Bolivia, one of the key instruments of social and economic change. In its application, public resources are distributed proportionally according to the population that inhabits a municipality. 308 autonomous municipalities have been created, all of equal hierarchy, including urban and rural dwellers. It is difficult to conceive a decentralization mechanism of such depth where the municipal regime, because of its characteristics becomes the public administrator nearer to the needs of the society.

Around 20% of the financial resources which were previously used to support the centralized burocracy have been transfered to the municipalities. This represented around 33 million US dollars in 1994 and 70 million in 1995. Most of them were receiving such resources for the first time in their history. Each municipal government has a bank account and resources are transfered daily and automatically.

Today under vigilance of specially created committees, legally constituted and recognized by government by a very simple procedure, municipal governments are using the new resources for building roads, constructing schools and other infrastructure as well as carrying out productive development projects. Only 10% of the resources received can be used for operative expenditures. In this way it is assured that no burocracy will be created and resources will be effectively transferred to projects thus creating new economic activities and jobs.

Approximately 12,000 communities and indigenous and peasant organizations in the rural areas and 5,000 boards constitute the above mentioned committees and they truly express the new social organizational texture of the country. Many of these have received training in "territorial municipal" management. Some municipalities because of special situation, such as very scarce population and where poverty is larger, have received special treatments.

Bolivia is a large country (about 1 million square kilometers with scarce population (6.7 million inhabitants). Before this Law was adopted, there were no territorial municipalities; the jurisdiction of a municipal government was given only by an urban radius, excluding rural areas. In this was nearly 2.7 million inhabitants were excluded from economic activities. Under such conditions small villages which before had no contact with economic centres have now been incorporated into the municipalities and are also receiving the benefits of the Law on Popular of Participation. In time, these will be demanding on the science and technology infrastructure as the need to create productive activities grow. Because of its relevance to Namibia, this Annex contains the Law adopted in 1994. Some adjustments are now under discussion to perfect this mechanism.

POPULAR PARTICIPATION LAW

REPUBLIC OF BOLIVIA

National Secretariat for Popular Participation
Ministry of Sustainable Development and the Environment

LAW NO. 1551

LAW OF APRIL 20, 1994

GONZALO SANCHEZ DE LOZADA
CONSTITUTIONAL PRESIDENT OF THE REPUBLIC

Given that, the National Congress has enacted the following Law:

THE NATIONAL CONGRESS DECREES:

TITLE I
ON POPULAR PARTICIPATION

CHAPTER I
ON THE SCOPE OF POPULAR PARTICIPATION

ARTICLE 1 (Object). The present Law acknowledges, promotes, and consolidates the process of Popular Participation, incorporating the indigenous communities, both rural and urban, in the juridical, political, and economic life of the country. It is aimed at improving the quality of life of Bolivian women and men, through a fairer distribution and better administration of public resources. It strengthens the political and economic means and institutions necessary for perfecting a representative democracy, facilitating the citizens' participation and guaranteeing equality of opportunity at all levels between women and men.

ARTICLE 2 (Scope). In order to achieve the objectives contained in Article 1:

a) The Law acknowledges the juridical status of the Base Territorial Organizations, urban and rural, and relates them with the public agencies.

(b) It establishes the Provincial Section as the territorial jurisdiction of the Municipal Government. It increases the responsibilities and resources of the Municipal Governments, and transfers to them the physical infrastructure for education, health, sports, local roads, micro-irrigation systems, along with the obligation to administer, maintain and renew them.

c) It establishes the principle of equal distribution per inhabitant of the resources from tax co-participation, assigned and transferred to the Departments, through the corresponding Municipalities and universities, with the aim of correcting the historical imbalances that exist between the urban and rural areas.

d) It reorganizes the attributions and responsibilities of the public agencies so that they act within the framework of the rights and duties acknowledged by this Law.

CHAPTER II
ON THE SUBJECTS OF POPULAR PARTICIPATION

ARTICLE 3 (Base Territorial Organizations and Representation).

I. The Law defines the subjects of Popular Participation to be the Base Territorial Organizations, which are rural communities, indigenous populations, and neighborhood councils, organized according to their traditional practices, customs or statutory disposition.

II. It acknowledges, as representatives of the Base Territorial Organizations, men and women, traditional leaders or chiefs, such as Captains, Jilacatas, Curacas, Mallcus, or General Secretaries, or others, designated according to their traditional practices, customs or statutory disposition.

ARTICLE 4 (Juridical Status).

I. The Law acknowledges the juridical status of the Base Territorial Organizations, which represent the entire urban and rural populations of a determined territory, corresponding in urban areas to neighborhoods determined by the Municipal Governments and in rural areas to existing communities, the only requirement being their registration following the procedure established in this Law.

II. The juridical status acknowledged by this Law grants legal capacity to the representatives and members of the Base Territorial Organizations in order for them to be subject to the rights and duties established by all public acts defined by the national juridical order.

ARTICLE 5 (Registration of Juridical Status).

I. The juridical status of the rural communities, indigenous populations and neighborhood councils in the Provincial Sections shall become effective, in accordance with the jurisdiction, through a resolution of the Prefecture or Sub-prefecture, to the Base Territorial Organization which presents documentation from their community such as books of minutes, minutes of public assemblies, minutes, acts, statutes, or public regulations which designate representatives or authorities in accordance with the nature of the Base Territorial Organization, together with a favorable resolution from the corresponding Municipal Council. Once these requirements are completed, the administrative authorities responsible for registration cannot refuse the registration of the Base Territorial Organization and they are responsible for any action or omission that does not comply with what is established in this Article.

II. The Base Territorial Organizations which have obtained juridical status prior to the passage of this Law, in order to benefit from the rights established for Popular Participation, should re-register themselves in their Prefecture or Sub-Prefecture, in which the administrative authority may not make any objections.

III. The procedures for registration of juridical status in accordance with this Law shall be free of charge.

IV. All other Civil Associations shall be governed by the stipulations of the pertinent laws.

ARTICLE 6 (Representation Unit)

I. Only one Base Territorial Organization shall be acknowledged in each territorial unit and have access to the rights and duties defined in this Law.

II. One representation only shall be acknowledged for each Base Territorial Organization.

III. Should a conflict arise with respect to the territorial or institutional representation, and the parties are unable to reach an agreement, this situation shall be resolved exclusively by the respective Municipal Council, without prejudice to a later petition by the interested parties to the Judicial Authorities defined by this Law. While the conflict persists, the rights acknowledged to the Base Territorial Organization which is a party to the controversy shall be suspended.

IV. The Municipal Governments and the Community Associations shall safeguard the unity, organization and strengthening of the Base Territorial Organizations, avoiding any unnecessary separation or division of the territory where they are located.

ARTICLE 7 (Rights of the Base Territorial Organizations). The Base Territorial Organizations have the following rights:

a) To propose, request, control, and supervise the works and the provision of public services according to the needs of the community in the areas of education, health, sports, basic sanitation, micro-irrigation, local roads, and urban and rural development.

b) To participate in and promote actions relating to environmental protection and preservation, ecological balance and sustainable development.

c) To represent and obtain the modification of actions, decisions, works or services rendered by the public agencies, whenever these are contrary to the interests of the community.

d) To propose the change or continuation of education and health authorities within their territory.

e) To have access to information concerning the resources destined for Popular Participation.

ARTICLE 8 (Duties of the Base Territorial Organizations). The Base Territorial Organizations have the following duties:

a) To identify, set priorities, participate and cooperate in the implementation and administration of projects for the public welfare, giving preferential attention to formal and informal education, the improvement of housing, health care and protection, widespread practice of sports, and the improvement of the methods of production.

b) To participate and cooperate, working together in the implementation of public works and the administration of public services.

c) To cooperate in the maintenance, safeguard, and protection of both municipal and communal public facilities.

d) To inform and brief the community with respect to the actions stemming from their representation.

e) To coordinate administrative and judiciary resources to defend the rights acknowledged by this Law.

f) To promote the equal access and participation of women and men at all levels.

ARTICLE 9 (Community Associations).

I. The Law acknowledges Community Associations constituted by the Base Territorial Organizations, in accordance with traditional practices, customs, or statutory disposition.

ARTICLE 10 (Oversight Committee).

I. An Oversight Committee shall be formed for each Municipal Government for the purpose of linking the Base Territorial Organizations and the Municipal Government in the exercise of the rights and duties established in this Law. The Oversight Committee shall be composed of a representative from each Canton or District in the jurisdiction, and shall be elected by the respective Base Territorial Organizations and have the following attributions:

a) To ensure that the municipal resources for Popular Participation are fairly and equitably invested in the urban and rural population, acting as a liaison to ensure that the Base Territorial Organizations exercise the rights acknowledged by this Law.

b) To ensure that no more than 10% of the Popular Participation resources are assigned for the Municipal Government's regular expenses.

c) To give opinions with respect to the budgeting of resources of Popular Participation and the submission of reports of expenses and investments carried out by the Municipal Government. These opinions should be made public using whatever means of communication, with a copy to the Executive Authority such that this authority acts in accordance with the responsibilities recognized by the Political Constitution of the State.

II. In the municipal jurisdictions where there is only one Canton, the Base Territorial Organizations shall elect three citizens to form the Oversight Committee, and where there are two Cantons, each one of them shall elect two representatives.

III. The Oversight Committee shall determine its own organization and work, as well as the election of its directors.

ARTICLE 11 (Suspension of Popular Participation Resources).

I. If the Oversight Committee denounces the use of municipal resources assigned for Popular Participation, in relation to Municipal Ordinances and Resolutions, the Executive Authority shall conduct a corresponding evaluation and, as necessary, shall require the transgressing municipality to correct the observed situation. In the event that the situation is not corrected, in conformity with Item 9 of Article 96 of the Political Constitution of the State, the Executive Authority shall denounce the pertinent Municipal Government before the National Senate.

II. The Executive Authority, as part of its duties to the Municipal Government, may also require that the Municipal Government rectify actions which it considers contrary to the Political Constitution of the State and the laws; should the required municipality not agree to correct the observations made, the Executive Authority shall denounce this failure to comply before the National Senate.

III. If the National Senate agrees with the denunciation, the tax co-participation disbursements for Popular Participation, corresponding to the Municipal Government denounced, shall be suspended. Until the National Senate resolves the situation definitively, the co-participation resources shall continue to accumulate in the account of the Municipal Government in question.

TITLE II
ON MUNICIPAL GOVERNMENTS

SINGLE CHAPTER
ON MUNICIPAL GOVERNMENTS

ARTICLE 12 (Municipal Jurisdiction).

I. The territorial jurisdiction of the Municipal Government is the Provincial Section.

II. There shall be only one Municipal Government in each Provincial Section.

III. Municipal jurisdiction in the Departmental capitals shall correspond to the respective Provincial Section.

ARTICLE 13 (Transfer of Physical Infrastructure).

I. Ownership of buildings and furniture that correspond to the infrastructure for public health, education, culture, sports, local roads, and micro-irrigation are transferred, free of charge, to the Municipal Governments, and these consist of:

a) Secondary and tertiary care hospitals, district hospitals, health centers and posts, pertaining to the Health Secretariat of the Munistry of Human Development.

b) Public primary and secondary schools.

c) Sports facilities for widespread practice of sports, and multipurpose courts, except for those facilities used for the practice of sports at the national or international level.

d) Micro-irrigation infrastructure and state-owned local roads.

e) Cultural centers, libraries, museums, and archeological sites pertaining to the National Government, with the exception of those institutions considered to be National Landmarks or Patrimony and those institutions which are the property of the universities in each Department.

II. The Executive Authority is responsible for defining the policies for the sectors of health, education, culture, sports, local roads, micro-irrigation, as well as governing the technical-pedagogical services in the fields of education and health. The specialized technical personnel responsible for carrying out such policies, pertain to the National Government, which must remunerate them, thus ensuring the provision of these social services.

ARTICLE 14 (Expansion of Municipal Responsibilities).

I. The municipal responsibilities are expanded to the rural area under its territorial jurisdiction.

II. In addition to the stipulations of Article 9 of the Organic Law of Municipalities, municipal responsibility is expanded in the following areas:

a) To administer and control the equipment, maintenance and improvement of buildings and furniture owned by the Municipal Government, including those transferred under this Law, regulating their use.

b) To furnish the equipment, furniture, didactic materials, inputs, and supplies, including medicine and food in the health area, to manage and supervise their use, for adequate operation of the infrastructure and the provision of health services, basic sanitation, education, culture and sports.

c) To supervise, in accordance with the respective regulations, the performance of the educational authorities, the directors and teachers, and to propose their continuation to the Departmental Educational Authority, for good performance, or their removal on justifiable grounds, either directly or at the request of the Base Territorial Organizations and the Oversight Committee.

d) To control, supervise and propose the change or continuation of public health authorities subject to the pertinent regulations, safeguarding the efficient provision of services, either directly or at the request of the Base Territorial Organizations and the Oversight Committee.

e) To manage the urban and rural real estate registries in accordance with the generally applicable technical standards issued by the Executive Authority.

f) To manage the taxpayers' registries necessary for the collection of their own income, based on the urban and rural real estate registries and the National Plan for Soil Use approved by the Executive Authority.

g) To preserve and restore the cultural and historical patrimony and promote all types of cultural activities.

h) To promote and foster sports for the purpose of attaining widespread practice of sports and increased competitiveness.

i) To promote rural development through the use of the people's own as well as applied technologies, including the installation of micro-irrigation systems and the building of local roads.

j) To provide and build new infrastructure for the areas of education, culture, health, sports, local roads, and basic sanitation.

k) To contribute to the maintenance of secondary and local roads that go through the municipality.

l) To respond to the petitions, representations, requests, and social control actions of the Base Territorial Organizations and the Oversight Committee.

m) To attend to the complementary feeding programs, including the school breakfast program.

n) To promote and foster policies which include the needs of women in carrying out of the above-mentioned municipal responsibilities.

ARTICLE 15 (Other Resources for the Exercise of Municipal Responsibilities). The Executive Authority can assign resources or credit from internal, external or international sources, to support the exercise of the Municipal Governments' responsibilities, provided that the established conditions and counterpart contributions are met.

ARTICLE 16 (Election of Council Members).

I. The second part of Article 13 of the Organic Law of Municipalities is modified and the new text shall read: "The Council Members shall be elected according to the number of inhabitants in each municipality, and there shall be a maximum of eleven members, designated in the following manner:

a) Populations of up to 50,000 inhabitants, 5 Council Members.

b) For each additional 50,000 inhabitants or fraction thereof, two Council Members, until the established limit is reached."

II. The Departmental capitals shall have eleven Council Members.

ARTICLE 17 (Municipal and Cantonal Agents and Sub-Mayors).

I. The Municipal and Cantonal Agents, members of the community and residents of the area, shall be elected by popular and direct vote, and they shall hold office for the same period of time as the Council Members, and will have the following responsibilities:

a) To support the Base Territorial Organizations of the Canton, rural and urban, in the exercise of the rights and duties established by this Law.

b) To exercise the functions delegated by the Mayor to the cantonal level.

c) To respond to the demand and control of the Base Territorial Organizations in the Canton, in accordance with the rights and duties acknowledged by this Law.

II. The urban Sub-Mayors shall be appointed by the Mayor, and they shall be responsible for the administration of the District assigned to them, and shall be residents of this District.

III. In those areas where there exists a geographic, socio-cultural, productive, or economic unit, smaller or larger than a Canton, the Municipal Government will approve the creation of a Municipal District and the appointment of a Sub-Mayor.

ARTICLE 18 (Districts). For the provision of public services, as well as the definition of census, electoral, and urban or rural planning units, the Law acknowledges the municipal jurisdiction or jurisdiction of an association of municipalities as an Administrative District which should coordinate all public services of the Administrative District. Each District, urban or rural, should be part of the process of Popular Participation defined in this Law.

TITLE III
ON THE RESOURCES OF POPULAR PARTICIPATION

SINGLE CHAPTER

ARTICLE 19 (Classification of State Revenues). For the purpose of Article 146 of the Political Constitution of the State, the following classification is established for the revenue of the State:

A) THE NATIONAL REVENUES ARE:

1) The value-added tax (IVA).
2) IVA's complementary regimen (RC-IVA).
3) The tax on the assessed revenues of the corporations (IRPE).
4) The transactions tax (IT).
5) The tax on specific consumptions (ICE).
6) The Consolidated Customs Tax (GAC).
7) The tax on free transmission of goods (succession).
8) The departure tax to foreign countries.

B) THE DEPARTMENTAL REVENUES ARE:

1) All royalties assigned by Law.

C) THE MUNICIPAL REVENUES ARE:

c.1. The tax on the assessed revenues of Property Owners which consist of:

1) The tax on rural properties (RPPB).
2) The tax on urban real estate (RPPB).
3) The tax on motor vehicles, motor boats, and airplanes (RPPB).

c.2. The taxes established by Municipal Ordinance in accordance with those stipulated in the Political Constitution of the State.

ARTICLE 20 (Tax Co-participation).

I. Tax co-participation is understood to be a transfer of resources from National Revenues to Municipal Governments and Public Universities for the exercise of their responsibilities as defined by this Law and for the accomplishment of Popular Participation.

II. Of the effective collection of the national revenues defined in Article 19, Paragraph A) of this Law, 20% shall be assigned to the Municipal Governments and 5% to Public Universities.

III. All municipal revenues defined in Article 19, Paragraph C) of this Law, are the exclusive domain of the Municipal Governments, which are responsible for their collection and investment as specified in the Municipal Budget, in accordance with the norms and technical tax collection procedures regulated by the Executive Authority.

ARTICLE 21 (Distribution of Tax Co-participation by Inhabitant). Tax Co-participation, as defined in the preceding Article, shall be distributed among the beneficiary municipalities according to the number of inhabitants in each municipal jurisdiction, and among the beneficiary public universities, according to the number of inhabitants in the departmental jurisdiction where they are located.

ARTICLE 22 (Popular Participation Account).

I. Tax Co-participation destined for the municipalities shall be automatically deposited by the General Treasury of the Nation, through the Banking System, into the corresponding Popular Participation Account of those Municipalities whose population exceeds 5,000 inhabitants.

II. The Municipalities which do not have a minimum population of 5,000 inhabitants shall form an association of municipalities in order to have access to tax co-participation through an account in the name of the association of municipalities.

ARTICLE 23 (Conditions for Tax Co-participation).

I. In order to receive the resources from Tax Co-participation deposited into the Popular Participation Account, the Municipal Governments, within the framework of Article 146 of the Political Constitution of the State must prepare their Municipal Budget in accordance with their Annual Operational Plan, as well as report their expenditures under the previous year's operating budget in accordance with and as prescribed by Article 152 of the Political Constitution of the State.

II. In the event that the Municipal Government does not comply with the conditions of this Article and the norms and the Administration and Control Systems established by Law No. 1178, the Executive Authority shall denounce this before the National Senate in compliance with the law.

III. The Municipal Governments must assign, for public investment, at least 90% of the resources from Tax Co-participation for Popular Participation.

ARTICLE 24 (Information about the Population).

I. The National Populatiion and Housing Census of 1992 constitutes the official reference for population.

II. For the National Census in the year 2000 and thereafter, the information relative to population will be obtained every five years either from the inter-censal demographic study conducted by the National Institute of Statistics or from the National Censuses which will be obligatorily carried out every ten years.

III. As a result of the need to adjust and correct the National Population and Housing Census of 1992, the next inter-censal demographic study will be carried out in 1996.

TITLE IV
PUBLIC ADMINISTRATION AND POPULAR PARTICIPATION

CHAPTER I

EXECUTIVE AUTHORITY

ARTICLE 25 (Attributions of the Prefect, Sub-Prefect and Corregidor). Within their jurisdiction and responsibility, the Prefects, Sub-Prefects, and Corregidors shall promote, coordinate, and support Popular Participation, as well as the exercise and fulfillment of the rights and obligations which this Law defines for the Base Territorial Organizations, Municipal Governments, and the Executive Authority.

ARTICLE 26 (Strengthening of Municipal Governments). The Executive Authority shall establish means for strengthening the capacity of Municipal Governments to plan and administer annual programs.

ARTICLE 27 (Participation of the Armed Forces). The Armed Forces, in compliance with their constitutional mandate to contribute to the integrated development of the country, are included in the process of Popular Participation in accordance with their Organic Law.

CHAPTER II

REGIONAL DEVELOPMENT CORPORATIONS

ARTICLE 28 The Regional Development Corporations are established in each of the Departments of the Republic for the exercise of the objectives established in this Chapter. The Executive Authority will regulate their organization and operation.

ARTICLE 29 (Departmental Compensation Fund). For the benefit of those Departments which are below the national average for departmental royalties per inhabitant, this Law establishes an annual budgetary compensation under the responsibility of the General Treasury of the Nation which will permit those Departments to achieve the national average.

ARTICLE 30 (Regional Development Corporations).

I. The departmental royalties and the resources from the Compensatory Royalty Funds established in this Chapter, shall be administered by the Regional Development Corporations for the following purposes:

a) Regional, sub-regional, and micro-regional planning in coordination with the Municipal Governments of the Department and the Ministry of Sustainable Development and the Environment.

b) The investment for physical infrastructure in the following areas: social, environmental, basic services, and road networks, concurrent with the National Government and/or the Municipal Governments in the corresponding cases.

c) The strengthening of the capacity of the Municipal Governments to administer resources and provide services.

II. The Corporations cannot transfer resources to third parties, except for projects in the areas of culture, research and production which are financed for the most part with national or international resources.

III. The Corporations shall preferentially use the resources they manage as a financial counterpart for obtaining new resources destined to improve the performance of their attributions.

IV. The Corporations cannot assign more than 15% of their income to cover their operating expenses.

ARTICLE 31 (The Corporation's Board of Directors).

I. The Boards of Directors of the Regional Development Corporations are modified as follows:

a) The Executive Chairman, designated in accordance with the Political Constitution of the State.

b) Three citizens, elected by the Mayors of the Provincial Sections of the Department.

c) Three representatives of the Executive Authority proposed by the National Council for Sustainable Development and designated by a Supreme Resolution.

d) The President of the Departmental Civic Committee.

e) The Executive Secretary of the Departmental Federation of Farmers.

f) The President of the Departmental Federation of Neighborhood Councils.

g) The General Manager will attend the Board meetings, having a right to voice his opinion. He shall be selected by the Board according to merit based on public competition.

II. The Directors will assume personal responsibility, together and unlimited, for the actions and administration in which they participate.

III. Thw elected Directors will not carry out financial, entrepreneurial or commercial activities related to the Corporation and they will be responsible for providing timely information to their constituencies at least once a month.

CHAPTER III

IMPLEMENTING ORGANIZATIONS

ARTICLE 32 (Implementing Organizations). The Implementing Organizations, especially the Social Investment Fund, the National Fund for Regional Development, the Farmers' Development Fund, and ONAMFA, will give preference to the Base Territorial Organizations, directly or through the Municipal Governments, Prefectures, Regional Development Corporations, Non-Governmental Organizations or other intermediaries.

GENERAL DISPOSITIONS

ARTICLE 33 (Application of this Law). This Law does not restrict the exercise of the rights of free association and petition, nor does it exclude other legitimate means of Popular Participation existing within the national territory.

ARTICLE 34 (Other Organizations of Civil Society). Civic organizations, unions, cooperatives, religious and non-governmental entities which are present in the Cantons, Provincial Sections, Provinces and Departments, can carry out actions according to their own purposes, in order to achieve the objectives of Popular Participation.

ARTICLE 35 (Provincial Councils for Popular Participation). This Law acknowledges the existence of Provincial Councils for Popular Participation which effectively integrate the principles of this Law and incorporate society's institutions, in accordance with the reality of each Province. The Provincial Councils for Popular Participation will coordinate, in a consultative manner, with the appropriate public authority in order to contribute to provincial development.

ARTICLE 36 (Exemption from Payment of Taxes). The exemption of payment of rural property taxes by Indigenous and Farm Communities, established in Law No. 1305 of February 13, 1992, is maintained.

ARTICLE 37 The National Government will give priority to assigning resources, from internal and/or external sources, to the poorest regions or those of lowest population density for the purpose of gradually reducing the historical differences in the development of different regions of the country.

ARTICLE 38 (Abrogations and Derogations).

I. The following laws are abrogated: Law No. 1399 of December 15, 1992; Law No. 1113 of October 19, 1989.

II. Law Decree No. 15307 of February 9, 1978 is abrogated.

III. Articles 56, 57, 63, 68 and Title IX of Law No. 843 of May 20, 1986 are derogated.

ARTICLE 39 (Effectiveness).

I. This Law goes into effect on the first day of the month following its publication.

II. The financial provisions of this Law go into effect from the issuance of regulations drafted for the purpose of putting these provisions into effect.

TEMPORARY ARTICLES

ARTICLE 1 (Position of Resources).

I. The resources assigned to the Provincial Sections which lack a Municipal Government shall accumulate for later use when a Municipal Government exists.

II. In the Provincial Sections which have not yet instituted Municipal Governments, and in order to use the corresponding financial transfers; the Base Territorial Organizations in the jurisdiction may request the formation of an association of municipalities in conjunction with another Municipal Government.

ARTICLE 2 (Transfer of Public Works and Projects).

I. Municipal public works that are being carried out by the Regional Development Corporations shall be transferred to the Municipal Governments, along with their international funding and liabilities, if any.

II. The public works and projects of the Regional Development Corporations, with technical and/or financial qualifications recognized by the National System of Public Investment, shall not be transferred to municipalities, but will be maintained under the responsibiity of the Corporations for the purpose of avoiding delays in their implementation.

III. The projects of the Regional Development Corporations now in the process of approval by the National Fund for Regional Development, and within the competence of the municipality, shall be the object of a meeting between the Municipal Governments and the Corporations for the purpose of determining the means for implementing them and the participation of both the Municipal Government and the Corporation in their implementation. In these cases, the municipalities will have the priority for defining their participation.

ARTICLE 3 (Performance of Obligations). The public works and projects now being carried out by the Regional Development Corporations, prior to and in a different manner than provided by this Law, shall be analyzed individually, case by case, by the National System of Public Investment.

ARTICLE 4 (Reorganization). The Regional Development Corporations shall reorganize their organizational and administrative structure in accordance with the new legal framework and the Supreme Decree which will be issued by the Executive Authority for this purpose.

ARTICLE 5 (Administration of Urban Property Taxes, Vehicle Taxes, and Rural Property Taxes).

I. The procedure described in Article 6 of Supreme Decree No. 21458 of November 28, 1986 shall be maintained until the municipalities carry out real estate assessments which can be substituted for the current assessments for urban real estate.

II. The procedure described in Article 7 of Supreme Decree No. 21458 of November 28, 1986 shall be maintained for the purpose of determining the tax base for motor vehicles, motor boats and airplanes.

III. Up to and including the fiscal year of 1995, the General Directorate of Internal Taxes shall be responsible for the collection of these taxes in order to carry out the new system of distribution of revenues established by this Law. During this period, the General Directorate will train and transfer responsibility for the collection of these taxes to the Municipal Governments which have the administrative capacity to collect these taxes.

ARTICLE 6 (Suspension of the Creation of New Provincial Sections and Cantons). The creation of new Provincial Sections and Cantons is suspended until January 1, 1996.

ARTICLE 7

I. The Municipal Governments and Council Members elected in the elections of December, 1993, and whose population with respect to this Law is contained in other municipalities, for this time only, shall maintain their responsibilities until completion of their mandate.

II. In the fiscal administrations corresponding to 1994 and 1995, the populations which are Provincial Capitals shall receive co-participation resources according to the number of inhabitants of the Canton in which they are located.

III. The plans and programs approved by the Municipal Council of these populations shall be coordinated with and adjusted to those of the Municipal Council to which they will pertain as of January 1, 1995.

Submitted to the Executive Authority, for constitutional purposes.

Chamber of the Honorable National Congress.

La Paz, April 20, 1994

Signed Juan Carlos Durán S., Guillermo Bedregal G., Walter Zuleta Roncal, Guido Capra Gemio, Georg Prestel Kern, Mirtha Quevedo Acalinovic.

Therefore, I promulgate this Law such that exists and be complied with as Law of the Republic.

Palace of Government of the City of La Paz, on the 20th day of April, one thousand nine hundred ninety-four.

SIGNED GONZALO SANCHEZ DE LOZADA, José G. Justiniano Sandóval, Carlos Sánchez Berzain, Enrique Ipiña Melgar.

ANNEX I

DESCRIPTION OF THE SOLIDARITY BANK OF BOLIVIA

BANCO SOLIDARIO S.A.

BACKGROUND

In 1984, ACCION INTERNATIONAL, a U.S. based non-governmental organization (NGO) operating throughout Latin America since 1961, invited a group of Bolivian businessmen to spearhead the creation of a microenterprise development program.

Thus in 1986, the "Fundación para la Promoción y Desarrollo de la MicroEmpresa" (PRODEM) was created as a joint venture of ACCION INTERNATIONAL which contributed the know how and methodology of the program and prominent leaders of the Bolivian business community who provided seed capital and leadership. Among them:

Mr. Julio Leon Prado and Banco Industrial S.A.,
Mr. Luis E. Siles and Banco Boliviano Americano S.A.,
Mr. Fernando Romero and BHN Multibanco S.A.,
Mr. Gonzalo Sanchez de Lozada and Compañia Minera del Sur S.A. COMSUR
Mr. Carlos Iturralde and Estaño Aluvial S.A.,
Mr. Fernando Illanes, and
Confederación de Empresarios Privados de Bolivia (CEPB)

PRODEM'S initial funding came from the United States Agency for International Development (USAID) PL 480 program, the Bolivian Fondo Social de Emergencia (Social Emergency Fund), the Bolivian private sector, and the Calmeadow Foundation.

PRODEM offered access to credit and training to the microentrepreneural sectors of Bolivia, thus broadening employment opportunities, encouraging investment in microbusiness, and increasing the level of income generated by this sector. The credit program provided working capital for small scale production, commercial activities, through the solidarity group lending methodology explained below.

The program was very successful, as PRODEM helped to finance until the end of 1991, more than 45.000 microbusinesses providing loans equivalent to more than U$ 28MM with a default rate close to zero.

Several factors prompted PRODEM's leadership to consider an alternative for its lending program. As a NGO, PRODEM was legally restricted from seeking sources of funding such as client deposits, loans from financial institutions, etc.

Only with access to these sources of funds PRODEM was able to realize its desired level of credit expansion.

Once PRODEM's leadership decided to create a Bank, they formed a separate steering committee called COBANCO to carry out the transition process. Its main objectives were to promote the project among financial institutions and potential national and international investors, coordinate the transfer of funds and other operative aspects from PRODEM to the Bank, and obtain the Operating License from the Superintendency of Banks. It took two years to complete this process.

Banco Solidario S.A. "BancoSol" started its operations in Bolivia on February 10th 1992, as the first private commercial bank in Latin America to provide financial services to the micro - entrepreneurial sector.

Other successful microenterprise banking experiences like Grameen Bank in Bangladesh and Bank Rakyat Indonesia (BRI), are public ventures that also illustrate the potential of this market.

SHAREHOLDERS OF BANCOSOL

NO.	NAME	TOTAL CAPITAL (000 US$)	PARTICIPATION %
1	ACCION INTERNATIONAL	48.3	0,8
2	COMSUR S.A.	263.5	4,3
3	COBODI S.A.	263.5	4,3
4	INVERSIONES AMERICA S.A.	263.5	4,3
5	INBO S.A.	144.9	2,4
6	PRODEM	2.155.5	35,4
7	INTER-AMER.INVESTMENT CORP.	1.460.6	24,0
8	JULIO LEON PRADO	0.5	0,01
9	GONZALO SANCHEZ DE LOZADA	0.5	0,01
10	FERNANDO ROMERO M.	0.5	0,01
11	ROBERTO CAPRILES	56.4	0,9
12	LUIS E. SILES (SUCESION)	0.5	0,01
13	JOSE M. RUISANCHEZ	13.9	0,2
14	PROFUND INTERNACIONAL S.A.	1.409.9	23,2
	T O T A L	**6.082.0**	**100,0**

Their vision and financial commitment blends in this enterprise two main objectives of profitability and social impact.

ACTIVITIES

BancoSol offers financial services to the micro-entrepreneurial sectors, with the main purpose of supporting the operations of self-employed entrepreneurs, and encouraging internal savings.

Loans are granted to groups composed of four to eight individuals with crossed - personal solidarity type - guarantees. Loans start at U$ 100 per individual for terms that do not exceed 60 days. The amount of the loan and its tenor may increment in phases, subject to the clients' repayment records. The portfolio's turnover is 2.5 times/year.

The quality of BancoSol´s loan portfolio is excellent due to its low arrears (below financial system's average).

Loan portfolio control is primarily based on a good initial screening process and strong ongoing personal relationship between loan officers and clients.

Loan officers are recruited from the same communities and neighborhoods where they undertake extensive fieldwork prior to selecting potential clients, based on training programmes provided by BancoSol.

The process continues further with the screening of potential borrowers through the solidarity groups, as members carefully select among themselves creditworthy individuals who will guarantee/respond to the group members´ obligations.

Most (70%) of BancoSol´s clients are women working as market vendors, while the rest of the portfolio is lent to shoemakers, tailors, bakers, mechanics, etc.

BancoSol now also offers saving accounts, as well as demand and time deposits. Unlike other commercial banks in the country, no minimum amounts exists to open accounts at BancoSol. The average size of saving accounts is about U$ 120, which comes from its current client base as well as from non-borrowers.

The latter reflects a big step forward, as theory prevailed that at the lower scale of the economy the saving power was not possible. Savings is as important a service for this market as is credit. Micro-entrepreneurs have a great propensity to save when provided with safe, accessible mechanisms.

Potential clients are excluded from formal sector financial institutions because of required minimum amounts, lack of accessibility from their neighborhoods, and literacy as a requirement. Consequently, this sectors have had no alternative but to store the value of their currency in assets, or save it without the benefit of an interest-bearing account, i.e. under the mattress.

Interest rates charged enables BancoSol to cover its costs and make a profit. Rates are 20 percentage points higher than commercial banks, as operating costs are also much higher, mainly due to the size of the loans, short tenors, investment in client education, etc.

PRESENT SITUATION

Many factors are contributing to BancoSol´s success. An organization committed to total quality were both clients and credit officers believe the program belongs to them, leader in the market with tremendous potential, investment in employee's training capacitation and corporate culture, and strategic geographic locations modestly designed, are among the most important.

BancoSol's growth has been significant and solid. The Bank is profitable, has a healthy loan portfolio, is the largest bank in the country in terms of number of clients, with a well established network of 32 agencies located in the main cities of Bolivia.

FINANCIAL HIGHLIGHTS
(000's of U$)

	1992	1993	1994	1995
Earnings Data				
Total Revenues	2.172	7.537	11.956	12.069
Net Income	125	232	865	600
Return on Assets	0.1%	0.7%	2.1%	1.3%
Return on Equity	2.6%	4.3%	13.3%	9.2%
Balance Sheet Data				
Total Assets	11.830	34.329	45.798	45.483
Loans	8.814	24.758	33.215	36.857
Deposits	1.865	3.295	5.645	7.102
Obligations	4.700	24.991	30.904	29.278
Shareholders Equity	4.882	5.435	6.513	7.113
Other Indicators				
Past due loans	3.2%	2.9%	5.1%	3.1%
Leverage	41.2%	15.8%	14.2%	15.6%
Average Loan (U$)	345	551	541	585
Clients	26.174	44.832	61.384	63.038
Agencies	8	20	29	32
Employees	147	275	428	454

APPENDIX

I. GENERAL CONSIDERATIONS

Engineering must be developed with urgency. To this end UNIDO could deploy an immediate mission to help design the engineering curricula at the Polytechnic and supply advice on the equipment to be installed for the laboratories.

It is important to continue strengthening areas of excellence. For example under SADC, Namibia is the leading country in fisheries and in that category it has organized courses and training activities for countries in the regional organization. The country must take advantage of this situation to develop other competencies around the fisheries "axis".

For demonstration purposes, it is very important to adopt a short term plan of action containing few programs/projects. This might imply that other important ones be left out, but, the execution and successful completion of a small set of projects will give the S&T System the credibility it needs in front of decision makers to become and active part of the development strategy of the country. Once this credibility is built many other activities can be later designed and executed.

It is of utmost importance that in the execution of the proposed actions, the international and bilateral agencies be involved. Many of them already have a plan or an on-going activity within the proposed actions. Some have large amount of resources already allocated. One of the purposes of the Short Term Plan would be precisely that of bringing together dispersed capacities in UNAM, the Polytechnic and many research laboratories with donor agencies and their experts.

The proposals of actions (programs) to be included in the Plan are divided into two categories:

- Changes in science, education and training

- Specific technological programs

II. SPECIFIC ACTIVITIES

II.1 - Creation of an Engineering Course at BSc Level Involving UNAM (physics, chemistry, mathematics, computer science) and the Polytechnic (electrical, computer science, mechanical and civil)

The creation of engineering capacities is key to the development of productive activities and the acquisition of innovative capacities of enterprises. Engineers must be trained locally in some disciplines, while in others it might be more reasonable to train them outside. Local training needs to be done in spite of the small labour market of Namibia. This latter limitation might be overcome through regional cooperation, for example creating a single school of engineering in only one or two universities throughout the region.

The policy to create engineering capacities in the Polytechnic should be supported, while at the same time UNAM and other research institutions should participate in its design and implementation. It would be a wrong policy to have engineering capacities in two institutions at the same time.

II.2 - Establishment of Joint Research Programs

If research will have any impact either on the advancement of knowledge or in the growth of the economy or provide solutions to social ills, it has to be carried out by very high level motivated people working in an appropriate academic environment, without bureaucratic traps, with sufficient financial resources for equipment, travel, acquisition of information, fellowships for training abroad (and in situ) and so on.

The above conditions impose severe limitations to countries which have a weak S&T system such as Namibia. It is therefore critical that any research activities that are to he carried out be conducted in the most ample schema of interinstitutional cooperation and the decision on the research topics be carried out with regard to what is really feasible to be obtained by the research teams.

One important condition that could he initially studied is to transform many of the very specialised public research institutes existing today in centres for science and technology development, thus covering a larger part of the innovation process. This has already been suggested by previous reports. For example, the Veterinarian Centre, could become a National Laboratory for Agriculture, carrying out not only research but also providing services.

II.3 - Creation of a Foundation by UNAM, the Polytechnic for Research and Development under Contract with Industry, in cooperation with the Namibia Development Corporation

The Foundation could be located either in one of the campuses or at an industrial park. The main initial purpose would be to bring the expertise of UNAM and the Polytechnic to the service of firms radicated at the park. It can also become a key player in the efforts to improve the whole educational system, creating awareness and diffusing expertise that can go from technical to managerial skills which are needed for the proper functioning of industry.

The NDC is key to this effort as it already brokers projects, projects management advice and facilitates business contacts. The Foundation could in time become one the Corporation's operators. The main issue here is that the presence of the S&T system must be established in the industrial parks.

The Foundation could well be the vehicle to improve and accelerate the use of the system for standards, norms, metrology and quality control that the MTI is developing with some difficulties.

The main initial activity would be the design of the Foundation, which will include location, ownership, definition of objectives, definition of an initial work plan, training, infrastructure and others.

II.4 - Training Program for Instructors of Vocational Centres using the Namibian Institute of Mining and Technology in Arandis and Involving Professors from the University and the Polytechnic

One basic need of Namibia is to create a stronger technical work force, through improved vocational colleges. For this to occur trainers must be retrained or fully trained again. At the same time training must he diversified into many areas where expertise cannot be found in the country.

One possibility of developing an enhanced training program is through the use of an already well equipped existing facility, so as to avoid high costs. This institution is the Namibian Institute of Mining and Technology.

Technical and vocational training, besides improving the abilities of technicians must introduce the concepts of maintenance and quality, if these will serve the productive sectors in their competence in both the national and international markets.

Main initial activities:

i) Determination of the present situation of demand - supply in skills training and vocational training for industry, but particularly addressed to rural communities;

ii) Definition of an appropriate curricula;

iii) Creation of a fellowship schema to receive trainers at Arandis;

iv) Creation of a visiting professorship schema to allow ample participation of university and other institution instructors;

v) Definition of equipment and other needs of the existing vocational colleges.

II.5 - Appropriate Technology for Low Cost Housing with Local Materials, Local Job Creation and Participative Design

This program is object of a very important cooperative project of the German Government with Namibia. It amounts to about 24 million marks. UNIDO could propose a joint task with Germany applying the ideas of technology diffusion and participative design and construction by local people.

A schema of this kind has been tried with success by COPPE (The Graduate School of Engineering of the Federal University of Rio de Janeiro).

II.6 - Solar Energy for Isolated Communities in the Rural Areas

Solar energy projects are quite common today in many countries. Those which have worked the best are located in areas where the locals communities have taken real and commercial interest in the project. A solar energy project can give way to many others not only in its specific area. For example, it could accelerate the plans of the Development Corporation for "planning for village level uplifting" or improve the Farmer Support Program. The main idea is that many activities could be built around a single project.

II.7 - Labour Intensive Technologies to Produce some Goods Locally and Selected to be Protected Temporarily through SACU Agreement Against Imports

This program can be divided into two parts which will then become one after initiation: the production of goods by the modern sector of the economy and the production of goods by small farmers.

The Farmer Support Program and some NGO's are sensitising small farmers on the potential to grow some crops, for example vegetables, develop and retain a local market. This is part of an effort to break dependence on RSA on goods that can be locally grown.

Such effort must receive attention from many sides. First, farmers must he protected from low cost imports. Then they must have technology to produce efficiently and have support for the marketing of their products. It is just not possible to think of sensitising small farmers to grow vegetables if nobody will after attend to their marketing needs.

A specific product can he tried at first. Through it linkages with other products and services can be produced and in this way many people and groups of people will participate: those that will produce working materials and equipment (supported and in business with the modern sector), vocational training centres (with a very specific mandate), educational colleges can support the effort in many ways, maintenance shops can he built and so on.

II.8 - Wood Industry Development through Plantation of Trees with the Support of the Joint Implementation Program for the Abatement of Carbon Emission to the Atmosphere (Greenhouse Effect Conference in New Delhi, India, January 1997)

Namibia can take advantage of the Joint Implementation Program by proposing a full fledged project. With its support the country can initiate a long term process for reforestation and the creation of a larger wood industry under conditions of sustainability.

II.9 - Diamond Processing Technology for Increasing Value Added of Exports in Large Scale

Although mining is dominated by foreign companies, it should be possible to interest them in participating in the transformation of raw materials into more processed goods. One clear example is the possibility to create a real jewellery industry from diamond (and other minerals) processing.

The main initial activities can be:

i) design of a strategy to create a jewellery industry in Namibia;

ii) interest private mining companies in accompanying the strategy;

iii) create the enterprises for processing jewels, in particular diamonds.

III. RESEARCH INSTITUTES

III.1 - The Geological Survey

The Geological Survey is one of the country's most advanced research and service institution in the public sector. It has 8 professionals[1] and in general finds it difficult to recruit black Namibians because they had little scientific education in the past. It holds working relations with European countries, in particular, Germany.

The growth potential of the Geological Survey is important. Today, however, in spite of Namibia's rich mining grounds, there is an over supply of minerals in the world, which difficult further exploration and investment. This is to be contrasted with the oil potential, which is being explored by several companies.

The infrastructure is very modern. Its building and laboratories are at world level, having new equipment, computer scanning system. Some improvement maybe necessary in the laboratories such as the chemical one, but in general the Survey has all it needs for its work.

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[1] Out of about 80 geologist and mining engineers in the country. Others can be found in the Ministry of Mines and Energy and private companies.

Main capacities are in the production of geological maps. Also there is capacity to develop software. It uses local companies for computer maintenance, with Namibian technicians

III.2 - The Central Veterinary Laboratory

The operation of this Laboratory is vital to one of the country's most important products. The result of its work can be judged from the fact that cattle diseases are well under control. It follows international standards in quality control for exports. The Laboratory is leader in Africa in its field. The work in the laboratory is complemented with measures such as the existence of a "red line" near the Angolan border to bar other cattle to come further south.

About 90% of the work done in the laboratory is addressed to commercial farmers. These pay only some of the services. There is also a network of veterinarian centres lined to it.

The staff comprises 14 technicians, 6 assistants and 6 scientists with Ph.D. and M.Sc. degrees. They have graduated in schools in Germany, the United States, Great Britain, Cuba and South Africa. The latter group has a modern molecular laboratory at its disposal and results of research are published in the best international journals.

The Laboratory has an important potential to be transformed a full fledged national institution/agriculture centre. Should this step be taken it could link better with the University and thus overcome the fact that training at the higher education institution is not so good for scientists as these need more experimental work.

III.3 - The National Marine Information and Research Centre

This Centre was created by funds collected from proceeds of the fishing industry. It has modern well equipped laboratories. The results of its work are applied to support fishery and they include sea biology and processing of satellite information. The Centre has a staff of 22 biologists, from which 5 hold M.Sc. and 2 Ph.D. degrees, most graduated from South African and European schools.

III. 4 - The Namibian Institute of Mining and Technology in Arandis

It is quite impressive to arrive to the Arandis airport, near the Rössing uranium mine in the middle of the dessert, after flying from Windhoek and finding there the modern building of the Institute. It was established by Rössing as its contribution to the built up of the country after independence.

It is today recognised that a technical institution naturally benefits from having the long term support of a major company. Locating it near the company enables an

important interaction between the two, particularly regarding the provision of practical training.

The Institute is well equipped, with workshops, for training middle level technicians in several professional skills. It holds an important potential as the demand in the country is still growing for artisans, technicians and supervisors in the mining, metallurgy, geology and engineering disciplines. This potential is further enhanced with the need to train black Namibians so they can take up many more skilled jobs.

With the relatively few numbers of more technical graduates required in industry, it is unlikely that the country could support graduate higher education in the mineral extraction disciplines. It is here that a gap is perceived in the education facilities within the country, which needs to be bridged for the benefit of the mining, engineering and other industries.

The Institute offers classes to both full time and day - release students the latter being mainly Rössing employees and Arandis, Swakopmund and Walvis Bay residents. Its main objective, as mentioned above, is to equip Namibians with the skills that will enable them to take up positions within the mining and engineering industries.

Training is presently provided for:

- Fitting and Turning (including Machining)
- Boilermaking/Plating
- Diesel Machines
- Auto mechanics
- Welding
- Electrical
- Instrumentation

Theoretical studies are complemented by courses in mathematics, engineering science, drawing, industrial electronics and applied trade theory. All training takes the two modalities of apprenticeship or skills training.

The Institute is managed by a Director appointed by the Board of Governors who is responsible for both academic and financial performance. It is envisaged that the Institute will be partly self financed for both capital and operational costs, obtaining funds from tuition and residential fees, central government and private support and other benefactors. For this purpose a Trust, known as the "Namibian Institute of Mining and Technology" has been created.

In Arandis, there exists a town with good infrastructure and sporting and sporting and other recreational activities. The existing schools in the town are of good standard and already attract people from other areas of the country.

IV. CONCLUSIONS AND RECOMMENDATIONS

(1) An important institutional development in science and technology has been the creation of the Ministry of Higher Education, Vocational Training, science and Technology. The Ministry is well placed to can act as an efficient Secretariat of an Action Board.

(2) The need to develop S&T is already recognised but, there is still a lack of understanding on how to go about relating S&T with economic and social processes. One commonly held view, in particular in the modern sector, is that technology is already available in more developed countries and, it should he sought there. This view is very short-sighted and needs to he overcome;

(3) In spite of the above, it is recognised that there exists an extreme technical dependence from South Africa, and this is situation that needs to be modified, recognising that Namibia cannot he technologically independent because of the size of its markets and capacities;

(4) There are few but solid applied science research organizations, for example: the Geological Survey, the Desert Research Centre, the Central Veterinary Laboratory or the National Marine Information and Research Centre. These have some ties to technology development and the innovation system. It is important to highlight the existence of such centers of excellence. They have high level scientists who can make important inputs to diffuse scientific and technical knowledge;

(5) For the time being it is not necessary to start new R&D institutions but to strengthen those which already exist. In particular, it is necessary to improve the infrastructure for research and services at UNAM and the Polytechnic. The existing one today is not sufficient to efficiently carry our R&D or services tasks for the productive sector;

(6) The University is more developed in the social sciences than in natural sciences and there a few technological research programs in course. The science and technology subjects in the programs have been introduced as a result of planning, but it is necessary that technical capability be developed to achieve the stated goals.