

Mauritius Research Council

Thematic Working Group

MANUFACTURING TECHNOLOGY

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PREFACE

The Mauritius Research Council set up nine Working Groups on Science and Technology, and one of them is the “Manufacturing Technology” Working Group. This Working Group met seven times during the period 21st May to 30th July 2001, and was made up of eleven members representing different sub-sectors in manufacturing.

The overall goal of the Working Group was to provide policy guidelines to the Council, with regard to research priorities in the form of a list of prioritised topics for research and specific recommendations for action by the Mauritius Research Council. This report takes care of the main issues affecting the manufacturing sub-sector and attempts to highlight such measures as can expedite technological development with ensuing social and economic benefits to the population.

The research priorities proposed will require adequate financial and other resources, and necessarily need high level commitment by Government, the private sector, and all relevant stakeholders.

As the Chairman of the Working Group, I wish to thank all members and other participants for their devotion and hard work during this short period, and the efforts made to come up with this report in spite of the many constraints. They showed a spirit of real team-work. Particular thanks are due to the staff of the Mauritius Research Council that provided all support necessary to complete this exercise.

Prof. Soodursun Jugessur

15 August 2001

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List of ABBREVIATIONS

AGOA	<i>African Growth and Opportunity Act</i>
CAD	<i>Computer Aided Design</i>
DCDM	<i>De Chazal Du Mée</i>
EPZ	<i>Export Processing Zone</i>
EPZDA	<i>Export Processing Zone Development Authority</i>
GDP	<i>Gross Domestic Product</i>
ICT	<i>Information and Communication Technology</i>
JEC	<i>Joint Economic Council</i>
MEPZA	<i>Mauritius Export Processing Zone Association</i>
MRC	<i>Mauritius Research Council</i>
MSA	<i>Mauritius Sugar Authority</i>
MSPA	<i>Mauritius Sugar Producers Association</i>
NHPA	<i>National Handicraft Promotion Agency</i>
SME	<i>Small and Medium Enterprises</i>
SMIDO	<i>Small and Medium Industries Development Organisation</i>
UOM	<i>University of Mauritius</i>
WTO	<i>World Trade Organisation</i>

REPORT

I INTRODUCTION

The purpose of this Study Report is to identify projects that will consolidate the industrial structure. More importantly, it seeks to put the manufacturing sector on a new trajectory with high sustainable growth. It takes into account the physical environment, qualitative and productive job opportunities, value added, linkages and appropriate technology. The projects are conceived against a backdrop of Mauritius' ambition to play both a hub and a leader in the region. Mauritius recognises the natural phenomenon of delocalisation with growing product maturity and rising production costs. As such, it seeks to position itself to take advantage of regional opportunities in addition to penetrating new markets in the US and Europe while consolidating its traditional markets. Moreover, in the wake of growing globalisation, it is imperative for Mauritius to sharpen its international competitive edge. The identification of some of the projects aims to achieve this very objective, directly or indirectly.

This anthology of projects is the outcome of seven brainstorming sessions with resource persons from different walks of the working world. It was a frank exchange of views from a blend of people who had a first hand experience as manufacturers, academia and policy-makers. The report is structured as follows. The introduction discusses the purpose of the report and ambition of Mauritius. The background focuses on the strategies adopted. It also contains a brief critical and historical overview of the manufacturing sector since the early 1960s. A current status on the performance of the manufacturing sector is intended to help assess the magnitude of the problem and the need to implement the projects identified, though these are by no means an exhaustive list. The section on sunrise, sunset and environmentally friendly industries set out the framework to adopt the best strategy for the transfer of technology and the modernisation of the manufacturing sector.

II THE RELATIVE IMPORTANCE OF THE MANUFACTURING SECTOR

For the past four centuries, Mauritius developed primarily as a plantation economy with the sugar industry dominating every sphere of domestic life. Agriculture as an industry underwent a process of diversification into tea and tobacco production. Sugar, however, maintained its overwhelming dominance. In spite of the start-up of import-substitution manufacturing activities, Mauritius remained essentially a producer of primary products until the mid-1970s.

As from the early 1970s, Mauritius embarked on a dual industrialisation programme. An export processing zone legislation was enacted and the incentives for import-manufacturing activities were formalised in "a Development Certificate" legislation. This dual approach to industrialisation created thousands of jobs during the 1970s, considerably relieving the unemployment problem. Indeed, the targets as set in the Plan Document (4-year plan) were exceeded. It made a significant contribution to value added and Gross Domestic Product. The emergence of manufacturing activities on an industrial scale strengthened the economic structure, making it less vulnerable to external shocks and reduced export volatility.

At the close of the 1970s, growth started to taper off because the strategy adopted created a dichotomy in the economy. A fast efficient export-oriented sector was flourishing alongside a slow inefficient inward-looking sector. The market suffered from distortion in the allocation of resources. In the wake of structural reforms during the late 1970s and early 1980s, the manufacturing sector was revamped. A package of reforms was introduced. Government adopted an export-led strategy. The EPZ grew by almost 30% annually during the mid-1980s. Employment exceeded the 90,000 mark by early 1990s. The EPZ became the lead sector, having surpassed sugar in 1985 and was the main engine of growth. During the 1990s growth has slowed down, averaging between 6 to 8%. Inefficient firms have been weeded out while the sector sustained an unbroken growth throughout. After falling to around 80,000, employment has started to increase again, albeit slowly. In 1999 manufacturing activities, however, grew by only 2.5% owing to severe drought prevailing in the country. The growth rate for 2001 is forecast at 6.5% and the level of exports is poised to exceed the Rs. 34 billion mark.

The role of the Manufacturing Sector in the development of Mauritius cannot be under-estimated. For the year 2001, its estimated contribution (EPZ, milling, and Other Manufacturing) to Gross Domestic Product (GDP) is Rs. 27.4 billion, which represents 24% of total GDP compared with only 15% in the mid 1970's¹. Currently, sugar milling accounts for about 1%, EPZ production 12% and Other Manufacturing 11% of GDP. With this ratio Mauritius satisfies one of the conditions of eligibility as a newly industrialised country. It clearly demonstrates the importance of manufactured export goods.

Total employment in that sector may have exceeded 150,000 persons (a share of about 30% of total employment) as at March 2001 with the EPZ representing a workforce of 93,200 - the biggest sub-sector employer. Total enterprises in the manufacturing sector (large establishments) may have reached around 1,100 in 2001 with 527 in the EPZ sector. Most manufactured output is exported. During the year 2000, exports for EPZ and sugar amounted to Rs. 31.2 billion and to Rs. 5.5 billion respectively.

The African Growth and Opportunity Act (AGOA) is expected to open new vistas for the expansion and diversification of the manufacturing sector (textile and non-textile products) with a higher share of value added and an increase in foreign exchange earnings. It is expected that the US with an actual market share of 24% of EPZ exports will be the No 1 market for the country with the AGOA.

¹ The statistics in the 1970s do not include Rodrigues

III CURRENT STATUS

DEPENDENCE ON LOW TECHNOLOGY

For the purpose of this report, the word 'technology' can be said to refer to anything that involves mechanical and intellectual processes in the transformation of raw materials into finished products.

Research indicates that the technology employed in Mauritius is fairly low. As pointed out by the Joint Economic Council (JEC)², Mauritius has stayed restricted for too long time in industrial activities that have limited learning potential and spill over benefits. Both sugar and apparel utilise low technology. This has created a business, technology and training culture that is hardly conducive to integrating both technology and information.

R. Dubois³ (1995) found that only 16% of Mauritian enterprises possessed the latest technology; 62% were aware that there exists a better technology than they currently have. Out of the 16% claiming to possess the latest technology, 38% came from enterprises with a Pioneer Status Certificate (See Annex 5).

A PASSIVE PRIVATE SECTOR

The private sector has not been in the forefront as far as technology and innovations are concerned. The private sector in general appears to have adopted a passive attitude to technology. They seem to have restricted themselves to lobbying for incentives rather than striving to achieve international competitiveness through internal efforts. Research culture has not developed at a proportional rate corresponding to the growth rate of the sector. It is time that a propitious climate to generate confidence and build a research culture be created. However, this is easier said than done in that there may not be available sufficient researchers to carry on. A first step is to take an inventory of the type of manufacturing activities that have dominated the economic landscape, and given the level of development attained, identify new types of manufacturing activities requiring higher technology and having higher growth potential.

SUNRISE, SUNSET AND ENVIRONMENT FRIENDLY INDUSTRIES

For analytical purposes and when formulating policies for this century, it may be useful to group industries under three broad headings. These are:

- (i) Sunrise industries⁴
- (ii) Sunset industries⁵

² The Economic transition of Mauritius, JEC, Feb 2001

³ Technological Competence in Mauritius, Dubois P. R. et al, MRC, Oct. 1995

⁴ Coined in 1983 by Babylon Mink, the "sunrise industry" describes the new, then successful manufacturing industries upon which the economic sun was supposedly rising e.g. high-technology, electronics, robotics, microchips, sophisticated automation and computers

⁵ A sunset industry is one on the way out of its window of economic viability. Some historical examples have been coal mining in Wales and steel mining/production in South Africa. The South Africa mining industry, for instance, is

(iii) Environment friendly industries⁶

A Sunrise Industry is nowadays referred to as an industry that is growing quickly and expected to be increasingly important in the future, that is, the knowledge industry or new economy. In the context of Mauritius, emphasis could be laid on the exploitation of marine resources. Another is Biotechnology with significant impact potential on agriculture and food production without neglecting ICT, which are the subject of separate Working Groups.

The marine technology, for instance, is a high growth “sunrise” industry with potential for productivity gain especially in terms of aquatic culture, energy production, clean water availability and exploitation of metallic nodules. The separation of hydrogen gas from liquid water is a potential source of renewable energy. Projects on exploitation of marine technology have been treated in another brainstorming work group and are compiled in a similar booklet. Research Topics in this theme appear in the Marine Resources Working Group. However, any project having futuristic trends and leading to improvements in the design, productivity and marketing are also classified herein as Sunrise Industries.

A Sunset Industry is an industry that is growing slowly or declining. The sugar industry in Mauritius can be qualified, to some extent, as a sunset industry. The challenge for Mauritius is to ensure the survival of these industries through the advent of new technology, utilisation of lower inputs, rationalisation, a reconciliation of modern managerial methods and exploitation of scale economies to minimise production costs and secure niche markets. The introduction of new technology can actually reduce the amount of resources necessary to produce same output or enhanced output. Indeed a sunset industry can still be significant in terms of economic growth, foreign exchange earnings, value added and productivity gain if appropriate actions are taken in time. The strategy therefore is to revamp them by introducing new technology to ensure their competitiveness.

An Environment Friendly Industry provides for desirable externalities. In today’s world, environmental protection has become a topic that greatly concerns all of humanity. The environmental protection industry is steadily gaining ground. It has already become one of the fastest growing industries in the world. The annual business of the environmental protection industry was estimated at US\$ 600 billion by the year 2000. This far exceeds other sunrise industries such as tourism and software.

In the context of the Manufacturing Sector, much stress has been laid so far on the development of the Sunset Industry and little on the Sunrise and Environment Friendly Industry. Since the Manufacturing Sector is a vulnerable one, and is always subject of new challenges and threats, it must be constantly maintained in focus and under review to cope with these challenges. As an illustration, the export performance in the Manufacturing Sector between 1980 and 2000 is depicted in Annex 3, and the employment situation in Annex 4.

considered to be a sunset industry as it is experiencing sharp decline in terms of employment, output and contribution to foreign exchange earnings

⁶ The environmental protection industry (or environment friendly industry) in its broader sense includes all activities that prevent environmental pollution, improve ecosystems, and protect natural economic resources. It is one which recycles its waste products that may be harmful to the environment into raw materials which could be used in other areas/sectors

MANUFACTURING SECTOR AND EMPLOYMENT

In 1998 there were 945 large⁷, 2,800 small⁸ and 1,800 itinerant⁹ units operational in Mauritius. The total number of employees in large establishments rose from 107,354 in 1996 to 114,477 in 2000. Employment in large EPZ firms rose by 8,690 during the same period while in the sugar industry, employment level fell from 5,039 in 1996 to 3,358 in 2000. Within large EPZ establishments, the wearing apparel group is the leading employer with total employment for this group reaching 73,881 in 2000. (See tables in Annex 4). It is expected that this sector will continue to be a major employer in the years to come, and hence adequate attention should be given to maintaining and promoting especially the small and medium enterprises, while giving them the tools to upgrade their technologies.

⁷ Large establishments are those employing 10 or more people.

⁸ Small establishments are those employing less than 10 people.

⁹ Itinerant units are those having no fixed place for operational and consists mainly of food producers and sellers eg hawkers.

IV THE CONSTRAINTS AND CHALLENGES FACING MANUFACTURING TECHNOLOGY

Manufacturing technology suffers from a whole range of constraints arising out of paucity of trained manpower, inadequate institutional and legal structures, and insufficient funds for promoting the sector. With globalisation, the challenges facing the sector have multiplied. New strategies have therefore to be adopted. The following have been identified as the main ones by the Working Group:

1. Absence of a **Technology Incubator Centre** which could enable industry, academia, entrepreneurs and financiers to interact, and assist in adopting innovative concepts and devices to promote productive, competitive and efficient manufacture.
2. Non-competitiveness of the **handicrafts sector** that still uses old technology, and does not have the means and the know-how to incorporate more up-dated technologies that can enhance its productive and employment capacity.
3. Inadequate **knowledge of the problems and needs** of the companies in the manufacturing sector which could be improved with adoption of latest technologies and production methods and marketing.
4. Necessity to **re-assess the recycling of wastes** which have become a real nuisance and need new ways and means to take care of them and make them profitable.
5. **Non-competitiveness of the fishing industry** that still uses obsolescent technology and does not have trained man-power to enhance its production and marketing.
6. **Obsolescence of technology** used in the **construction sector**. The sector is likely to reduce employment for low skills but will become more efficient by adopting modular construction methods.
7. Absence of a **technology-guide for small and medium enterprises and industries** that could assist small entrepreneurs to complete necessary formalities, get financial assistance, acquire necessary technologies, and know the markets.
8. Need to assess the possibility of upgrading/converting **old textile machinery** to suit the needs of the fast growing and competitive textile industry.
9. Inefficient utilisation of **by-products of sugarcane**, that could have been utilised more profitably by converting them into other value-added goods.
10. Negative impact of **sugar-mills centralisation** on the social and economic life of the workers.
11. Need to assess the manufacture of products other than sugar from sugar cane, and review **existing laws** prohibiting other uses of sugar cane.

12. Need to assess the impact of **information technology in the sugar-industry**. IT has the potential of enhancing productivity and efficiency, but can also affect employment opportunities.
13. Need for improved **designs for sugar-mills** with latest technologies.
14. Need for stressing on **export oriented manufacturing** to increase domestic income.
15. Need for **establishing manufacturing industries outside Mauritius** to compete with countries like China and Bangladesh where labour is cheap.
16. Need for a **network of Mauritian Diaspora** settled in developed and fast developing countries, that can assist in acquiring latest technologies, finding partners and finance for joint ventures, and markets for manufactured goods.
17. Weaknesses of **family-business culture** and the need for expanding into publicly owned manufacturing companies.
18. Need for manufacturing enterprises to achieve **quality of manufactured goods** in line with international standards, and for the Standards Bureau to monitor such quality.
19. Lack of **local awards**.
20. Lack of **institutional coordinating mechanism** with National Science and Technology Commission for many years. MRC is now trying to fill this gap.
21. **Limited role played by the private sector** in the promotion of Manufacturing Technology and in the support of applied research.

V PROPOSED RECOMMENDATIONS AND MEASURES TO ENHANCE MANUFACTURING TECHNOLOGY IN MAURITIUS

Each of the constraints and needs identified above can be taken care of by adopting suitable measures that can enhance the productive and competitive capacity of the manufacturing sector. A set of measures are given below:

1. Government should set up a task-force to put in place a Technology Incubator Centre (see Annex 2), in collaboration with MRC, universities, representatives of the manufacturing sector, bankers, and patent specialists and knowledgeable people. The task force will recommend in detail what is required for a successful technology-incubator centre.
2. In the handicrafts sector, it is necessary to conduct product/market study to establish ways and means to improve existing craft products regarding style, design, presentation and marketing. Weaknesses of the sector should be highlighted so that suitable measures are taken to take care of them.
3. For the entire manufacturing sector, a survey of manufacturing technology needs should be undertaken in order to be able to assist them in the selection and acquisition of latest technologies and markets. MRC with the assistance of local expertise should undertake the survey.
4. In the waste management sector, a study should be undertaken to establish how waste can be separated into usable materials, and how organic materials, plastics, and glass could be recycled. The study should urgently lead to the setting up of waste recycling plants so that manufactured goods could be placed on the market.
5. The non-competitiveness of the fisheries sector can be attributed to the poor technology utilised, the poor knowledge of fish stocks in the Exclusive Economic Zones, and to the existing legislation affecting the sector. A study should be undertaken to establish the exact situation concerning the above parameters, and on ways and means to make the sector more profitable.
6. The construction sector still relies on classical construction methods while the outside world is moving towards design and use of ready-made panels to expedite the building completion. A study should be carried out if such an approach can be applied to the Mauritian context where tradition still dictates construction methods.
7. In the domain of SMEs, there is need for traditional SMEs to transform into efficient, internationally competitive and export oriented enterprises. A research study should be undertaken on the present technology level in selected SMEs, and on ways to enhance their quality, competitiveness and profitability.
8. The textile industry is facing the intense competition from countries where labour is cheap, and can therefore not compete with them. There is need to move to manufacturing of high value/fashion products while observing high quality standards, and utilising latest manufacturing technologies. A study covering the above needs should be carried out with the collaboration of the University of Mauritius, the Mauritius Standards Bureau, and representatives of the textile sector.

9. One of the main by-products of the sugar industry is molasses. The major part of the 180,000 tons produced is sold at very low prices to overseas buyers. A study can be undertaken to see to what extent it can be converted into industrial alcohol which can be used as additive to imported transport fuel, highlighting its feasibility, and social acceptance.
10. The centralisation of sugar-mills in order to ensure its survival and enhance the profitability of this sector is raising eyebrows amidst the social and political circles. A study should be urgently carried out by MRC in collaboration with concerned groups to look into social impacts of this centralisation as well as on ways and means to take care of the problems that arise, in order to safeguard the survival of this sector.
11. Some products other than sugar can be more profitable, especially to small-scale producers. However existing laws concerning sugar cane do not allow such activity. A study should be carried out about the economic viability of producing things like jaggery, canned cane juice or raw non-crystallised sugar that can be marketed locally and abroad. Existing laws should be reviewed in the light of positive recommendations.
12. Information technology has the potential of enhancing the productivity and efficiency of the sugar industry. A study should be carried out to assess the impacts of IT on this industry and see to what extent it will also affect employment.
13. With the advent of new technologies, specially in micro-electronics, robotics, information technology, classical designs of the sugar-mills need to be reviewed, and new designs developed to make the sector more integrated and profitable. A study should propose the type of new design required.
14. Unless local manufacturers produce high quality goods for the export market, the local market being too small, they cannot survive, especially in the face of competition from imported goods. Hence export oriented manufacturing should be encouraged by the government, with suitable packages of incentives.
15. Since Mauritian labour costs are becoming very high, and the manufacturing sector cannot compete with other developing countries, there is need to start manufacturing in other countries where labour costs are low. A study should be carried out to propose those countries where Mauritian enterprises can transplant their production to compete with international manufacturers.
16. The implication and potential input of the implementation of WTO provisions on the Manufacturing Sector, and the measures that must be taken to adapt to the new environment.
17. National awards for innovation in the Manufacturing Technology need to be popularised by MRC.
18. The search for up-to-date technologies, finance and market can be facilitated if a network of people of Mauritian origin, settled abroad, can be developed. A study should be made of Mauritian Diaspora willing to assist the development and enhancement of the manufacturing sector.

VI LIST OF RESEARCH TOPICS THAT NEED TO BE UNDERTAKEN

The projects set out below are the outcome of seven brainstorming sessions. Key resources were mobilised. The projects have been identified as priority projects but regardless of its ranking.

TOPIC 1: DEVELOPMENT OF A NETWORK OF MAURITIAN DIASPORA IN THE FIELD OF MANUFACTURING TECHNOLOGY.

Objective

Develop a network capable of enhancing capacity to source global technologies and assist in implementing projects in Mauritius.

Justification

There is a vast pool of Mauritian expertise that has settled abroad, specially in developed countries, and that may be willing to contribute to an accelerated technological development in the home country. Presently they are working or studying in different countries, and have acquired knowledge and skills that can be gainfully exploited by Mauritius. They can assist in providing information on suitable and latest technologies available, and in assisting Mauritian entrepreneurs acquire such technologies. Often, as born Mauritians still concerned about development of their motherland, they are willing to provide their expertise at nominal or no cost, provided they are given the necessary opportunities. The proposed network will establish close links with them and keep them informed of needs and opportunities here.

Methodology

An appropriate questionnaire will be developed and sent to all Mauritian Embassies and Consulates in selected countries. The cooperation of the Ministry of Foreign Affairs will be sought for forwarding the questionnaires to relevant nationals and people of Mauritian origin settled abroad. They can also ensure that these questionnaires are filled and returned. They will thus assist in providing the relevant coordinates of these people and their expertise. A data bank will be developed locally at the Mauritius Research Council, for subsequent use by all interested.

Expected Results

A computerised databank of Mauritians abroad and of people of Mauritian origin, engaged in or interested in technology related enterprises, easily accessible through the internet to interested parties.

Resources required: Rs. 250,000.00

Time Frame: One year

Cooperating Institutions:

Ministry of External Affairs, Mauritian Embassies and Consulates in Europe and America.

TOPIC 2: SURVEY OF MANUFACTURING TECHNOLOGY NEEDS OF MAURITIAN ENTERPRISES

Objective

To assist Mauritian enterprises in selecting and acquiring suitable technologies to enhance their production.

Justification

The development and acquisition of suitable technologies to accelerate technological development in Mauritius starts with a survey of technology needs of the enterprises, having in view the global competitive environment, and the fast changing technological picture. While Mauritian enterprises are individually sourcing their own technologies, and are often unaware of latest technologies in their field, or are constrained by circumstances to stick to what they have, they need to be assisted by providing them with a wider range of suitable technologies to choose from. International entrepreneurs interested in joint ventures can also gain from knowledge of Mauritian technological needs. The MRC, with assistance of local expertise, can play a crucial role in this process. Hence a survey of their present needs and those in the near future is urgently required.

Methodology

With the assistance of knowledgeable people, an appropriate questionnaire can be developed. The assistance of the University Faculty of Technology will be sought in providing undergraduate or graduate students who can help to have the questionnaires filled, through field visits and interviews with enterprise bosses and technicians. The data compiled will be analysed, and the needs prioritised, depending on their potential in enhancing technological development and in easing the employment situation in the country. The use of Mauritian Diaspora settled in developed countries, in selecting and acquiring the technologies will be sought, once the needs have been expressed in concrete terms. A brochure highlighting these technologies needs will then be published and made available to interested people and partners locally and abroad.

Resources required:

- A consultant to develop the questionnaire on manufacturing technology needs.
Two graduate students from the University of Mauritius
- Resources for publication of brochure.
- Rs. 150,000

Expected Results:

A comprehensive computerised data bank of technology needs of Mauritian enterprises, and a brochure for exploitation by concerned stakeholders.

Cooperating Institutions:

UoM, Ministry of Industry, Chamber of Commerce and Industry.

TOPIC 3: TRANSPORT TECHNOLOGY FOR IMPROVED MANUFACTURING PERFORMANCE

Objective

The objective of the project is to investigate the why (?) and how (?) of transport technology and transport modes in improving international competitiveness of manufactured exports and in facilitating movements of goods and people for the manufacturing sector both within the factory and external to the factory.

Project Description

The project will determine the contribution of transport technology in the manufacturing sector and the needs for transfer of appropriate transport technology to achieve stated goals as well as the legal aspects of technology transfer.

Background

Transport is the artery of development. It is a key component in manufacturing activities. It is therefore essential to review both the transport sector and the manufacturing sector in conjunction. The performance of both sectors is inextricably linked and interdependent. The manufacturing sector is the largest economic sector in terms of output, employment and foreign exchange earnings. Its share of GDP has rotated around 23.5% for the period 1998-2001. It is expected to grow by 6.8% in 2001. The shares of the EPZ, non-EPZ and sugar manufacturing activities in GDP for the year 2001 are expected to be 11.7%, 10.7% and 0.9% respectively. 29.6% of the people in employment work in this sector in 2000. EPZ products and sugar account for 97% of total exports (EPZ: 82% and sugar: 15%).

"Textile and wearing apparel" comprised 54.4% of the enterprises in the EPZ sector, employed 79,813 persons (88.0%) in December 2000 and represented 86% of EPZ exports and 71% of total exports.

Justification

With globalisation it is becoming increasingly difficult for the sugar sector to compete internationally. In order to survive, the sector will have to resort to downsizing, centralisation and rationalisation of activities. With centralisation the sugar cane all around the island will have to be carried to only a few factories and the final product will be transported to the Sugar Terminal.

With the African Growth and Opportunity Act, new markets are opened to Mauritius. One implication is to raise value-added to meet the conditions. To do so, firms will have to be fully integrated (vertically, horizontally and diagonally). This may have serious economic and social implications. For instance, the factory must be larger, more security conscious, with bigger stores for inventories and an economical transport mode reflecting economic needs and efficiency criteria. With the multi-fibre agreement due to be phased out by 2005, Mauritius will face increased competition from low-cost, large volume producers. We will thus have to move to capital intensive units as human resources become more expensive and scarce. The cost of transport charges is a key determinant factor. In this context, new modes of transport will have to be designed, the optimum size determined, the fuel

consumption and environmental impact assessed. The new modes of transport will have to take into account efficiency, competitiveness, speed, economies of scale and appropriateness of technology to ensure international competitiveness and penetration of markets. The new modes of transport will carry the raw materials to the factory and take the finished products to the port. In parallel, goods and people have to move within the compound of large integrated and spacious factories.

Cost of Project: Rs. 3-4 million

Duration of Project: 6-9 months

Methodology:

- (i) Desk research;
- (ii) Survey;
- (iii) Carry out inventory of current transport technology;
- (iv) Sensitivity analysis and simulation; and
- (v) Develop appropriate model for a holistic approach.

Output:

- (i) Assess the impact of transport technology on performance of main economic activities; and
- (ii) Make recommendations to reduce cost of production, improve commerce and enhance international competitiveness through more appropriate, efficient and least cost mode of transport.

Beneficiary:

Commuters, the industrial sector and the public at large.

TOPIC 4: RESEARCH STUDY ON TECHNOLOGY TRANSFER AND APPLICATION IN SMALL AND MEDIUM ENTERPRISES

Objective:

The objective of the study is to encourage SMEs to continuously adapt, innovate and improve their technology in order to increase productivity and efficiency. In this context it is proposed to have the services of Mauritius Research Council to:

- (a) Carry out a research study on present technology level in SMEs operating in 6 sectors namely metal, printing, plastic, jewellery, leather craft and wooden furniture.
- (b) Make available consultants to conduct the research study in at least 10 selected SMEs in each sector.
- (c) Propose a technology guide for promoting and disseminating technology transfer in SMEs.

Brief Background:

Investment on production equipment in these sectors varies from Rs. 20 million to Rs. 130 million. There are 900 firms registered with SMIDO and approximately 9000 employment has been created in these sectors.

These sectors are regarded as the backbone of industrial development since they enhance the capabilities of other industrial development sectors as well. Research by SMIDO has indicated that there is a lot of work to create an enabling environment for technological innovation in SMEs. Generally, SMEs are more focused on day-to-day operations. Efforts have to be put to motivate enterprises to further invest in new equipment with appropriate technology and sourcing of the right materials.

Methodology:

The steps below will allow the consultants to understand the levels at which the enterprises are operating, to propose changes and to ultimately write the guide.

1. To review each sector by diagnosing the existing technological problems of at least 10 SMEs in respective sectors.
2. To carry out research in selected firms on new technologies, which have to be adapted to local needs.
3. To make proposal and recommendations for these problems.
4. To recommend step-by-step guide explaining technology identification, acquisition, absorption and management of technology transfer.
5. To submit a technology guide for the said sectors to support productivity and technical development of SMEs.

Resource Requirements:

Financial Input: Multi-disciplinary project team of consultants including project leader: Rs. 1,2 million.

Manpower: Consultants should hold advanced degree with extensive industrial experience at least ten years relevant to the sectors.

They should have successful track record in diagnosing technological problems and providing technological solutions in the relevant sectors.

The team leader should be able to coordinate the activity of the consultants in all the six sectors and to prepare a strategy to support SMEs which lack specific technological and strategic capabilities.

Equipment : Logistic support on agreed terms.

Institutional Support: Mauritius Research Council
Small and Medium Industries Development Organisation (SMIDO)
University of Mauritius
Mauritius Standard Bureau
Overseas Consultants

Time Frame : 3 man-months.

Expected Result

The steps outlined in the methodology leading to the production of the guide will help selected firms to improve their productivity. At the end of the project period, all SMEs in the respective sectors will benefit, as the guide will be utilized as for reference purposes.

Beneficiaries

The direct beneficiaries of the project will be:

- Mauritius Research Council, SMIDO and other institutions
- SMEs
- The Business Community in Mauritius
- Lecturers and the student of the University of Mauritius

TOPIC 5: STUDY OF THE IMPACT OF MILL CENTRALIZATION ON THE COUNTRY AT LARGE

Background

The sugar industry of Mauritius is faced with a major issue regarding its production costs. Indeed, forecasts indicate that the selling price per tonne of sugar to our traditional buyers in the European Union, will decrease drastically in the coming years reaching a total decrease of the order of 38 per cent (on the present sugar selling price) in five years time. Survival of the sugar industry is therefore subject to at least a corresponding decrease in its production costs over the coming years. Decrease in production costs may be achieved through a number of initiatives which may not always be easily acceptable, particularly to those traditionally involved in the very production of the sugar. Decrease in production costs may be obtained through the application of the following measures amongst the large number of possible actions:

- a) Increase in production volume per factory
- b) Decrease in direct production costs through costs reduction in all areas of activity.
- c) Decrease in labour costs through reduction in labour employed.
- d) Automation of manual activities requiring a large number of workers.
- e) Centralisation of identical activities (such as purchasing offices, workshops, stores, administration) from a number of small factories towards a better organized central office.
- f) Centralisation of milling activities into much higher capacity mills capable of handling more efficiently much larger volumes of canes annually.
- g) Increasing the length of the sugar crop in order to utilise the existing equipment more efficiently.
- h) Mechanisation of agricultural activities regarding planting, fertilising, irrigating, cutting and loading of canes in the fields.
- i) Rationalising transport of canes from the fields to the factory through the utilisation of larger pay load transports.

Objective

A number of issues following these doom predictions shall have to be studied in order to make sure that the changes to be undertaken are effective in achieving the desired results and are also acceptable to the Mauritian community at large.

Methodology

The Research Study should look into the various aspects of Mill Centralisation as mentioned in the few points listed above. Indeed the Research Study should also address the effect of Mill Centralisation on the country at large including:

- Human aspects (providing new possibilities of work to workers losing their jobs)
- Re-location of these families
- Life in the villages where the mills have ceased their activities
- Impact on road transport with larger cane trucks travelling longer distances.
- Technical aspects of milling activities

- Agricultural aspects of cane production
- Economics and benefits derived from Centralisation of activities.

Resource Requirements:

Financial

Multi-disciplinary project team of consultants including project leader: Rs. 2,0 million

Manpower

A large spectrum of local consultants will be required to tackle the various aspects of the Research project.

They should have extensive industrial experience of the Sugar Industry in order to propose solutions adapted locally.

A large consulting firm of the type DCDM or other similar institution should be the leader of such a project.

Equipment

Logistic support on agreed terms.

Institutional Support

Mauritius Research Council
 Mauritius Sugar Producers Association
 Mauritius Sugar Industry Research Institute
 University of Mauritius

Time Frame

Once the research project is awarded, the preliminary report should be made available within a period of six months.

Expected Results

The study taken up as mentioned in the Methodology above, should enable the Sugar Industry at large, to embark in the difficult process of mill centralisation without penalising unduly those who might be left out of the final plan. This study should also help propose suitable solutions as regards problems related to Environment and to Transport on the already over-crowded roads of the island.

Beneficiaries

The direct beneficiaries of the project shall be:

- The sugar community of the island
- The workers of the sugar industry
- The population of the country at large

TOPIC 6: DESIGN OF A CANE SUGAR FACTORY ADOPTING LATEST ADVANCES IN TECHNOLOGY

Objectives

To propose a design incorporating latest developments in cane processing technology from which Mauritian cane sugar factories can draw in order to adopt or adapt items within their individual sugar factories in their quest to increase their efficiency in sugar recovery, energy use and limiting environmental degradation.

Methodology

- To carry out review of current cane processing in Mauritius on a workstation by workstation basis
- To identify areas where state-of-the-art proven technologies can be incorporated and
- To propose a design of a sugar factory 7000 TCD crushing capacity

Brief Background

Significant developments have been occurring over the past decade in the various unit operations in the process of sugar recovery from cane right from cane weighing through to juice extraction bagasse combustion, clarification, evaporation, boiling, crystallisation, centrifugation and the final crystal sugar handling. Such developments, based on energy efficiency and optimising or maximising sugar recovery in an environment friendly manner, have not been properly evaluated in the Mauritian context.

Resource Requirements:

Financial: Rs. 0.5 to Rs. 1.0 million (estimated)

Manpower: 1.0 to 1.5 man months as foreign consultant(s) and a team of local sugar technologists

Equipment: Non except computing facilities

Institutional Support: MSA/MSPA

Time Frame: 6 months

Expected Results

A database incorporating latest developments in sugar cane processing available to the millers especially in the context of centralisation of cane milling activities in Mauritius.

Beneficiaries: The cane sugar industry in Mauritius.

TOPIC 7: WASTE RECYCLING IN MAURITIUS

Objectives

The proposal aims at not utilising dumping grounds but recycling the waste into products that can give a return instead as an expense to the taxpayer.

Brief Background

From last year's figures 375,000 T is being transported (not including the sludge) annually and it will reach 642,000 T in 2020. Mauritius being a small island, dumping scavenging will soon be a nightmare. Proper place to dump is rare; we have risks of polluting our underground water.

Methodology

- (i) To quantify and characterise wastes. It is known that such wastes comprise of plastic, textile, metals, rubber, organic (e.g. kitchen waste, garden wastes, paper, cardboard).
- (ii) To review methods of segregation of various fractions of the wastes with emphasis on its feasibility at household/commercial/industrial levels, as well as collection and transport to alternative end use sites.
- (iii) To propose ways of utilisation of each fraction and identify ones that are more appropriate in the Mauritian context.
- (iv) To carry out feasibility studies for each fraction. The option of incineration of the organic fraction mixed with bagasse may be considered.
- (v) To work out a sensitisation campaign including the feasibility to segregate waste at household level.

Resource Requirements: Rs. 800,000

Investment Forecasts

Saving time in using foreign consultants at a further stage. It is also possible to obtain that study for free from friendly countries (Canada-France).

Manpower: Four months to a foreign consulting firm.

Equipment: Nil

Institutional Support: MSA, MSPA, Min. of Environment.

Time Frame: Six months up to presentation.

Expected Results

Apart from the environment aspect which is difficult to evaluate (cleaner Mauritius, for example) substantial revenue may be perceived.

Beneficiaries: The Mauritian community at large.

TOPIC 8: WASTE REDUCTION IN THE SMALL AND MEDIUM SIZE CLOTHING MANUFACTURERS

Objectives

To propose measures that will reduce waste during the cutting of fabric so as to improve fabric utilisation and reduce raw material cost.

Background

As Mauritius is losing its competitive edge in the region, it is essential that efforts be made to reduce production costs. In general the fabric accounts for more than 50% of the cost of garment. It is obvious that, if the amount of fabric used to produce a garment can be reduced, then a significant saving in garment cost can be achieved. Despite the effort of the EPZDA and SMIDO, the SMEs have lagged behind the larger companies in terms of productivity and quality. They have also not been able to take full advantage of the technology diffusion scheme and the IVTB levy grant scheme for training. However if they are informed of the best practices in the cutting room and also of the benefits that accrue from the use of CAD systems, the SMEs' will be in a better position to reduce costs and waste.

Methodology

A study can be carried out in a sample of small and medium clothing enterprises to understand the current situation in the cutting rooms. The investigators can then prepare a manual of best practices in consultation with these companies.

Resource

Requirements: Financial: Rs. 1.0 M to Rs. 1.5 M

Manpower: 1 Textile/ Mechanical engineer and 1 Management/ Economics graduate.

Equipment: Computing facilities

Support: UOM/EPZDA/SMIDO

Time frame: 1 year.

Expected Results

A manual that will, in very simple manner, explain the best practices in the cutting room for different types of fabrics and garment styles.

A strategic plan that would facilitate at reasonable costs access to CAD systems for SMEs'.

Beneficiaries: The small & medium size clothing manufacturers.

TOPIC 9: DEVELOPMENT OF A TECHNOLOGY TRANSFER NETWORK FOR MAURITIAN COMPANIES AND INDIVIDUALS

Objectives:

To set up a portal which is a collection of websites that will provide information in the field of manufacturing technology. This will also act as a forum where there is exchange of information and ideas among Mauritian companies. Such a network will improve awareness of new technologies.

Background:

Lack of awareness of recent technologies is one of the main factors that restrain the growth of the manufacturing sector. There are organisations such as SMIDO and the EPZDA that provide excellent information services to the textile industry and the SMEs'. However such services are not fully utilised and there is scope for providing a service that is dedicated to new manufacturing technologies. This service should be easily and instantly accessible as well as user-friendly. The maintenance of this portal can be a joint UOM/MRC venture.

Methodology:

The requirements of the manufacturing industry in terms of technologies in operation have to be ascertained initially. This would then be the basis for developing a portal that will include the following features:

- A collection of websites classified according to type of technologies.
- Information about technology licensing
- A public forum for exchange of technology information and ideas.

Resource Requirements:

Financial input:	Rs. 0.5 M to Rs. 1.0 M
Manpower:	1 IT professional and 1 Mechanical Engineer.
Equipment:	Computing facilities.
Support:	UOM/EPZDA/SMIDO

Time frame: 6 months.

Expected results

A website which will be the technology transfer network for the Mauritian Manufacturing sector.

Beneficiaries: The manufacturing sector.

TOPIC 10: PROCESS CONTROL IN CIRCULAR KNITTING

Objectives

To develop an effective monitoring system of the knitting process to avoid defects and to detect defects as soon as possible. Such a system will improve productivity and quality. The system will consist of two main elements: a measuring unit and an automatic detection unit.

Background

T-shirts represent about 30% of the production of the clothing sector and this share of the market is expected to grow in the near future. The fabric utilised for making T-shirts is produced mostly on circular knitting machines. When a defect occurs during production, the knitting machine has to be stopped and the fault corrected, thus resulting in time loss which is uneconomic. The fabric may even be rejected if the quality requirements are not met. A sensor that can detect yarn tension variation may help in avoiding defects. Automatic detection, on the other hand, will reduce time loss in dealing with defects. This monitoring system will therefore reduce time loss and fabric rejects thereby increasing the profitability of the industry.

Methodology

Monitoring systems of processes do exist but they are not very effective. It is proposed to construct a system tailor-made for the Mauritian context. The type of yarns and fabrics that are used in Mauritius do not vary widely. It is possible to build an effective monitoring system suitable for Mauritius based on similar existing systems that are more generic.

The system consists of 2 parts:

1. Measuring unit: this will essentially measure the yarn input tension.
2. Robust and reliable automatic detection system specifically for the types of fabrics utilised in Mauritius.

Resource Requirements

Financial:	Rs. 2 M (estimate)
Manpower:	1 Textile and 1 Electrical Engineer.
Equipment:	Sensors and computing facilities.
Support:	UOM/Industry.

Time frame: 1.5 – 2 years.

Expected Results:

A system that consist of instruments and control devices that would avoid and detect defects so as to reduce time loss and fabric waste.

Beneficiaries: Knitting industry.

TOPIC 11: SURVEY ON HANDICRAFT IN THE REPUBLIC OF MAURITIUS AND RODRIGUES

Objectives

In Mauritius and Rodrigues, there is a serious problem concerning the availability of information regarding the Handicraft Sector. In this respect, it is proposed to make an assessment of existing handicraft enterprises which are run by a single artisan, a group of artisans or a co-operative organization.

Brief Background

Given that the Handicraft Sector has most of the time been viewed as an informal sector of the economy, it is considered as a hobby-related activity. As a result, there has not been any scientific compilation of data regarding the different aspects of the sector. The latest available data compiled by the NHPA dates as far back as 1996 and have to be updated.

Methodology

The survey can be conducted by making use of the existing data bank of registered artisans available at the NHPA. Compilation of necessary information can be gathered by issuing questionnaires to these artisans.

Resource Requirements:

Financial: Total costs of the survey will amount to Rs. 200,000
Manpower: The survey will require the expertise of one Consultant with the support of Field Staff.
Institutional Support: MRC and University of Mauritius

Time Frame: Two months

Expected Results

The survey will bring forth a complete analysis of the Handicraft sector with concrete details on the different fields of handicraft including the number of existing artisans, the type and size of their business etc.

Beneficiaries

- (i) NHPA which acts as a facilitator and provider of training and **support** services for artisans;
- (ii) Buyers who will have a complete list of the various handicraft enterprises operating in Mauritius thereby enabling them to build contacts with the producers for the purchase of any particular type of craft items;
- (iii) Artisans will benefit from this survey because this will give them the opportunity to make themselves known to potential clients;
- (iv) Suppliers of raw materials and equipment who can, through the directory of artisans target the end users.

TOPIC 12: A SURVEY ON PRODUCT POSITIONING IN THE HANDICRAFT SECTOR

Objective

This study will lead to the identification of the target market for the local craft product. Its conclusions will enable artisans to develop new lines of products and at the same time improve existing products in order to satisfy market requirements.

Background

Despite the fact that the handicraft sector has the capacity of developing itself into an economically productive and income generating sector, it has still not been able to attain the desired growth rate. Though directly related to the tourism sector, which is actually flourishing, receipt from sales of handicraft represents only about 15 to 20% of total tourist expenditure. This may be explained by the fact that, present craft production lacks attractiveness in terms of innovation and presentation. Besides, the National Handicraft Promotion Agency (NHPA) which is responsible for the promotion of handicraft needs considerable restructuring in order to provide the required service to artisans.

Methodology: The study will include:-

1. A review of the local handicraft production.
2. The market trend for craft product and buyer expectations.
3. The improvements that need to be made to the existing craft products regarding style, design, presentation, pricing and quality technique.
4. The type of training centres that would best fit existing structures
5. The improvements that existing sales outlets require to work more efficiently.

Resource Requirements:

Financial: The total cost of the project is estimated to be about Rs400,000

Manpower: One Marketing Expert to undertake the research programme

Institutional Support: University of Mauritius and Mauritius Research Council

Time Frame: One Month

Expected Results:

The study will enable all those involved in the handicraft sector on the opportunities that can be tapped taking into consideration the needs of the market.

Beneficiaries:

- (i) Artisans will benefit enormously from the study which will guide them on the strategies they need to adopt in order to meet customer requirements;
- (ii) NHPA will be in a position to review its operational and marketing strategy in light of specific information gathered from the survey.

TOPIC 13: SURVEY ON RAW MATERIALS USED IN HANDICRAFT

Objectives

The purpose of the survey will be to enlist all raw materials which can be used in the production of handicraft items without the risk of being depleted and which would not cause damage to the environment. The study will also provide information regarding availability of new raw materials.

Brief Background

Access to raw materials has for many years been one of the major problems faced by local artisans for the production of craft items. In fact, sourcing of these materials is becoming more and more limited. Growing environment concern and high taxes on imported materials have made matters worse. As a result, it is proposed to carry out a survey on the use of natural fibres which are easily accessible for craft production.

Methodology: The study will be on two levels and will include:

1. A general survey on natural fibres available in Mauritius and Rodrigues (such as straws, bamboo, pandanus, aloe, vetiver, banana fibres, etc.) in view of ensuring long-term availability of such materials for use in the making of artisanal products.
2. A research project on the best use of natural fibres in the making of handicraft products, especially in mixed-media production.

Resource Requirements:

Financial: Total costs of the survey will amount to Rs200,000
Manpower: The survey will require the expertise of a Team Leader supported by Field Staff.
Institutional Support: MRC and University of Mauritius

Time Frame: Two months

Expected Results

The results of the survey will guide the artisans and raw materials suppliers on which materials that could best be used in craft production without much risk of depletion. This study will also give indications on new materials that can be used in conjunction or as a replacement of those materials which are not easily available.

Beneficiaries:

This study will bring a definite advantage for artisans who will be able to make economic use of raw materials that are available to them. Raw materials suppliers will also benefit from the study.

TOPIC 14: PROMOTION OF STANDARDS

Objectives:

To Enhance productivity of organisations through the use of standards.

Brief Background

In an era of liberal trade policies, Standards, Technical Regulations and testing methods of different countries can become technical barriers to trade. The setting up of WTO/TBT (World Trade Organisation – Technical Barrier to Trade) Enquiry point at each National Standards Body aims at harmonising Standards, Technical Regulations and testing methods of all signatories of WTO agreement.

The WTO agreement puts heavy emphasis on building infrastructure and capacity to support activities such as Standards, Metrology, Testing, Quality Assurance, Certification and Accreditation so as to produce better quality goods and services competitively.

Standardisation has thus become a critical component in the promotion of trade and investment

Methodology:

- Survey to determine the actual awareness and the use of Standards related activities in the community
- Assess the strength and weaknesses of existing Standards facilities
- Benchmarking

Resource Requirements:

Financial	-	About Rs 500 000
Manpower	-	University Students, Officers of MSB
Equipment	-	NIL
Institutional Support	-	MSB, MEF, MEPZA, EPZDA, Consumer Association, Chamber of Commerce & Industry, Ministry of Industry, Commerce & International Trade

Time Frame: 3 to 6 months

Expected Results: Establishing an effective standards infrastructure

Beneficiaries: Business Community, Public Services and Consumers

TOPIC 15: THE CRITERIA OF FAMILY BUSINESS IN DRIVING TECHNOLOGICAL INNOVATION IN MANUFACTURING SECTOR

Objectives

To evaluate the impact or constraint of ownership structure on the performance of manufacturing organisation in an open and highly competitive markets

Brief Background

Organisations with ownership around family members have been highly effective when markets were protected. At a time when markets are opening up and major demand is exerted on organisations to redefine their processes and management style and where customers are becoming more demanding, there is a need for a leadership that is committed to involve all the workforce in decision making areas through empowerment. There is also a need to invest heavily on modern workstations and innovative technologies in order to create a working environment conducive to high productivity. Knowledgeable employees have identified such approach as the appropriate recipe in building strength through creativity and innovation. The effectiveness of family business to create such environment has to be evaluated.

Methodology

Conduct a survey on organisational climate prevailing in different type of ownership structures to gauge responsiveness to the New World business order.

Resource Requirements:

Financial	-	Rs 800,000
Manpower	-	University Students/Researchers
Equipment	-	NIL
Institutional	-	University of Mauritius, Research Institution

Time Frame: One year

Expected Results

To ensure the creation of an appropriate internal organisational infrastructure that shower confidence on all stakeholders and remove likely constraints so as to meet the highly competitive business environment.

Beneficiaries: Country as a whole

TOPIC 16: SUGAR INDUSTRY BY-PRODUCTS UTILISATION: MOLASSES

Background :

Molasses, a by-product of raw cane sugar manufacture, is produced on a large scale in Mauritius. Some 150 000 tonnes are produced currently during a normal cane production year. Molasses contains not less than 30 % sucrose and total sugars amount to about 45 % by weight. Part of the molasses is used in the local distilleries to produce ethyl alcohol; but the major part (80%) of the molasses is exported at a ridiculously low price presently. Molasses could be transformed into anhydrous industrial alcohol where the conversion rate is of the order of 230 litres of anhydrous alcohol produced per tonne of molasses. Thus, about 27 million litres (equivalent to about 22 000 tonnes) of such alcohol could be produced annually. This alcohol would be available for blending with unleaded gasoline in volumes not exceeding 10 %, as it is currently practice in a number of European and American cities, with a view to improving the environment. Thus the savings on the importation of gasoline would amount to 22 000 tonnes annually, (for a total annual import of about 90 000 tonnes). Substantial savings in foreign exchange would also amount to about Rs 105 million annually.

Objectives and Methodology :

A detailed feasibility study on the production of anhydrous industrial alcohol from local molasses could be initiated. This study would first verify the technical aspects of the problem, i.e. availability of the molasses, quality of local molasses, type of industrial process recommended, size and situation of plant, technical problems associated with the mixing and storage of the alcohol with the usual gasoline, impact on environment, and man power requirements. The study would also verify social acceptance of the new product, distribution to local fuel suppliers for the local market and economic savings on the foreign import / export balance.

Resource Requirements:

Financial

Technical and financial project team of consultants including project leader: Rs. 1,0 million

Manpower

A team of foreign consultants will be required to tackle the various aspects of the Research project.

They should have extensive industrial experience of alcohol production and distribution, in order to propose solutions to be adapted locally.

A consulting firm from Brazil, where they have successfully realised this project already, should be best suited to carry out this research project.

Equipment

No special equipment required.

Institutional Support:

Mauritius Research Council
Mauritius Sugar Industry Research Institute
University of Mauritius
Local petrol importers and distributors

Time Frame:

Once the research project is awarded, the preliminary report should be made available within a period of three months.

Expected Results:

The study taken up as mentioned in the Methodology above, should enable the Sugar Industry to produce industrial anhydrous alcohol from its by-product: molasses. This study should also help propose suitable solutions as regards problems related to Environment and help government formulate realistic proposals on this subject.

Beneficiaries:

The direct beneficiaries of the project shall be:

The sugar community of the island
The population of the country at large

VII CONCLUDING REMARKS

The Working Group on Manufacturing Technology discussed the major problems affecting this sector, and has come up with research proposals that can ensure sustained development in this area that contributes significantly to the GDP and to providing employment to a major section of the population.

The Working Group reached the conclusion that for firms to be internationally competitive, entrepreneurial qualities are a pre-requisite of successful company leadership. This implies being permanently innovative in business processes, products and services, without which firms cannot compete successfully. Any check in innovations or delay in applying new technologies imply that the company is degenerating into the mode of repetition or imitation, to the detriment of a cost competitive strategy.

Innovation is not restricted to new technology. Any new product or service, technological application or process, any improvement in management, finance, marketing or advertising is an innovation. Innovations occur when we use new methods of production with radically improved effectiveness, leading to enhanced international competitiveness. Three key concepts dominate successful company leadership: **entrepreneurship, innovation and technology**. Indeed, the integration of aggressive entrepreneurship with innovation and advanced technology is known as the new economy, which has, as central goal, costs and price reduction with expanding volume.

The new business model coincides with globalisation and deregulation in transportation and financial services along with genetic engineering, development of venture capital and extensive use of internet. The characteristics of the new business model encompass growing respect for entrepreneurs, high tolerance for business risk, effort recognition and easy access to capital. The Mauritian business and government class have been for too long dependent on stewardship, which has flourished merely to serve the mediocre mass.

A modern Mauritius would need a new breed of entrepreneurs, obsessed with *creating* new wealth – a breed of revolutionary heroes – rather than traditional stewards who *conserve to survive*.

This paper has sought to create the propitious climate with a view to releasing an **entrepreneurial spirit** within the country to sustain a dynamism for ideas, capital and talent.

With respect to sunset type manufacturing industries, **better management practices, upgraded technologies and marketing techniques** form the subject of detailed research. For sunrise type industries, **systems enabling rapid response to a fast changing technological environment** marked by the advent of information technology in a competitive global market form the subjects of research. And for environmentally friendly industries, studies are proposed on ways and means to **recycle waste generated by traditional industries**. The **development of networks**, including the mobilization of the Mauritian diaspora that can cooperate in transferring up-to-date technologies and resources, have been proposed as methods of expediting technological development.

No doubt these studies and eventual research findings will provide solid foundations for policies and strategies that will point the way to the future of manufacturing technology in Mauritius. They will dictate **strategic thinking, planning, and policy formulation**. These will stimulate the exploration of new avenues for growth, the upgrading existing sunset industries and the promoting of environment friendly industries. Undoubtedly it will require additional financial and fiscal incentives. **There may be need for some convincing at national level if environment preservation, wealth creation and redistribution of this wealth among socio-economic actors, as well as employment generation are to be assured.**

The authorities, particularly the Ministry of Finance, will need to use its development tool, the Budget Exercise, to induce private sector to divert more resources to research and development. This can be achieved in a number of ways. First, it can directly raise the budget of the MRC. Second, it can employ a carrot and stick strategy. The carrot is to provide fiscal incentive by exempting three folds the R&D expenditure of firms from Corporate Tax. The stick is to raise the training levy by 1.5% and channel the revenue increase together with the corresponding matching grant exclusively to research along the same line as the training scheme. This will provide fresh motivations for both private sector and public firms.

Should we be successful in this endeavour, then we can safely expect that **export oriented manufacturing technology** will continue playing a significant role in the life of Mauritians. In this respect, a proper balance between traditional manufacturing technologies and frontier sunrise technologies has to be achieved, so as not to jeopardise the social context in which **employment generation** still forms the basis for national security and stability.

This report is to be considered in parallel with those on the Working Groups on sunrise type manufacturing technologies like Information & Communications Technology, Marine Resources, Biotechnology and others which also have tremendous potential for development in Mauritius (See Annex 6 for a list of other Working Groups).

Policy-making and funding of research need to be based on a long-term vision of development over and above short and medium term, which is usually the pattern. Hence the need for a new vision on development perspectives in order to ensure sustained long term growth and sound socio-economic policies.

Research Projects Undertaken by MRC in the Field of Manufacturing Technology (Ongoing and Completed)

S/No	RD No.	Research Projects	Researcher	Status
1	URGS/93/03	National Survey on qualities of cotton yarns and fabric knitted and finished in Mauritius	Mr. S. Mungar	Completed
2	URGS/94/TCS	Technological Competence Survey	MR R. DUBOIS	Completed
3	URGS/96/11	Fabric Waste Recycling	Mr E. Beedassy	Completed
4	URGS/96/13	New Industrial Strategies: A Study of Gender, Migrant Labour & EPZ in Mauritius	Mrs V. Nababsing	Completed
5	URGS/96/14	Organisation Culture & Women Progress Management	Mrs A. Ramguttty-Wong	Completed
6	URGS/97/02	Towards World Competitiveness: Manufacturing Industry in Mauritian Industries	Mr R. Dubois	Completed
7	URGS/97/16	Mauritius and the Indian Ocean Rim Association: Prospects & Potential	Mr L. Bowman	Completed
8	URGS/98/2	A feasible solution towards efficient and economic generation and use of steam and utilities at Valentina Industrial Zone	Mr G. Jawaheer	Completed
9	URGS/98/5	Oil Monitoring based condition maintenance	Mr G. Gokhool	Completed
10	URGS/99/01	A study of technology and investments decision in the SME sector in Mauritius	Dr S. Matadeen	Ongoing
11	URGS/99/03	Electronic data interchange for quicker response in the clothing industry	Mr D. Maherchand	Ongoing
12	URGS/99/04	Comparative study on productivity of local and imported workforce in the clothing manufacturing sector	Mr M. Kwai Pun	Ongoing
13	URGS/00/07	The implications of the Informal Sector on the Mauritian Economy: Analysis and Evaluation	Mr P. Dinan	Ongoing
14	URGS/00/15	Motivation to entrepreneurship and enterprise performance	Mr A. Darga	Ongoing
15	URGS/00/09	Optimising control of Batch Dyeing Process	Dr R.B. Ramgulam	Ongoing
16		SMIDO: Study of SMEs	Mr V. Appanah	Completed
17	SRGS	Technology Centre – A Feasibility Study	Pr E. Beatty & Pr G.D. Sims	Completed
18	SRGS	S&T Audit	MRC	Completed
19	SRGS	Task Force: Construction Materials	MRC	Completed

Center for Technological Innovation

by
Prof. Soodursun Jugessur.*

Introduction

It is being increasingly realised that the survival and growth of any economy, and specially that of a developing country, have to depend on its ability to utilise its human and natural resources optimally. This implies the transformation of the economy, enhanced manufacturing technology based on making greater use of the technologies available in the world, and on developing technological capacity that can transform and add value to the natural resources in such a way as to be competitive in the world market.

Science and technology are invariably linked with the generation of wealth. Where natural resources are lacking, it is the national human resource that can be developed to take full advantage of world resources. With the advent of globalisation, the integration of world economies forces developing countries to take urgent steps to build their technological capacity in order to face the ever increasing forces of a competitive global market. Since the market value of natural resources keeps changing, and the global economy is more and more being led by developments in genetics, nanotechnology and robotics (GNR), there is urgent need for nations to review their development scenarios and adopt the necessary strategies for staying competitive. Those that get into this band-wagon fast enough have the chances of staying afloat, while those that don't, risk being swept off their feet in this mad materialistic market-dominated world. Hence priority setting for the accumulation of technological capacity becomes a real imperative rather than an alternative!

Center for Innovation

Countries that aim at accelerated technological development and on enhanced manufacturing technology capacity have invariably put in place a host of institutions that enable them to channel ideas from foreign countries as well as those from their own scientists and technologists to practical implementation for the benefit of the community. Unless appropriate institutions backed by proper legislations and incentives are available, brilliant ideas gather dust and cannot find their way to social and economic development. It is in this spirit that the development of a Center for Innovation within a University becomes a priority.

Universities and research institutes that are already doing good work in terms of research should aim at commercializing their research results and benefiting from the application of their findings.

In this respect **Centers for Innovation** as well as **Technology Incubators** have brought the private sector to work hand in hand with the university. The private sector, through such contacts, gets to know the potential of new findings and inventions emanating from overseas or locally, and capitalizes on these to increase its competitive edge over its rivals in similar business.

Taking an idea developed locally in the laboratory, or generated in other countries, to the market involves a whole array of new steps which the university staff cannot undertake so easily. Often, by its very mandate, a publicly funded institution, is not allowed to become a commercial enterprise. This is why technology innovation centers are necessary. For achieving success in giving a practical expression of such ideas, the following steps have to be ensured by a distinct group.

The following tasks have to be carried out:

- 1- Evaluate the commercial potential of all opportunities in university findings and of ideas imported by interacting with the research and private sector community.
- 2- Arrange for protection of intellectual property (patenting)
- 3- Develop licensing contracts with industrial entities that manufacture and exploit the technology. Such contracts involve (a) licensing fees as initial payments as well as annual fees and (b) minimum annual royalties.
- 4- Provide initial start-up costs, legal fees, costs of patenting and business expertise.
- 5- Act as a broker between the industrial partner and the university or research institute.
- 6- Organize seminars and technology demonstrations for interested industrial parties.

In order to implement the above six steps, a new company has to be set up, for the university staff cannot undertake such tasks without sacrificing their own academic work. In some developed countries the university has set up a Center for Innovation as part of its own organization. This center then sets up an operating company with a mandate to deal with the six steps mentioned above. Profits realized from sale of patents and royalties are then shared between the university administration, the researcher and the venture company.

In order to facilitate the process, initial funding is often realized through a **Research Trust** set up by MRC and the universities, while the contract licensing fees and annual royalties ensure an early recovery of patenting and other expenses.

A three tier structure helps to take care of the above, while keeping the mandate of the university unaltered.

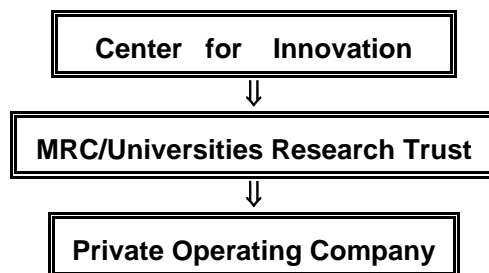


Figure I: A Structure for commercializing research results

It is often taken for granted that the above steps will follow automatically, once ideas are available. Such is not the case unfortunately, and a lot of potential is wasted by not having the appropriate structures, legislation and incentives.

For example, the absence for a suitable **Patenting Office** locally forces the innovator to seek assistance overseas. The costs of patenting are so prohibitive that the innovator gives up very early. Hence the urgent need for such offices locally, staffed with adequately trained staff. The World Intellectual Property Organization is ever ready to train such staff for developing countries, and even to provide advisory services through their pool of resource persons.

The issue of **Licensing Contracts** is also not properly understood by academics, unless they have spent some time in industry where they have had an opportunity to deal with such matters. Licensing fees as initial payments and also as annual fees are not readily available, unless institutions that cater for them are set up. The problem of Royalty Payments is also not properly understood, and innovators are taken for a ride by smart developers.

Hence the primordial need for **initial start-up costs, legal fees, costs of patenting and business expertise**. These are ensured if a proper Center for Innovation is set up.

The close collaboration between the private sector and the academics is thereby ensured. Regular meetings of the board governing the Center become a necessity. The funding organisations, through the Center and the Private Operating Company, can then generate a substantial percentage of its own running expenses through the sale of patents, and income from royalties. It then becomes less dependent on Government subsidy for its development and existence. This concept has been successfully practiced in many developed countries where rapid technological development is taking place.

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'Government, Industry and University Partnership in Science & Technology', in 'Science Based Economic Development', Annuals of the New York Academy of Sciences, Vol.798, 1996.

Recent Manufactured Export Performance by Mauritius, 1980-2000

Export Performance (US\$ million)

Item	1980	1985	1995	2000
Fish & preparations	-	-	36.7	32.6
Pearls, precious stones	5.9	8.3	27.8	28.3
Textile yarn, fabrics	-	5.2	59.5	66.1
Clothing, accessories (a)	73.1	155.9	792.6	855.1
Toys, sporting goods	-	-	11.9	6.2
Gold, jewellery	2.4	3.8	13.1	15.3
Optical instruments	-	-	13.5	6.2
Watches, clocks	2.2	9.8	11.9	17.2
Other (b)	-	-	3.0	7.8
Total	83.6	183.0	970.0	1034.8

Average annual growth rates (%)

Item	1980-85	1985-95	1995-2000
Fish & preparations	-	-	-2.2
Pearls, precious stones	7.0	23.5	0.4
Textile yarn, fabrics	-	104.4	2.2
Clothing, accessories (a)	16.4	40.8	-1.0
Toys, sporting goods	-	-	-9.6
Gold, jewellery	9.2	24.5	0.1
Optical instruments	-	-	-10.8
Watches, clocks	34.2	2.1	8.9
Other (b)	-	-	32.0
Total	23.8	43.0	1.3

Source: Calculated from UN figures and data on EPZs and Pioneer Status Enterprises, Central Statistical Office, Mauritius Rupee figures converted to US dollars at official rate given in IMF, International Financial Statistics.

Notes: (a) Data for clothing include the small value of non-EPZ exports (b) 'Other' exports include chemicals and machinery.

(b) The data for the year 2000 are estimates.

As shown in the above tables, the export performance of Mauritius has been remarkable during the period 1985-1995 with an average annual growth rate of 43.0%. However, during the last five years, the rate has considerably slowed down to an average growth of only 1.3% per annum probably due to a lack of adequate product diversification and the unfavourable international climate. This clearly indicates the need for Mauritius to review its exports strategy.

TABLE 1: EMPLOYMENT IN LARGE¹ MANUFACTURING ESTABLISHMENT

Industrial Groups	1996	1997	1998	1999	2000
Sugar	5,039	4,346	4,090	3,886	3,358
EPZ	79,567	79,617	84,031	88,920	88,157
Other	22,848	21,886	23,105	22,503	22,962
Total	107,354	105,849	111,226	115,309	114,477

Source: CSO

¹ refers to establishments with 10 or more employees.

Table 2: Employment in large establishments of EPZ by industrial group and sex, March 1998 – March 2000.

Industrial Groups	March 1998			March 1999			March 2000		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Food	633	978	1,611	627	1,010	1,637	588	1,011	1,599
Textiles	3,916	1,156	5,072	4,070	1,220	5,290	4,264	1,293	5,557
Wearing Apparel (except footwear)	19,092	51,003	70,095	21,666	53,314	74,980	21,112	52,769	73,881
Footwear and Leather products	195	800	995	158	600	758	143	519	662
Wood and furniture	247	63	310	227	58	285	222	55	277
Professional / Scientific Measuring Equipment & Optical Goods	543	671	1,214	571	779	1,350	594	887	1,481
Jewellery and Related Articles	661	885	1,546	598	863	1,461	609	904	1,513
Other	1,131	2,057	3,188	1,137	2,022	3,159	1,163	2,024	3,187
Total	26,418	57,613	84,031	29,054	59,866	88,920	28,695	59,462	88,157

SOURCE : CSO

Pioneer-Status Enterprises in Mauritius

Introduction

In effect since 1991, this government incentive gives assistance to Mauritian enterprises that engage in activities that involve technology or skills which are considered “above average” and contribute to the enhancement of the industrial and technological development of local industry.

Qualifying activities

To qualify for a Pioneer-status enterprise certificate, a firm must engage in one of the activities summarized in the table below (activities are divided in three broad categories: new technology, support industries and service industries):

Qualifying activities for a Pioneer-status enterprise certificate		
New technology	Support industries	Service industries
(a) Activities involving the assembly of electronic products and components (but excluding TV) (b) Microtechnics and fabrication micromechanics including horological products – comprising high precision micro-mechanical assemblies (c) Manufacturing technologies – manufacture of such item as dies and moulds, measuring instruments, automobile components, high precision tools, high precision sheet metals, electric motors (d) Specialised informatics and communication technology – software designs; computer-based information and other related services; computer aided design (e) Biotechnology (with direct application to production sectors) (f) Technology for conditioning of produce for export	Activities intended to give support to the electrical and electronic light engineering, microtechnic, horological products, optical goods, printing and jewellery industries including: (a) High precision sheet metal electroplating (b) High precision plastic rubber injection moulding (c) Powder coating of metallic parts (as a high quality substitution to wet spray painting) high precision, light alloy metal foundry production of electronic (d) Components specialised stockists/distributors of essential electronic parts and consumables for jewellery manufacturing process.	(a) Service and maintenance activities for the electronic and engineering sector (b) Research and development activities (with direct application) (c) Consultancy Services in production engineering, advanced industrial engineering designs, fashion designs and development of applied creative and technical services. (d) Materials testing laboratory and consultancy and quality management.

Incentives

Firms with a Pioneer-status enterprise certificate qualify for the following incentives:

- (1) Corporate tax rate of 15%;
- (2) Tax exemption on dividends paid to shareholders; and
- (3) Exemption from payment of customs duty and sales tax on scheduled raw materials and equipment.

Status of the Pioneer-status sector to date

According to recent statistics on the sector, there are a total of 243 Mauritian enterprises in actual operation that have acquired Pioneer-status certificates. The table below gives a breakdown of the population of Pioneer-status firms by industry sector:

Industry sector	No of Firms	% of total
Audiovisual products and related services	6	2.5%
Automobile parts and related services	10	4.1%
Building and construction	9	3.7%
Consultancy	16	6.6%
Electronics	18	7.4%
Engineering and related services	12	4.9%
Environmental services	4	1.6%
Glass manufacturing	16	6.6%
Information and communications technology	77	31.7%
Jewellery manufacturing and related services	4	1.6%
Metal works	11	4.5%
Personal hygiene	4	1.6%
Plastics manufacturing	20	8.2%
Printing	16	6.6%
Other	20	8.2%
Total	243	100%

¹⁰ Source: Ministry of Industry, Commerce & International Trade