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TOOL MANUFACTURING AND PRODUCT DEVELOPMENT FOR METAL WORKING AND PLASTICS INDUSTRIES

DP/TRI/85/007

TRINIDAD AND TOBAGO

Report of the Evaluation Mission*

Prepared in co-operation with
the Government of Trinidad and Tobago,
the United Nations Development Programme and the
United Nations Industrial Development Organization

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* This document has not been edited.

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I. SUMMARY AND RECOMMENDATIONS

1. The Project Document design is relatively satisfactory. It is clear and realistic; outputs and activities are fairly well defined. It is, however, rather short and not sufficiently detailed. It must be used in conjunction with the Project Document of the previous Phase.

2. The quality and quantity of UNDP/UNIDO inputs delivered are by and large satisfactory; so is the level of expertise. Substantial delays were experienced during the life of the project.

3. The project was properly monitored and backstopped.

4. Most of the activities planned have been carried out or will be carried out, and the majority of outputs are at hand.

5. All immediate objectives have been attained - in varying degrees - and the project is contributing to the realization of the development objective.

6. The Mission recommends that at this point of time no additional phase of this project be planned.

7. In order to complete the delivery of assistance and full achievement of objectives, the Mission recommends that the budget be revised so that certain additional equipment can be obtained and short-term expertise can be fielded without exceeding the presently approved budget amount.

8. The Mission also recommends that all UNIDO equipment not in the premises of the Metal Industries Company, Ltd. (MIC) be returned to MIC as soon as possible. The national Project Coordinator should resume his duties in MIC on a full time basis; and in order to maintain its national service character MIC should divest its interest in Monogram, Inc., as soon as possible.

9. The Mission is of the opinion that MIC should continue to function not only as a private sector service company, but also as a public training institution. MIC is uniquely qualified to perform its mandate as a national training center within the Trinidad and Tobago setting. The quality and quantity of this performance are a direct function of the financial support which MIC can muster from the public sector budget.10. MIC should not rely exclusively on the profits proceeding from the service contracts to underwrite the expenses of training. This would definitely compromise MIC's position as a well-respected training center, jeopardize the sustainability of the institution as well as that of the present and past project results.

11. The Mission is of the opinion that further technical assistance to MIC is worthy of consideration by international as well as bilateral agencies, if the Government of Trinidad and Tobago, in order to enhance regional cooperation, wishes to expand and upgrade further MIC's training capabilities and facilities to respond to regional needs. Fellowships to potential trainees from the region and/or further assistance to MIC for the expansion of its training capabilities are the two obvious and desirable vehicles for this technical cooperation. However, MIC's becoming a regional training institution in the formal sense is not recommended, nor is this possible given MIC's commercial nature.

II. PROJECT CONCEPT AND DESIGN

A. Overall Context

1. Previous Phases

To expand the manufacturing sector has always been one of the major development objectives of the Government of Trinidad and Tobago. This sectoral development would have the properties of being flexible, modern, efficient, and dynamic with sufficient forward and backward linkages which, in turn, would contribute substantially to the growth of GDP and the welfare of the population. The principal implementation agency of industrial development has been the Industrial Development Corporation (IDC).

Industrial development is contingent upon a set of infrastructural facilities, such as roads, communications network, electricity, water, etc. These are necessary but not sufficient conditions for a dynamic manufacturing/ industrial sector. One critical component among a host of infrastructural conditions is to have in place a "service center" for the provision of adequate specialized engineering services to the manufacturing enterprises. This center would provide tool, die, and mold making services, precision engineering, and highly specialized and trained labor inputs to the indigenous manufacturing sector.

Until the early seventies Trinidad and Tobago was dependent upon foreign expertise to keep the wheels of manufacturing turning. This dependency still continues, though to a much lesser extent. In 1974 a technical assistance project was designed to assist Trinidad and Tobago in developing tool and die making capabilities and precision engineering. Metal Industries Company, Ltd. (MIC) was set up. IDC was the Government Cooperating Agency and UNIDO was designated as the Executing Agency (TRI/74/001). The UNDP contribution amounted to US$ 11,234,000, and the Government contributed TT$ 3,467,000. The project lasted five years. The immediate objectives can be summarized as establishing and building technical engineering capabilities within MIC.

TRI/74/001 ran through its course rather successfully, and the Second Phase of the same project (TRI/78/005) was put into implementation in 1980. The agreement signed by UNDP, UNIDO, and IDC in August 1980 provided US$ 2,169,700 as UNDP input, and the Government obligated to the Project TT$ 6,814,400 (in kind). The Second Phase was also clearly an institution building project with a direct support component. The immediate objectives of the Second Phase appear to be multiple in the Project Document, but basically center around expanding and extending MIC's capabilities to provide training for tool makers and precision workers; increasing its services to existing industries; and assisting newly established manufacturing ventures.

To appreciate fully MIC's role within the development process of Trinidad and Tobago, a brief look at the country's economy in general terms is warranted.

2. The Economy of Trinidad and Tobago

From independence to the early eighties the economy of Trinidad and Tobago has expanded and grown appreciably while displaying, at the same time, many characteristics of underdevelopment. Per capita income grew appreciably until 1983, but the end of the oil boom signalled an overall decline. In 1989 per capita income was half the 1983 level in US dollars and 86% in TT dollars.[1] The impressive 5.8% average annual growth rate of the 1974-1983 period gave way to an annual decline of 4.4% during 1984-1989. However, a positive growth rate of 0.7% was recorded in 1990.

Both the exuberant growth rate of the seventies and early eighties and the negative growth rate thereafter can be understood within the context of an economy that has continued to display certain structural rigidities. The major structural features include:

- dependence upon a single product (petroleum) as the economy's major export and revenue earner;
- absence of adequate linkages among the sectors and sub-sectors;
- a persistently high level of unemployment;
- a high degree of technological dependence; and
- substantial State participation in economic activities.

It must also be added that Trinidad and Tobago is a small open economy with a limited population and labor force base; its development will have to be viewed from the perspective of such constraints.

Sectoral development in Trinidad and Tobago has been severely conditioned by the dominance of the petroleum sector. In nominal terms, the relative position of the manufacturing sector declined from 9.6% of the GDP at the start of the oil boom in 1973 to 5.2% in 1981 towards the end of the boom period. Thereafter, as petroleum revenues declined, the sector recovered to a relative position of 9.0% in 1990. Notwithstanding its improved position in the post-boom period, the sector has shown some degree of inertia. Substantial growth rates averaging 19% in current prices in the 1974-1983 period declined to an average of 5% between 1984 and 1990.

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[1] Per capita income in 1983: US$ 6,851, TT$ 16,442; in 1989: US$ 3,339, TT$ 14,191.

The sub-sectoral configuration of the manufacturing sector (excluding refining and petroleum derivatives) indicates a heavy concentration in food and beverages (48%), assembly type industries (19%), and chemical and non-metallic industries (16%).[2]

Aware of the shortcomings of the economy, the Government has focused its attention and efforts on economic stabilization and structural adjustment within the context of a Medium Term Macroeconomic Planning Framework, 1989-1995. The major objectives of the economic reform program include:

- elimination of domestic and external imbalances;
- reversing the decline in economic activity and improving the competitiveness of the economy;
- strengthening the non-oil sector and increasing the degree of integration among sectors of the economy;
- reduction of the level of unemployment and the creation of productive employment opportunities;
- improving the efficiency of the public sector.

In order to reduce the social distress that is likely to stem from the economic reform program, consideration has been given to protecting the society's poor and vulnerable groups through measures that tighten the social safety net.

Both the economic reform program and associated social security programs are being supported by assistance from the principal multilateral agencies, including the World Bank, the International Monetary Fund, and the Inter-American Development Bank.

3. MIC and Industrialization

It is important to understand the basic tenets of the Medium Term Macro Planning Framework in order to appreciate fully the role of MIC within the industrialization process of Trinidad and Tobago. The plan puts forward the need for a rapid development of the agriculture, tourism, and manufacturing sectors. The strategy with respect to the light manufacturing sector (within which MIC operates) is to develop a strong and diversified industrial structure geared towards the expansion of export earnings. The strengthening of the light manufacturing sector is seen as a prerequisite for increased intra- and extra-regional trade as well as establishing the necessary linkages within the economy.

It is recognized that the deepening and heightening of regional cooperation can serve to reduce the constraints

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[2] Republic of Trinidad and Tobago. Central Statistical Office. Review of the Economy, 1990.

associated with small size. One of the important advantages in this regard is access to larger markets for manufactured goods. As small individual countries Trinidad and Tobago and the other Caribbean countries have not been able to reap the potential benefits of trade facilitation measures, such as the Caribbean Basin Initiative. CARICOM countries will continue to be adversely affected by tariff and non-tariff barriers to the principal exports of manufactures unless greater efforts are directed towards regional cooperation in production and trade.

The Plan also proposes the facilitation of entrepreneurial activity as a means of achieving the widest possible public participation in business enterprise. In this regard, the establishment of strong links between training institutions and the work place is to be encouraged. MIC provides a model for the development of such linkages.

It must be clearly understood that diversification and linkages mean a close relationship between development and technological change on the one hand, and human capital formation on the other. It is undeniable that the existing technical/technological dependence should give way to the attainment of a strong local capability with respect to product development, repair and maintenance, engineering design, and the like. This capability should take the form of machinery and equipment as well as human capital, the latter being a direct function of teaching and training. It cannot be overemphasized that these capabilities can only be had if appropriate institutions are at hand. If such institutions are absent, they must be created; if they already exist, they must be strengthened.

The above premise has certain implications for MIC and a direct bearing on the present evaluation. The report will return to this point in Chapter VI.

Before entering into the institutional analysis of MIC, a brief look is warranted at the training and technological institutions that currently exist in Trinidad and Tobago. The main avenues for technical and craft training are provided, in addition to MIC, by the John S. Donaldson Institute (JDTI) and the San Fernando Technical Institute (SFTI). Craft training is also provided in apprenticeship programs of some institutions, such as T&TEC, Caroni (1975) Ltd. and TRINTOC. The courses offered by JDTI and SFTI are largely theory oriented and attract mainly students from secondary schools.

Because of the inadequacy of hands-on training or experience in a commercial environment, graduates of JDTI and SFTI are not immediately employable. As a result, those graduates who wish to join MIC are required to follow the entire four year training program as are all other trainees. However, some MIC trainees and employees also pursue courses at JDTI and SFTI as a means of improving their theoretical background or to obtain certificates which qualify them for entry into the university in pursuit of engineering degrees or into the teaching profession.

At the professional level, the Department of Mechanical Engineering of the University of West Indies (UWI) offers traditional academic programs with heavy emphasis on new technologies. It is considered to be a well-equipped department with high academic standards. However, its graduates lack the practical experience to immediately become productive in the commercial environment. Graduates of the University are required to pursue two years of training at MIC in order to become proficient.

One objective of industrial policy in Trinidad and Tobago is to enhance the level of national technological capability and to reduce technological dependence. Capability in product design and development and precision engineering has evolved in the industrialized countries over many generations. Developing countries like Trinidad and Tobago have not had the benefit of this history of engineering experience to draw upon. As a result, very little of the essential industrial culture has been able to evolve. At the same time, the specialized nature of local industrial development, with concentrations during most of these years in the petroleum production, oil refining, and sugar industries, has seriously affected the development of a broad-based engineering capability, particularly in the areas of manufacturing and precision engineering industries. It is only in the past five years that the signs of an industrial culture are beginning to emerge. There is now a growing appreciation of the critical need for the development of a true manufacturing and precision engineering capability in establishing a strong and diversified industrial base. MIC is posed as a key organization in the provision of that industrial base.

B. Metal Industries Company, Limited: Its Organization and its Mandate

MIC is structured as a private sector company but with majority Government ownership through IDC and State Enterprises. At present the shareholder ratio is about 60:40 between the Government and the private sector, respectively (see Annex 5). The company operates under the guidance of a Board of Directors comprising key persons from both the public and private sector. It is administered by a Managing Director and its activities are targeted to:

- training of technicians and engineers;
- developing products;
- manufacturing tools, dies, molds, equipment and machines; and
- providing engineering and industrial services.

As can be surmised, MIC functions both as a training institution and a commercial factory providing diverse services to the local manufacturing sector. The company receives

Government grants for its training activities, but it is self-sufficient in other activities; in other words, the company operates commercially.

Over the period of about fifteen years MIC has evolved into an establishment where skills and technological know-how make it unique in Trinidad and Tobago and in the English speaking Caribbean. MIC has designed and manufactured more than 300 dies and 200 plastic molds for local and regional customers. It has also assisted in setting up new production lines and developed several products both for the internal and the external market. Considerable assistance has been channelled to the small business sector through MIC. Its ability to design and manufacture fairly sophisticated molds, to maintain and operate computer numerical controlled (CNC) machines indicate that a relatively high level of technology has been absorbed and disseminated by MIC.

It is important to note that MIC has trained more than 150 technicians and engineers through its regular program. A great majority of the graduates are employed by the private sector in Trinidad in various capacities ranging from general managers of companies to highly skilled workers. In addition to regular training, MIC also provides short-term training courses and skill upgrading to technicians working in private manufacturing firms.

At present, MIC possesses a well-equipped workshop nearly complete with equipment both for training and for production, and the necessary (but not sufficient) staff to carry out its mandate (see Annex 5). Both personnel development and the equipment of MIC are discussed in detail in Chapter IV.

To recapitulate the overall rationale behind setting up MIC: In the process of industrial development Trinidad and Tobago has to make better use of its human resources and installed production capacity. It has to develop and produce goods which offer higher added value; expand its exports of manufactures and enhance its technological capabilities internally. In technical terms these imply the production of increasingly more complex types of tools, dies, molds; the provision of machining services and spare parts; maintenance and repair, and increasingly complex and sophisticated training. Since its inception MIC has been geared to respond to these needs, and it continues to do so today. This makes the institution unique within the Trinidad and Tobago setting. Notwithstanding the existence of other training and service establishments, in the eyes of both the private and public sector MIC is seen as the only set-up able to carry out these activities, so that the manufacturing sector can deliver higher quality products at competitive prices. The long lasting UNDP/UNIDO assistance to MIC can be properly understood only within this context.[3]

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[3] It is worthy to note that similar institutions in developing countries throughout the world have needed long lasting assistance prior to becoming self-reliant. The institutional capacity and capability building of 28 similar institutions reviewed by UNDP required more than 10 years of continued assistance. See, UNDP, Programme Notes Manual, Chapter IV, p.IV 2-8.

C. Project Document

1. Project Rationale - Development Objective

The previous Project (TRI/78/005) had developed MIC's capability both in terms of quality and quantity of training offered, and in terms of providing to the industry a wide range of services.

While in the seventies and early eighties the Government's industrialization policy gave priority to the development of oil and gas industries, the change in the world oil market forced it to redefine its industrial development policy and reorder its priorities. Goods which require higher skills and advanced technologies acquired primary importance.

In view of this reality, strengthening MIC and providing it with further assistance to acquire up-dated technologies appeared to be a sound approach to raise its ability to provide technical and training services required by a rapidly modernizing industry. A new Project Document was prepared. It in fact constituted the Third Phase of TRI/74/001. The intended outcome of the project was to deepen and strengthen further MIC's capability to assist successfully in the implementation of the new industrial policy.

The Development Objective was not stated in a separate section; it was incorporated into the Justification section of the Document. Nevertheless, it was stated well. Government's intention was to establish flexible, efficient, and dynamic manufacturing industries capable of adapting to changes in technology and international markets. Emphasis was put on the production of goods which require higher skills and advanced technologies. The underlying rationale was to make use of human resources to produce goods which incorporate higher value added and adapt production to the relatively high wage levels in the country and away from low wage industries. Better engineering design, product creation, and technology absorbing skills were essential to achieve this end.

One such area which required high skills and advanced technologies is the manufacture of dies, molds, jigs and fixtures etc. which are used, in turn by other industries for the production of various other goods. To continue to assist industry, particularly the metalworking and plastics sub-sector, in obtaining tools and engineering expertise at the high level required, the range, quality and level of services, and training provided by MIC was deemed to be essential.

The Project Document's list of "immediate objectives" basically repeats the five (5) elements of the "overall objective" statement by relating them to the Project's five (5) outputs. This was not really required and did not add to project clarity.

Overall, the project objective was well stated even if it does contain information which is at the project output level.

2. Project Objectives

The Project's "overall immediate objective" was stated to be the following: Strengthening of the Metal Industries Company Limited (MIC) in aspects of staff technological capability and equipment by establishing/strengthening the

- Tool and Metal Product Development Unit (TMPDU)
- Mold and Plastic Product Development Unit (MPPDU)
- Tool Manufacturing Unit (TMU)
- Maintenance and Repair Unit (MRU)
- Marketing and Extension Service Unit (MESU)

These Units will provide the following services for the metalworking and plastics industries at the end of the project:

- design and manufacturing of tools for production of metal products - tools of such complexity as multi-station progressive dies, forming dies (of irregular shapes), draw dies, jigs and fixtures for machining and assembly etc., and development of metal products;

- design and manufacturing of molds for plastics molding - such as molds for products of irregular shapes, molds with complex parting surfaces, molds for threaded components etc., and development of plastic products;

- precision machining, including Computer Numerical Controlled (CNC) machining, of tool components and spare/ replacement parts of machines;

- maintenance and repair of machines - mechanical, hydraulic, and electrical systems;

- marketing, techno-economic studies, technical information, extension services in metalworking and plastics technology.

The Project Document provides a good indication of the level of technological complexity MIC will be able to operate at by its end. A baseline of the skills and technology levels at the beginning of the project was not provided.

3. Beneficiaries

Beneficiaries are not delineated specifically in the Project Document, but both the direct and ultimate intended beneficiaries can easily be inferred from the present as well as the previous project documents. The direct beneficiaries are MIC and the trainees, and the ultimate beneficiary (end-users) is the manufacturing sector.

4. Work Plan

The original Project Document does not contain a tentative Work Plan. Throughout the life of the project several specific work plans were prepared in conjunction with the activities of international experts only.

III. PROJECT IMPLEMENTATION

A. Budget Inputs

The budget figures presented at the end of this section show the original budget as approved on September 15, 1986, in the left column and the latest approved revision (J) in the right column. The (J) revision was approved in May 1991.

The project originally envisaged 124 m/m of short-term consultant assistance for a total of 158 m/m of international expertise input at a total cost of US$ 1,302,000. The budget revision allocates 166.2 m/m of expertise to the project. Of the 166.2 m/m, 142.2 are for international expertise and 24 for one national expert in maintenance and training. The personnel component now totals US$ 1,398,341, an increase of only US$ 96,341.

In terms of m/m planned and delivered and of cost of the personnel component there is only a 6% increase in the US dollar amount to be spent. In this respect the project can be considered remarkably on target. However, there have been some significant shifts within the personnel component budget lines. Budget line 11-01 - Product and Tool Designer - was reduced from 44 to 21 m/m to allow for the provision of 20 m/m for a Product and Mold Designer. This was partially due to the unsatisfactory services of the expert involved and the need for more expertise in molds due to the increased demand for such services from industry and the lack of MIC's expertise in this field.

Another major change previously not envisaged by the project was the hiring of a national expert in the field of maintenance. This project carried over a maintenance expert under budget line 11-04 from the previous Phase of the project for a total of 12 m/m costing US$ 84,083. These services were terminated leaving 10 m/m under the 11-04 budget line. The intention was to use this money to hire consultants in specialized maintenance fields. After it became apparent that UNIDO had difficulty in recruiting experts with the required qualifications, it was mutually agreed to hire a fixed-term contract employee of MIC, who was highly qualified as a national maintenance expert, under budget line 17-01. This appears to have been a good decision, since an international expert with similar qualifications commands a salary far in excess of what MIC could pay and, therefore, would not normally be available to MIC. Budget savings were realized by taking this option.

The Mission has found that Revision "J", although recently approved, does not accurately reflect the project's current intentions on how unutilized personnel component funds will be spent. Under budget line 11-01 - Product and Tool Designer - US$ 95,850 (9 m/m) remain unspent. Several attempts to recruit an expert under this budget line have failed due to postponements and because nominee experts have in the mean time accepted other job offers.

Under budget line 11-04 - Maintenance and Repair Expert - twice a candidate was approved by the Government, but the selected experts have turned down the final agreement at the last moment. This is why 10 m/m are left under this budget line. Approximately 2 m/m of the 10 remaining are expected to be transferred to finance the extension of the national maintenance expert under budget line 17-01 for 6 m/m to the end of 1991. Therefore, a total of 25 m/m are available for programming which amounts to approximately US$ 266,250. Another project revision will be required to program this money. Suggestions on the parameters of further assistance which would need to use this money are provided in Chapter VI related to recommendations.

Metal Industries Company Limited
UNDP/UNIDO Contribution
(1986-1989)

Budget Line		Original Budget Sept. 1986		Latest Budget(J) May 1991		Remarks
Project Personnel		m/m	US$	m/m	US$	
11.	**Experts**					
11.01	Product & Tool Designer	44	363,000	21	190,165	split equally into .01 and .05
11.02	Tool & Die Maker	28	229,200	26	237,210	
11.03	Moldmaker	30	248,400	22.5	211,457	
11.04	Maintenance & Repair	22	179,400	22	190,593	contract of the incumbent terminated after 1m/y
11.05	Product & Mold Designer	0	0	20	195,663	B/L 17 natl exp. recruited for 11.04
11.50	Consultants	34	282,000	30.7	304,171	
11.99	**Sub-total**	**158**	**1,302,000**	**142.2**	**1,329,259**	
13.	Support pers.	0	0	0	0	
15.	Travel	0	0	0	0	
16.	Other costs		20,000		26,695	
17.01	Natl. Expert	0	0	24	50,948	
18.	Surrender (Py.Ob)				(8,061)	
19.	**Component Total**	**158**	**1,322,000**	**166.2**	**1,398,841**	
30.	**Training**					
31.	Fellowship		40,000		38,874	
32.	Group training		20,000		12,833	
38.	Surrender (Py.Ob)				(1,202)	

Table cont'd

40.	**Equipment**		
	Expendable		52,031
	Non-expendable	970,000	922,225
48.	Surrender (Py.Ob)		(4,487)
50.	**Miscellaneous**	**10,000**	**7,302**
99.	**Total UNDP**	**2,362,000**	**2,426,417**

UNDP Inputs

Personnel

A listing of expert assistance provided to the project is provided below along with an assessment of their performance by MIC's management. The Mission has been able to validate these assessments during interviews with MIC's staff, trainees, and MIC's end-users.

Analysis of Project Personnel Performance

Post title	Evaluation	Remarks
11.01 Product & Tool Designer June-May '89 12 m/m	Unsatisfactory	Although competent on paper, expert produced more than 6 designs which never worked. All tools needed extensive modifications. MIC lost considerable customer confidence; had losses. Contract terminated after one year.
11.02 Tool & Die Maker Jan-June '88 4 m/m	Good	Competent and respected by MIC and industry.
11.03 Moldmaker Feb'90-Dec'91 23 m/m	Good	Competent & Well respected by MIC's personnel & trainees.
11.04 Maintenance & Repair Jun'89-Dec'91 30 m/m	Good	Natl expert performed very well; instrumental in upgrading the level of training.
11.05 Product & Mold Designer Dec'89-Nov'90 12 m/m	Unsatisfactory	Expert's knowledge and experience did not correspond to his CV. Not well regarded by trainees & personnel.

Table cont'd

Post title	Evaluation	Remarks
11.50 Short term consultants		
Advanced Plastics Dec'89-Jan'90 1.5 m/m	Unsatisfactory	Not enough practical experience to support technical personnel; approach much too theoretica'.
Machine Design Feb-May'91 6 m/m	Good	Worked well with counterparts; provided more training than specified in job description.
Heat Treatment May-Jun'89 & May'89 split mission	Good	Instrumental in upgrading heat treatment facilities and capabilities; well respected by MIC.
CNC Machining July-Sep'89 3 m/m	Satisfactory	Reasonably competent; very cooperative; enthusiastic; adequate experience for basic training.
Pneumatics & Hyrdraulics Nov'89-Feb'90 Oct'90-Jan'91 4.5 m/m	Good	Very competent; provided considerable training; initiated new dev't projects at MIC.
CNC wire EDM Jul-Oct'90 3 m/m	Good	Competent practicing engineer; helped to develop a strong EDM dept for training & commercial activities.
CAD Design Jun-July'91 Oct-Nov'91 3 m/m (total)		To early to assess (ongoing).
Welding Apr-Jun'89 3 m/m	Satisfactory	Competent & experienced especially in specialty steels; conducted in-depth training.

Equipment

The following equipment and accessories as well as training materials have been provided:

- CNC milling machines from MAHO - supplied Aug.'88.
- CNC milling machine TREE JOURNEYMAN 325 - supplied Mar'91.
- CNC lathe from Colchester - supplied Feb'89.
- Heat treatment equipment from DEGUSSA (Tuff triding, EBEGE electrode, salt bath, pot furnace, small chamber furnace, hardness tester - supplied Apr'89 and Nov'90.
- Wire cut electrical discharge machine from McWilliams - supplied Jun'89.
- CAD/CAM hardware and software from IBM - supplied Jan'90, Jan'91, and May'91 (additional required, see Chapter VI).

Orders outstanding

- Accessories for MAHO CNC milling machine;
- Wolhaupter boring head for MAHO and CNC milling machine.

Assessment

Equipment provided by the project is well maintained, used for purposes intended, and is considered appropriate to the needs.

Training

MIC's personnel who have benefitted from external training are listed below:

Plastics technology training in Austria

Mr. V. Bheekho, Tool Designer	Oct-Dec'88
Mr. S. Tang Foon, Plastics Technician	Sep-Nov'89

CNC programming in USA

Mr. J. Humphrey, Asst Workshop Manager	Aug'88
Mr. R. Gayadeeen, Sr. Instructor/Toolmaker	Aug'88

CNC electronics maintenance in USA

Mr. L. Owen, National Expert, Maintenance	Aug'88

CNC mechanical maintenance in USA

Mr. I. Lawrence (left MIC)	Aug'88

CAD/CAM in USA and Canada

Mr. J. Choong (left MIC) Nov-Dec'89

Heat treatment in Sweden

Ms Z. Ali Apr-Jun'90

Assessment

Training was found to be useful and appropriate; it effectively increased skills and knowledge and improved attitudes. Unfortunately two trained staff left MIC to join private firms in Port-of-Spain.

Government Inputs

The project is unusual in that contributions in kind are provided not only by the Government, as reflected in the project budget, but also by MIC itself. The Government counterpart budget does not reflect the contribution of MIC.

The Government budget attached to the Project Document has provisions only till the end of 1989, the year the project was originally expected to be completed. The budgeted amounts from 1986 to 1989 are given under Column A. Also provided under Column A are estimates of Government contributions for 1990 and 1991; these are based on 1989 figures, as the project was extended to December 1991 due to late start-up. Actual amounts received are given under Column B.

Summary of In-kind Budget Contributions Expected and Received from the Government of Trinidad and Tobago
(In TT dollars)

Year	(A) Budgeted Government as per Project Document	(B) Actual Funds Received	(C) % Actual to Projected
1986	3,034,000	2,600,000	86
1987	3,640,000	3,200,000	88
1988	3,868,000	2,338,170	60
1989	4,138,000	1,750,000	42
1990	4,400,000*	1,750,000	40
1991	4,400,000*	775,000	(as at 6/11/91)

* Estimates based on 1989 figures as the project was extended to December 1991 due to late start-up.

The analysis of MIC's cash flow projection for 1991 shows that expenses related to training are estimated to total

approximately TT$ 2.7 million. This amount was derived from a formula which covers 100% of trainee stipends and itemized trainee expenses, including instructor salaries, and 20% of MIC's professional and administrative recurrent costs.

If this formula and the resulting TT$ 2.7 million amount are accepted, payments by Government during 1986, 1987, and 1988 can be considered to have represented a fair contribution in kind and a reasonable subsidy of MIC's training activities. In contrast, with the reduced subsidy in 1989 MIC is actually subsidizing the Government by an amount of TT$ 1 million per year.

B. Project Activities

UNDP signed the Project Document based on the understanding that marketing studies of the trends of the engineering sector be carried out to clarify MIC's product and market niche. This was never completed. MIC's marketing manager prepared an excellent analysis of the market at the request of the Mission. This analysis could be expanded and discussed at the MIC Board level.

Since the project is a continuation of its Phase II, activity under Phase III to strengthen MIC further continued without hiatus. A detailed history of project implementation activities would not enhance the usefulness of this report, since the issues to be addressed by the Mission lie elsewhere.

The bulk of project activity envisaged by the Project Document consisted of experts providing extensive and intensive on-the-job training in:

- the design of metal production components and of engineering tools for the same;, production development of the same; and programming of CNC machine tools;

- design of molds; development of plastic product molding and trouble shooting; operation of injection molding machinery;

- maintenance of machine tools, plastic molding equipment and other equipment; fabrication of spare parts and reconditioning of parts; repair and maintenance of hydraulic and electrical systems;

- techno-economic analysis costing; sales and market analysis; manufacturing technology and tooling.

Connected with the above, experts were to provide advice in:

- selection of and purchase of equipment; installation and putting into operation machine tools for more advanced operations, such as CNC machines;

- direct assistance in machining molds, jigs and fixtures, dies, and simple machines.

Experts also supported MIC in providing troubleshooting and consulting services to industry, especially in modern technology applications.

Finally, experts assisted MIC's staff in conducting training sessions at MIC and in developing training materials, although this was accomplished in an ad hoc fashion.

As indicated earlier, the quality of expert input and their capability to upgrade MIC's staff were uneven (see the assessment of project personnel performance, pp. 15-17 above).

The Mission found that on many occasions experts were used to supplement the shortage of staff resources by being called upon to supervise production and train trainees directly, instead of training the trainers.

The Mission was impressed with the way the project is managed by MIC, particularly with the project's national Project Director, the Managing Director of MIC. He has an in-depth understanding of the role technical cooperation plays in strengthening an institution like MIC. The Mission found the various reports prepared by him and his staff to be analytical and objective and in concordance with its own findings. A report on outputs prepared by MIC in a format prescribed by the Mission could be readily incorporated into this report's Chapter V, Section A - Outputs with only minor changes.

MIC is also closely supervised by an active Board of Directors which meets once a month to discuss the company's affairs. The Board is composed of leaders in industry, business, education, and Government. The Mission was impressed by the Board's composition and commitment to support MIC's dual commercial and national industrial development function.

The experts had extremely well specified job descriptions which clearly set out their capability building (training) and direct support functions. Of particular interest is the specification of the performance standard expected from the experts. Generally the terms of reference were discussed and agreed upon by the expert, MIC, and UNIDO at the beginning of the assignments. In a few cases the experts had to spend too much time in helping MIC with its commercial business, even when this activity involved on-the-job training and helped MIC establish its good reputation. In one case, however, an expert's involvement in designing a dies had the opposite effect when his poor design damaged MIC's credibility with an important customer. On the whole, maximum use was made of the experts' experience.

The experts' technical (assignment) reports varied in quality and mostly summarized their activities. One notable exception is the correspondence and reports written by the EDM and CAD/CAM consultant which are analytical and provide good

guidance to MIC in developing its capabilities.

Also noteworthy is the proposed work program and its execution by the national expert in the fields of maintenance and training, who prepared an excellent two-year time-bound plan of action giving expected start-up and completion dates, estimated costs, and derived benefits, and defined in categories of importance and urgency. The program basically covered the revision of the present training program for maintenance and revising the maintenance program system at MIC. (The program is assessed to be approximately 85% completed.)

C. Project Monitoring/Reporting

Project monitoring by MIC, UNIDO, and UNDP was carried out conscientiously by all concerned. Project Performance Evaluation Reports (PPER) were prepared annually. On one occasion, however, it was prepared too late for UNIDO to prepare its comments before the tripartite review.

Notable to the Mission was the quality of the tripartite review meeting (TPR) discussions as reflected in the TPR reports. Almost all the issues and problems of the project were thoroughly discussed during these meetings, although some issues related to MIC's commercial activities were never resolved.

The PPERs were effective in identifying problem areas. Some highlights include:

- From Feb'77 to Jan'87 sixteen staff members left MIC, including fourteen project engineers, one design engineer, and one workshop manager.
- The economic problems experienced by Trinidad and Tobago excused MIC to put more emphasis on self-sufficiency in the light of reduced Government inputs.
- Techno-economic studies' sub-output was de-emphasized.
- There is need for more market research.
- Initially, on-the-job training was delayed severely due to delay in expert arrivals and the quality of some of them.
- There were delays in equipment deliveries partly due to changes in equipment required.
- Loss of instructors and training coordinator resulted in the cutback of training activity.
- There is a serious shortage of toolmakers at MIC which has affected its production schedule and income.

- Trainee batch for the first year should be raised to thirty-two from sixteen in two half yearly batches.

- There is a need to strengthen the training function. The bulk of trainees are employed on actual production. More structured training is required.

- MIC is inclined to accept work which is beyond the capability of the staff employed. The majority of production staff are trainees.

- Volume of work at MIC is below what one would expect from a plant in operation for over 15 years.

The PPERs, with the exception of the latest, did not report on individual outputs. They did not, therefore, provide a clear assessment in reporting on progress made in strengthening the five organizational units of MIC.

IV. PROJECT RESULTS

A. Outputs

In a project such as this, where the focus is basically on institution building, several problems arise in measuring outputs. First, some important project results may be hard to quantify precisely. Second, quantifiable outputs require additional qualitative assessment for which there are no hard and fast rules. The Project Document attempts to specify success criteria as well as the necessary verifiers for each set of outputs. Quantitatively, therefore, to measure the outputs is less problematic. Qualitative assessments are based upon the Mission's interviews within and without MIC and on observations. In what follows a quantitative and qualitative assessment is given with respect to each set of outputs. The expected outputs are listed according to the project document followed by an assessment of the present status.

Output 1: Tool and Metal Product Development Unit (TMPDU)

Fully functional Tool and Metal Product Development Unit (TMPDU) performing its functional activities:

- design of tools for metal manufactures - tools of such complexity as multi-station progressive dies, forming dies (of irregular shapes), draw dies, jigs and fixtures for machining and assembly, fixtures for welding etc.;
- design and development of metal products, components for locally assembled products;
- cooperation with Tool Manufacturing Unit (TMU) in tool production and in programming of CNC machines;
- technical assistance, consultancy, and information for industry in metalworking technologies;
- training engineers and technicians for industry.

Status 1986	Status 1991
Personnel	Personnel
2 engineers	1 engineer
2 technicians	2 technicians
Facilities	Facilities
50 sq.m. office space	100 sq.m. office space
Office equipment (desks, drafting tables, book shelves, library	Office equipment (desks, drafting tables, bookshelves, library facilities etc.)

facilities, etc.)
2 mechanical presses 2 mechanical presses

Project Activities

- on-the-job training in design of metal products, components, engineering products;
- on-the-job training in design of tools for manufacturing metal products/components;
- on-the-job training in production development of metal products;
- training in programming of CNC machines (joint activity with TMU)

Assessment

The capability of this Unit is adequate to service the needs of the local and regional industry. Very few problems have been encountered, even with the design and manufacture of relatively complex multi-station progressive dies, jigs, and fixtures.

A considerable amount of extension services is provided to local industry in the areas of tool and product design.

The Unit is understaffed, primarily through loss of trained personnel and trainees to industry. One trainee graduating from the Unit has also been absorbed in the Marketing and Extension Services Unit. There is considerable support for this Unit from the expertise available in the Tool Manufacturing Unit. Over the period 1987-1991 more than 75 tools have been designed by this Unit for manufacture by MIC. Four major machines designed by this Unit have been successfully fabricated by MIC for use by the local industry.

Continuous on-the-job training is provided in the areas of tool design, product development and manufacturing technology. Two training courses have been held by MIC for external students in tool and product design. Fellowship training has been provided to 1 engineer and 2 technicians in China, United Kingdom, and India through the assistance of UNIDO, the EEC, and the Indian Government.

Training in the programming of CNC machines and in Computer Aided Design is undertaken jointly with the Tool Manufacturing Unit. The Unit has provided consultancy services in Grenada for the Caribbean Development Bank. CNC milling machines, CNC lathe, and CNC and wire EDM have been commissioned at the workshop.

Output 2: Mold and Plastic Development Unit

Strengthened Mold and Plastic Product Development Unit (MPPDU) performing the following functional activities:

- design and development of molds for plastic molding, such molds for products of irregular shapes, molds with complex parting surfaces, molds for threaded components, etc.;
- design and development of plastic products;
- molding operation engineering and planning;
- technical assistance, consultancy, and information for industry in plastic molding technologies;
- training engineers and technicians for industry.

Status 1986	Status 1991
Personnel	Personnel
2 engineers	1 graduate engineer
2 technicians	2 engineers
	3 technicians
Facilities	Facilities
150 sq.m. office space	200 sq.m. office space
Office equipment (desks, drafting tables, bookshelves, library facilities, etc.)	Office equipment (desks, drafting tables, bookshelves, library facilities, etc.)
2 injection molding machines	Complete CAD facilities (6 computer work stations with design software)
	Complete plastics training courses (video & manuals) in plastic product and mold design and in plastics processing technology
	7 injection molding machines

Project Activities

- On-the-job training in design of molds.
- On-the-job training in development of plastic products.
- On-the-job training in development of plastic product molding and troubleshooting of plastic molding.
- Training in operation of injection machines with programmable controllers.

Assessment

The design capability of the mold and Plastic Product Development Unit at MIC is adequate for simpler molds and products for which MIC has had previous experience. The diversity of plastic products and molds often creates serious technical problems in design and fabrication because of the relative inexperience of MIC design personnel, and the difficulty in achieving narrow specialization in a small market while having

to service a very wide range of industries. Comparable institutions in other countries would tend to develop a cadre of specialist designers who would be competent in fairly narrow areas of specialization. The diversity of work within this Unit is excellent for training, but can create problems when complex projects are undertaken.

Considerable on-the-job training has been undertaken during the project period in the design of molds, development of plastic products and in the molding process. More than 60 molds have been designed for fabrication within MIC during 1988-1991. During this period at least 6 new products have been developed and put into production. Five training courses in plastics technology have been held with a significant practical content in the operation of injection molding machines with programmable controllers. Approximately 75 trainees have participated in these courses.

Unfortunately, the selection and approval of the UNIDO expert for this Unit was delayed for more than two years, and on taking the assignment the expert was found to be unsuitable for this level of training. Finding a suitable expert has proven to be very difficult. This has been one factor underlying the currently existing deficiencies in attaining a higher level of technical capability.

Recent activities have also involved the design and manufacture of short-run aluminum tooling and molds for three dimensional ornaments with very high technical specifications.

Fellowship training has been provided to 3 engineers through UNIDO, the Indian Government, and the Japanese Government. Expertise has also been obtained through a six month attachment of an expert sponsored by the Japan International Cooperation Agency (JICA).

The Unit has undertaken two successful consultancy assignments in St. Lucia for the Caribbean Development Bank.

The technical capacity of this Unit is less than expected and desired, and deficiencies persist in engineering capabilities. The Mission concludes that the achievement is only partial, especially in CAD/CAM.

Output 3: Tool Manufacturing Unit

Strengthened Tool Manufacturing Unit (TMU) performing the following functional activities:

- manufacturing of tools, dies, molds, fixtures;
- production of metal components and products using processes of stamping, welding, machining;
- precision machining services, including CNC machining;

- troubleshooting and setting up of tooling of customers;
- training craftsmen/toolmakers, machinists, and technicians for industry.

Status 1986	Status 1991
Personnel	Personnel
1 supervisor	1 manager
3 die makers	1 engineer
3 mold makers	5 supervisors
4 precision machinists	4 mold makers
18 trainees	10 precision machinists
	4 CNC machinists
	40 trainees
Facilities	Facilities
15 sq.m. office space	120 sq.m. office space
800 sq.m. workshop area	1050 sq.m. workshop area
7 lathes	1 CNC lathe
10 milling machines	7 lathes
1 jig borer	2 CNC lathes
6 grinders	7 lathes
1 EDM machine	2 CNC milling machines
1 pantograph machine	10 milling machines
1 band saw	1 jig borer
1 shaper	3 EDM machines
2 drill presses	1 CNC wire EDM machine
2 flywheel presses	3 pantograph machines
Workbenches, hand tools and misc. support equip.	1 band saw
	1 shaper
	2 drill presses
	2 flywheel presses
	Workbenches, hand tools, and misc. support equip.
3 heat treatment furnaces	7 heat treatment furnaces

Project Activities

- On-the-job upgrading of toolmakers and machinists.
- Selection, purchasing (by the UNIDO purchasing section), installation, putting in operation machine tools for the more advanced machining operations and CNC machine tools.
- Training machinists in operation of machine tools (copy mill, jig boring, wire EDM) and in programming of CNC machine tools.

- Making dies, molds, jigs and fixtures, development of new types of tooling not made before at MIC.

Assessment

Considerable effort has been directed towards strengthening the Tool Manufacturing Unit which forms the core element of the technical base of MIC and provides support to all other Units as well as training activities. TMU is adequately equipped to cater for most high skill training activities and industry services. However, additional equipment for precision measurements and gear cutting would complete the creation of a well-rounded facility. This Unit has a fairly high level of technical capability, as is evidenced by the quantity of its output and complexity of the projects and jobs executed for the industry. Presently this Unit consistently completes more than 1000 jobs, including more than 30 metalworking tools and 20 plastic molds. Several fairly complex plastic molds have been manufactured recently for customers in the Caribbean region and the USA. The CNC machining facilities and the expanded heat treatment facilities are well utilized. MIC is widely regarded as the center for CNC training and heat treatment in the country. CNC capability is quite good as demonstrated by the complexity of the projects completed in this area.

Continuous training and upgrading of toolmakers and machinists are carried out on an ongoing basis. More than 12 specialized training courses have been held for external students over 1988-1991. Approximately 250 trainees have attended these part-time courses.

Fellowship training has been provided for 8 persons (3 through UNIDO and 5 through the EEC).

The Tool Manufacturing Unit appears to be well established. Its continuing problem of high turnover, however, needs urgent attention.

Output 4: Maintenance and Repair

- Maintenance of MIC's machines and equipment.
- Machine repair service for industry.
- Extension services for industry.
- Training maintenance engineers, technicians, and craftsmen for industry - 6 trainees per year.

Status 1986	Status 1991
Personnel	Personnel
1 engineer	3 technicians
2 technicians	4 second year trainees
3 first year trainees	9 first year trainees

5 second year trainees
3 handymen
1 welder

Facilities
10 sq.m. office space
150 sq.m. workshop area
7 workbenches

1 hydraulic pres
1 MIG welder
1 electric arc welder
1 gas welding unit
7 training stations
(mech.1, elec.1, a/c 1,
pneu.1)
Testing equipment (elec.,

Hand tools etc.
1 lathe
1 milling machine
1 grinder
1 drilling machine

3 welders
3 handymen
1 UN expert

Facilities
30 sq.m. office space
420 sq.m. workshop area
7 workbenches complete
with vises & accessories
1 hydraulic press
2 MIG welders
1 gas welding unit
15 training stations
(mech.6, hydr.1, penu.2,
elec.1, a/c.1, simulator
stations 4)
Testing equipment (elec.,
a/c)
Complete set of hand tools
6 sets of training films,
videos, and manuals
1 lathe
1 milling machine
1 grinder
1 drilling machine

Project Activities

- On-the-job training in maintenance and machine tools, plastic molding machines and other equipment installed at MIC.
- Installation and putting in operation machines and equipment for the Maintenance Unit.
- Training in machining and fabrication of spare parts and reconditioning of parts.
- Training in maintenance of hydraulic systems.
- Machine repair and extension services for industry.

Assessment

All MIC maintenance work is undertaken by the Maintenance and Repair Unit. Trainees are rotated in different areas (mechanical, electrical, air conditioning, etc.) every three months as a normal part of their training. Assessment of individual trainees are done every three months. Senior trainees are given area responsibilities. The following numbers of maintenance trainees have graduated: 1986 - 3; 1987 - 4; 1988 - 4; 1989 - 3; and 1990 - 4.

The maintenance training program has been restructured and improved to produce a higher quality of all-rounded maintenance technicians. This has been clearly recognized by the local industry. There is, however, a high drop-out rate among first year trainees, as they are offered jobs in the market.

All new machines in MIC are now installed and commissioned by the Maintenance Unit. This was not the situation in 1986 when outside contractors were utilized. The level and quality of the Unit's activity can be judged from the successful installation and commissioning of the Journeyman CNC milling machine which was completed the Unit within one week without any external assistance. This performance is exceptional for any developing country.

Adequate training is given to maintenance trainees to enable to manufacture and recondition spare parts for their own needs. Extensive training is done in this area, including total overhaul of hydraulic equipment. Additional training is carried out in design and construction of control panels, etc.

There has been an increasing demand for the services of the Maintenance Unit over the period 1989-1991 to reduce the downtime on MIC machinery. Whereas in 1986 60% of the training equipment and 30% of the workshop production equipment were not in working condition, today less than 5% of all machines are not functioning (awaiting imported spare parts). Two common problems faced by the Maintenance Unit are high wear and tear on MIC machines because of the age of machines, their constant use by inexperienced trainees, and the lack of proper manuals which were never supplied with many machines acquired through UNIDO in Phase II of the project.

The existing performance level of the maintenance technicians makes the need for a full time engineer unnecessary. Graduate engineers in other units provide back-up, if required. Fellowship training was provided to one technician and one engineer in India through Indian Government assistance.

More testing equipment - electric, hydraulic - is required. Separate classroom facilities (160 sq.m.) would be very useful for laying out simulator stations. Separate video and television are required for maintenance training.

The Mission concludes that the most essential segments of the output have been achieved.

Output 5: Marketing and Extension Services Unit

Fully established Marketing and Extension Services Unit (MESU) performing the following functional activities:

- Preparation of techno-economic analyses and costing new products.

- Performing market research.
- Actual sales of MIC's services and promoting MIC's capabilities to industry.
- Troubleshooting and process rationalization of clients in cooperation with other MIC staff.

Status 1986	Status 1991
Personnel	Personnel
1 engineer	3 engineers
1 technician	1 technician
1 secretary	1 secretary
Facilities	Facilities
30 sq.m. office space	60 sq.m. office space
Office furniture	Office furniture (desks, tables, typewriters, etc.)
	4 display stands
	2 sets of exhibition displays

Assessment

This Unit is producing consistently outputs in quantities exceeding those indicated in the Project Document. A minimum of 20 techno-economic analyses and new product costings are undertaken annually. The Unit has also prepared, in April 1991, a full feasibility study for the Caribbean Development Bank of an expansion project in St. Lucia.

Market research, MIC sales and promotion, and troubleshooting extension services to MIC clients are all carried out on a daily basis as a normal part of the Unit's activities. More than 150 industry clients are actively serviced by this Unit.

The Unit's personnel has been receiving both in-house and external training in areas related to the Unit's activities. One engineer has been trained in techno-economic analysis using UNIDO's COMFAR Computer Program. In-house training has been conducted in manufacturing technology and product and tool design.

The Unit's personnel has also attended local and regional training courses and seminars in sales techniques, exporting, and customer service. The services of UN experts have been utilized well in industry visits and discussions with clients. The Unit is also involved in conceptualizing the design of products and tooling for all new projects.

The Unit has been responsible for MIC's participation in two Caribbean Expo trade exhibitions and in a number of other

displays and exhibitions.

The Mission concludes that this output is basically at hand.

Utilization of Project Results

In addition to the brief discussion of the previous section on each service output provided to industry, more detailed information is given in:

Annex 7. List of MIC trained personnel in the industry.
Annex 8. List of MIC customers in Trinidad and Tobago.
Annex 9. List of MIC customers overseas.
Annex 10. Record of MIC new tooling and workshop orders March'88-Apr'91 and total sales.
Annex 11. A sample of MIC services provided to industry.

These annexes are a testimony to the capability and capacity of MIC to provide services to industry. The utilization of projects are exceptionally good.

B. Immediate Objectives

Since its creation MIC has accumulated local and international experience in manufacturing and in the design and production of tools, dies, molds, and precision engineering products. The objective has been the provision of basic infrastructural services in these areas to the local industry and to train highly skilled engineers, technicians, machinists for Trinidad and Tobago.

MIC possesses a very well equipped workshop at Trincity Industrial Estate complete with CNC machines, electrical discharge machines (EDM), heat treatment facilities, conventional machine shop equipment, metal production presses, and plastic injection molding machines.

MIC has made more than 200 molds and 300 metalworking tools for local and regional customers and has reached the level of CNC machines to tolerance of almost one micron. This level of development has been achieved largely because of considerable Government inputs through IDC and of UNDP/UNIDO support to provide experts, equipment and training subsidies for an accelerated training program for a large number of craftsmen, technicians, and engineers. The UNDP supported training program is designed to cover areas of tremendous importance to anyone in the manufacturing industry and to upgrade the skills of technical personnel who have working experience. Since the inception of this program MIC has produced more than 100 skilled craftsmen, technicians, and engineers who are now occupying responsible positions within the local industry. Additional 110 technical personnel are either employed or are under training at MIC at the present time.

The analysis so far indicates clearly that the project

objectives have been achieved. Issues concerning the sustainability of this achievement are discussed in Section E below.

C. Development Objective

MIC's range of services to industry has resulted in significant foreign exchange savings for the country and has been meeting the manufacturing sector's need for skilled manpower, basic technology, and tools in expanding and diversifying into higher quality products for both the local and export market.

The Mission wishes to state that the project, by successfully strengthening MIC, has contributed significantly to the attainment of the development objective of the Government of Trinidad and Tobago, as stated in the Project Document.

D. Unforeseen Effects

No unforeseen effects have been detected.

E. Sustainability

The sustainability of the results of a project of this nature is inextricably related to the sustainability of the institution to which assistance is directed. The project provided equipment, training, and advice to achieve certain objectives. The outputs conducive to that end are basically at hand. The project did help MIC reach a certain plateau. Whether MIC can continue at that plateau or even exceed it or whether it slides depends upon a number of issues which are yet to be resolved.

Some of these issues are rather simple; others are quite complex. Moving from the simpler to the complex, mention has to be made first of the maintenance of the equipment provided by the project. The failure of proper maintenance will seriously impair the training activities. A second issue is staff training. To maintain its present course MIC will have to continue with the training of its staff and the upkeep of the capacities and capabilities the project created. To do so it must command a certain amount of financial resources. Installation, programming, and training of CAD/CAM will have to be completed within the shortest time span possible. Finally, some fundamental issues need solution. By its very nature MIC is a commercial service establishment in addition to being a training center. The prevailing tendency is to make MIC as much a self-financing venture as possible. If so, MIC will have to juggle its activities between training and service, perhaps emphasizing more the service aspects. It is axiomatic that shortage of Government subsidies would cause training to suffer. And should financial strains force MIC to economize in its wage bill, the staff turnover will be higher than what it is at present and will affect the institution negatively. The salary level of

instructors, engineers, technicians etc. is somewhat lower than what the market bears, and under no circumstances can an institution function as a private enterprise with public sector salaries. Subsidizing training out of profits from sales makes training an untenable activity. In other words, it is imperative that training be recognized as a social cost and dealt with accordingly. Moreover, the service side of MIC will not continue forever in its quasi-monopolistic position. Private firms are bound to enter the market place and eventually compete with MIC. The unique position of MIC can only be held if it is treated and subsidized as a learning and technology development institution.

Presently MIC has two objectives. One seeks to produce highly skilled engineers, technicians, an tool and die personnel to service the immediate needs of the country as a whole. The other, parallel to the first, is to attain commercial independence through provision of services to the industry. The synchronization of these two objectives will continue to require trade-offs and will remain a dynamic situation. It is, therefore, imperative to carefully weigh any major policy decision which may affect either stream of activity.

Skilled personnel is MIC's most vital resource. If MIC is to continue to meet the increasingly sophisticated demands of its clients, training must be a continuous activity. This is critical, since MIC is already facing increased competition particularly from foreign companies, due to the removal of tariff barriers that served to regulate imports of goods and services prior to 1991 and of a licensing system for imported engineering products and services. The impact has already been felt on MIC's market.

Given this competition, MIC, more than ever, must sell a range of services that will be heavily dependent upon a base of highly skilled and motivated personnel who are conversant with rapidly changing technologies. Yet, the company is faced with an inability to undertake the increasing volume and calibre of work which is required to sustain growth and commercial operations in keeping with its objectives, size, and potential. Since its machinery and manufacturing techniques compare in many instances favorably with what is available in more developed manufacturing sectors, its role is becoming all the more complex as it interacts with more informed and demanding clientele. It must, therefore, seek ways and means to ensure that its personnel stay with the organization and be on top of the changing demands of industry.

An ongoing training program in the latest tool, die, and mold technologies must go hand in hand with a greater appreciation of customer demands for timely and high quality products and services. This inter alia requires that, as promised, MIC must deliver now more than it has in the past. The Mission suggests that, given its present limitations in skills and equipment, MIC audit its own skills and capacities to render commercial services to assure that deliveries will be attainable.

These comments indicate quite clearly that a precise and well-defined policy for MIC and its incorporation into the Government's guidelines are absolutely indispensable. If this is not done and a concrete policy is not articulated, MIC's sustainability becomes questionable, and with it that of the project result.[4]

F. Project Follow-up

The current project, together with its two previous phases, covers a time span of about a decade and a half. During this period considerable efforts and financial resources have been channelled to strengthening MIC as an institution. In view of the tangible evidence of the project's relative success, the Mission suggests that no new project of the same nature (or a Phase 4) be planned at this point of time. The project should be allowed to run its budgetary course and terminated thereafter. Some very specific technical assistance may be warranted after a hiatus and after MIC's own soul searching. To this end specific recommendations are put forward in the last chapter.

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[4] The report of MIC's marketing manager referred to earlier (see p. 20) contains concerns with respect to the institution's sustainability. Some of these have been incorporated into this evaluation report. His full report (dated June 10, 1991) is worthy of consideration by the MIC's Board of Directors.

V. CONCLUSIONS

A. Related to the Project Document

1. The Project Document was drafted in the latter part of 1985 as a new one; in reality it was extensively built upon TRI/78/005.

2. Some formulations are rather vague; others are absent. There is no statement of the beneficiaries; nor is there a clear formulation of the development objective. Instead such formulations are implicit in the Justification section of the Project Document.

3. The Mission was unable to find an in-depth evaluation of the Second Phase (TRI/78/005); it assumed that it was not carried out. The absence of this evaluation report must have affected the preparation of the Third Phase (TRI/85/007) rather adversely.

4. The formulation of outputs/activities appears to correspond adequately to the immediate objectives; but the formulation of outputs frequently lacks conformity to the quality of capabilities and capacities that are expected to result from the activities planned.

5. The Mission wishes to point out most emphatically that the major weakness of the Project Document is the conspicuous absence of a training module and the programming of the services of a training expert. In a project of this nature, where an appreciable portion of the technical assistance is geared towards training, such an oversight is regrettable.

B. Related to Project Implementation

1. In general, despite major delays in input deliveries, the project is well implemented, especially if judged on the basis of the quantity of outputs produced.

2. The national Project Director has a good understanding of the project and has managed it quite efficiently and professionally. It is to be regretted that in the immediate past he has simultaneously assumed the duties of managing director in Monogram Products Caribbean, Ltd. (a joint venture between MIC and Hallmark). All quarters recognize that he did try to give his full attention to the project; nevertheless, his efficiency was overtaxed.

3. The implementation might have even been even better had the following difficulties not been encountered:

- Delays in fielding experts, mainly due to the difficulties encountered in identifying extremely specialized and experienced ones who corresponded to MIC's specifications, and the Government's slow bureaucratic process of approving such experts. In addition, on more than one occasion, the recruitment of experts was postponed due to Government's delay in contributing to UNDP's general program funds.

- Delays in the delivery of some equipment (especially CNC machines).

- High turnover of staff throughout the implementation of the project.

4. While UNDP/UNIDO delivered in most instance (though some with delay) all the inputs foreseen in the Project Document, the Government input, which was basically in the form training subsidy, has been gradually reduced (from TT$ 3.2 million in 1987 to TT$ 1.8 million in 1991), leaving MIC ever more at the mercy of its own sources. Profits of commercial activities were used to subsidize training. As a result, commercial activities were given higher priority at the expense of training, and MIC was led to expand its commercial operations by using some of its cash resources for investment in a joint venture arrangement with a foreign company. This is detailed in Section E of this chapter.

C. Related to Institution Building

1. The project contributed considerably, but perhaps unevenly, to MIC's institutional capabilities. The major weakness is detected in the area of marketing with few exceptional instances where international experts have had some input. The Marketing and Extension Services Unit still remains little more than a Sales Unit. it is staffed with capable and dynamic personnel; regretfully, however, all their present efforts are directed to the generation of commercial activities. All other Units have been strengthened with varying degrees of success. Special mention must be made of heightened CNC and EDM capabilities.

2. By virtue of providing extensive on-the-job training, the project has also contributed to human resource development within the institution. MIC-trained technicians and engineers command high respect and fetch good remuneration in the market, a point which was frequently stressed by industry leaders.

3. Last but not least, the project has contributed directly and/or indirectly to MIC's reputation within

and outside Trinidad. MIC's reputation as a unique training institution is now well established. Its extension services are sought after despite the considerable delays in fulfilling some industrial orders.

D. Related to Monitoring and Backstopping

The Mission concludes that monitoring and backstopping activities were carried out professionally and with high quality by UNDP and by UNIDO. The backstopping officer at the UNIDO Headquarters has been responsive to MIC's needs and has been prompt and efficient in the follow-up of all project related matters. From time to time he has made an extra effort, over and above his normal duties, to respond to MIC's urgent needs. The Project Team perceives him as a person with genuine understanding of the problems and needs of the institution. He is highly regarded and respected by the national counterpart staff, as well as by the international experts the Mission interviewed.

E. Related to MIC's Joint Venture (Monogram)

In 1989, MIC signed a joint venture agreement with Monogram Products, Inc, to establish a factory to produce decorated plastic items destined exclusively to the export market. This commercial activity has far reaching implications for MIC as an institution and also for the project under evaluation. The issue is sui generis and cannot be dealt within the standard guidelines of the evaluation procedure. It is discussed in this chapter as a specific issue.

MIC has a 50% holding in Monogram Products Caribbean, Ltd. (MPCL). In addition, it charges MPCL for management and workshop services. At present, MPCL employs about 300 workers; by 1993 it is expected to employ approximately 800 persons. The joint venture provided employment; but it was also seen as a good vehicle to transfer technology in the field of low cost plastic molds which did not exist in Trinidad. The joint venture involved an investment of more than US$ 3 million and viewed as an activity which would earn foreign exchange and create backward linkages.

As per agreement, MIC rented space from MPCL's plant which allowed it to transfer some machinery to a better physical facility and gain access to the MPCL's infrastructure facilities for plastic injection mold machines. (For the inter-company charges see Annex 12.) At its inception the joint venture was seen as an important step in the Government's thrust for foreign investment and diversification of the economy. It was also received enthusiastically by MIC's management and Board of Directors as a profit making commercial activity that would enhance the financial position of the company.

MIC's managing director was seconded to MPCL for an unspecified period to start the operations, and five pieces of equipment, two of which are project equipment purchased out of

project's training funds, were relocated in MPCL premises. The Director continued to discharge his functions as the national Coordinator of TRI/85/007 while simultaneously working at MPCL.

What appeared to be an interesting and profitable business for MIC soon raised certain issues which are yet to be resolved. These briefly are:

- The physical location of the project equipment outside MIC's premises was seen as a misuse of project funds. Although the project personnel stated that this equipment continued to be used exclusively for project purposes, it is hard to ascertain with complete confidence that this has been the case. Be that as it may, such transfer has taken place without UNDP's explicit agreement. As a result, considerable misgivings have ensued.

- The national Project Coordinator became de facto a MPCL employee; therefore, the original understanding between UNDP/UNIDO and MIC was violated.

- A number of UNIDO-fielded international experts have given technical advice to MPCL. Under normal circumstances this activity might very well be conceived as part of their terms of reference. Under the present circumstances it can be misconstrued as a favorable treatment extended to the joint venture.

- Finally, but most importantly, MIC became intimately tied with a particular firm. Yet it was expected to provide extension services to all industrial establishments and on a need basis and not on the basis of a particular vested interest. The project, which had the manufacturing sector of Trinidad and Tobago as ultimate beneficiary in mind, now appears to be linked, be it indirectly, with a particular foreign firm.

- Although a clear demarkation between the operations of MIC and MPCL has been worked out, as the Mission observed, this demarkation is not easily visible and is easily conducive to misinterpretations.

This report cannot, and does not, pretend to put forward any policy suggestions for the Government. But at the same time, and strictly from the UNDP/UNIDO side, it cannot refrain from pointing out that what appeared to be a good idea at the start has turned out to be rather problematic, to say the least. The crucial issue is whether MIC should continue to serve all industries on an equal footing or whether it should become some sort of a holding company, especially if the MPCL experience were to be repeated with other firms. Should the training benefits accrued and equipment provided by the project be unduly channelled to a single company who then would have a privileged position in the manufacturing sector?

The Mission is of the opinion that MIC should continue to serve the industry of Trinidad and Tobago without any vested interest and should continue to train the labor force for the open market. Certain specific recommendations are put forth in the next chapter in accordance with these conclusions.

VI. RECOMMENDATIONS

A. Related to the Project

1. The Mission recommends that the project be terminated as the third and last phase of a long standing technical assistance. It is of the opinion that some very good foundation is at hand and that no further "institution building" is warranted.

2. However, the Mission also recommends strongly that, prior to the project's termination, its budget should be revised to endow MIC with some indispensable equipment (such as software for CAD/CAM) and to provide selected specific short-term consultancy. These do not require additional funds, but may extend the life of the project for only a few months and would complete the assistance originally envisaged.

   In the event that this recommendation is accepted in principle, the funds then should be used for:

   - Purchase of computer software for the CAD/CAM equipment (estimated cost US$ 70,000). This software is an essential component of the IBM 6000 which is about to be installed.

   - 6 m/m international expert time for CAD/CAM (estimated cost US$ 60,000).

   - Purchase of a coordinate measuring machine (estimated cost US$ 100,000). The acquisition of this machine is deemed necessary in view of the increasing demand for high precision tools and molds.

   - Extension of the contract of the maintenance and repair national expert for an additional 6 months (estimated cost US$ 12,000). His services are deemed necessary to evaluate all MIC equipment and to complete MIC's preventive maintenance system.

   - Contract an international expert for a maximum period of 2 months to initiate and supervise an independent evaluation procedure for maintenance (expected cost US$ 20,000).

   The total cost of all the above amounts to US$ 262,000.

B. Related to MIC

1. The Mission recommends that the national Project Director return to his post at MIC and relinquish his

post at MPCL as soon as possible, but no later than August 1, 1991.

2. All equipment purchased through UNDP/UNIDO funds' which is now in the premises of MPCL, should be returned to MIC as soon as feasible according to a plan jointly worked out by UNDP and MIC.

3. MIC should divest itself from MPCL within a reasonable period, preferably within the current calendar year, in order to maintain its image as an independent entity.

4. Mic should systemize and organize its training procedure very quickly, define its policy, establish training standards and coordinate training materials.

5. Clearly, MIC's social function is training. This can be provided properly if the sources of funds are secured. To this end, MIC should carry out an effective dialogue with the decision makers in the Government to secure the necessary funds. The Mission estimates the minimum subsidy requirement around TT$ 2.7 million per annum.

C. Related to Further Assistance

1. The Mission does not recommend any extension (with additional funds) or a further phase of the project. This does not imply, however, that in future MIC will be free from the need of further specific assistance. UNDP may wish to entertain the idea of such assistance for very specific needs at an appropriate time.

2. At that point several possibilities may present themselves. At this juncture the Mission suggests one alternative, namely, assisting MIC to extend its regional training and service activities. MIC is on its way to make its reputation in neighboring countries and is well recognized by the Caribbean Development Bank as a unique institution.

3. To endow MIC with further capabilities to expand its training and service outreach to the region. This may be accomplished with further UNDP assistance within the framework of regional cooperation and/or within the technical cooperation among developing countries. It can also be carried out within the framework of regional assistance from donor countries.

VII. LESSONS LEARNED

1. In a project where institution building requires substantial technology transfer, technology base building in a sophisticated and complex field, and a long process of training quick results cannot be expected. Institution building will have to progress from several baselines, each developing the institution in question to a progressively higher level of technical competence.

2. Corollary to the above, the document of such a project must spell out very clearly and specifically, quantitatively as well as qualitatively, the results that are expected to be achieved.

3. Moreover, if the institution's major function is training, any project that aims at strengthening that function must have a separate output module which specifies in full the training capabilities and capacities that are to be established and/or strengthened. A training expert must be one of the major inputs of the project.

4. Budgetary provisions must be made in accordance with the exceptional qualifications and experience that the project requires from technical personnel inputs.

ANNEXES

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TRI/85/007/6-70 13 June 1990

Dear Mr. Benn,

TRI/85/007 - Tool Manufacturing and Product Development for Metalworking and Plastics Industries
(Tripartite Review Meeting)

. . . Please find enclosed the following documents:

- Report of the Tripartite Review Meeting held on 31 May 1990 and an Annex providing information on the status of project outputs and objectives;

- Project Performance Evaluation report covering the period from 20 January 1989 to 10 March 1990 together with an annex providing complementary information.

- Report of the in-depth evaluation mission of November 1989.

We would like to draw your attention to the following important points:

(a) In-depth evaluation mission of November 1989: While having noted it was further to a joint Headquarters/Field office understanding that one single consultant represent UNDP and UNIDO, we suggest that future in-depth evaluation missions comprise a UNDP consultant as Team Leader, Executing Agency consultant as member, and Government representative as member. The recommendations of the mission to extend project activities for a further period of 3-4 years beyond October 1991 has officially been accepted by the Government, and as you note from the attached report of the Tripartite Meeting, we had a difficult time convincing the Government that any extension of this project (which has been operational for 16 years) beyond October 1991 would necessitate the holding of another in-depth evaluation mission. your support of this office's position will be appreciated, especially

2/.....

Mr. Denis Benn
Chief, Division III
RBLAC
UNDP
New York, N.Y. 10017

in view of the new concept expressed by the Metal Industries Company Limited (MIC) to create private companies and to have the training unit directly support their production.

(b) Relocation of Equipment: In January of this year, further to a decision of the MIC Board of Directors, equipment totalling US$215,680 acquired under project funds was relocated to the Trinidad branch of MONOGRAM Products Inc. of Florida, USA, with which MIC has in August 1989 signed a joint venture agreement. While appreciating the fact that UNDP assistance should be oriented towards and strengthen the private sector, yet the way this action was initiated is deplorable. You will note from the Tripartite Review Report that the Government is now considering requesting UNDP retroactively to transfer the equipment.

We would appreciate receiving your comments at your earliest convenience.

Yours sincerely,

Charles L. Perry
Resident Representative

DRAFT TERMS OF REFERENCE

Joint Evaluation Mission of the Government of Trinidad and Tobago/UNIDO/UNDP

DP/TRI/85/007

Tool Manufacturing and Product Development for Metalworking and Plastics Industries

I. BACKGROUND

The Government's development objective in respect of the manufacturing sector is to establish flexible, modern, efficient and dynamic manufacturing industries with significant domestic linkages and contributing to the gross national product, but capable and resilient enough to adapt to changes in technology and international markets, and characterized by high productivity and a significant export capability.

The Government's strategy in this regard is to strengthen and diversify the industrial structure, deepen the process of industrialization, promote productivity increases and promote actively the development of exports, with particular reference to manufactured goods.

One of the areas of industrial manufacturing which requires high skills and advanced technologies is manufacturing of tools such as dies, moulds, jigs and fixtures, etc., which are used, in turn, by other industries for production of various products. The development of tool manufacturing facilities and expertise in tool and production engineering is, in fact, a necessary condition for development of other manufacturing industries.

To assist industry, in particular metalworking and plastics industries, in obtaining tools and engineering expertise, the Government proposed to build and strengthen capability already developed in the Metalworking Company Limited (MIC) - a joint venture of the Government and private sectors of Trinidad and Tobago, which has previously been the recipient of UN assistance, by increasing its range of industrial production, services and training activities.

The previous technical co-operation project (DP/TRI/85/007) had developed MIC's capability in tool manufacturing, precision machining and repairs, to the level which allows MIC to serve more than a hundred industries by providing them with a wide range of services in tool repairs, making new tools, repairs of machines, machining of spare parts, etc. MIC has also been training engineers, technicians and craftsmen for industry, in the field of tool engineering and tool manufacturing.

The last in-depth evaluation of the present project phase DP/TRI/85/007 was undertaken during the period 13 to 24 November 1989 by the evaluation team, consisting of Mr. R. Zielinski, UNDP/UNIDO consultant and by Mr. P. Samuel representing the Government of Trinidad and Tobago. UNIDO Headquarters's comments on the evaluation report were sent to UNDP New York and UNDP Port of Spain under cover of Mr. Vassiliev's letter dated 6 December 1989.

In August 1989 the Metal Industries Company (MIC) attracted "Monogram Products Caribbean Ltd./USA which formed a joint venture with MIC. The technical and management relations between Monogram Products and MIC, its impact on employment creation and technical support services provided by MIC could not be examined during the last in-depth evaluation.

The intended outcome of the project to be evaluated was to deepen and strengthen MIC's capability in the metalworking and plastics field, in order to:

(i) Provide new types of tools of higher degree of complexity and product engineering services for industry;

(ii) Provide efficient, modern machining services for production of spare parts, and components using Computer Numerically Controlled (CNC) machines;

(iii) Provide a wider range of maintenance and repair services;

(iv) Act as a catalyst to the industrial sector by developing new products and demonstrating their production, by techno-economic studies, marketing and extension services.

Immediate Objectives are as follows

(i) Strengthening Tool and Metal Product Development Unit (PMPDU) to serve metalworking industries with services, training, and information in metalworking technology;

(ii) Strengthening Mould and Plastic Product Development Unit (MPPDU) to serve plastics industry with mould and product designs, training and technical information.

(iii) Strengthening Tool Manufacturing Unit (TMU) to serve industry with making tools of higher complexity, precision machining, including CNC machining, and advanced training.

(iv) Strengthening Maintenance and Repair Unit (MRU) to provide wider range of services for industry including maintenance of mechanical, hydraulic and electrical systems of machines.

(v) Establishing Marketing and Extension Services Unit (MESU) providing services of marketing, techno-economic studies, technical information, and extension services in metalworking and plastics technologies for industry.

Validity of UNDP/UNIDO Input:

Since the expertise required to develop further capability in tool manufacturing and product development was not available in Trinidad and Tobago, it justified the necessity to introduce qualified technicians. The alternative to this would be to purchase know-how or pay licence fees which does not transfer technology to advance the skills of MIC employees. An essential input of new ideas, experiences, techniques and equipment from industrialized countries will be facilitated by UNDP/UNIDO assistance.

The project budget is presently US$2,362,000 for UNDP inputs and TT$14,680,000 (US$3,454,000) for the Government contribution, thus making an external in-depth evaluation mandatory.

It has been agreed by all parties concerned to undertake an in-depth evaluation, in order to assess the overall achievements of the project and identify the need for further assistance.

II. SCOPE, PURPOSE AND METHODS OF THE EVALUATION

In accordance with the provisions of the UNDP Policies and Procedures Manual (PPM), the primary purposes of the in-depth evaluation are as follows:

(a) To assess the achievements of the project against its objectives and expected outputs, including a re-examination of the project design;

(b) To identify and assess the factors that have facilitated the achievement of the project's objectives, as well as those factors that have impeded the fulfillment of those objectives;

(c) To examine the extent to which the results of the project have contributed towards increasing MIC's capability to provide the full range of services to industry as set out in the project document.

(d) To identify and to assess factors which led to the creation of the Monogram Products Caribbean Ltd. as a joint venture with MIC; to assess present and future technical and management relations and services provided between MIC and Monogram and the employment creation of this joint venture at present and foreseeable future.

As part of the above-mentioned tasks, the mission will also review whether the approach utilized in the project has led to optimum results or whether another approach could have improved the results. The will include a review of the following:

Project concept and design

- Whether or not the problems were clearly stated in the project document and whether the project design in terms of inputs and duration was sufficient to resolve these problems;

- Were the beneficiaries properly identified;

- Were the inputs and outputs clearly stated;

- Whether the specified inputs, activities and outputs were in line with the project's objectives; and

- Were the objectives achievable.

Implementation

The mission will examine:

- Whether UNDP/UNIDO and Government Inputs were timely and the quality satisfactory;

- Whether activities were initiated on a timely basis, and if not, why;

- Whether relevant agencies/authorities were responsive to changes required during project implementation;

- The quality of the monitoring, back-stopping and technical assistance from UNIDO Headquarters to facilitate implementation; and

- Whether adequate time was given for additional activities and whether these activities were successfully implemented.

Results

The mission will examine:

- Whether the project produced the outputs expected;

- The quality of the outputs;

- How the outputs are being utilized;

- Whether the project attained its objectives or it is likely to when the project is completed.

- Whether the project produced any impact on the target groups or any institutions; and

- What the significance of the project's results on the country as a whole have been, if any;

- Assess the extent to which the following factors have affected project results:

  - Reduction of Government subsidies to MIC;
  - Difficulties in locating mould maker and product and mould design experts;
  - Staff turnover;
  - Delays in equipment procurement.

The evaluation should also assess:

(a) Relations of MIC with industry end-users and, in particular, with Monogram Products Caribbean Ltd.

(b) Future financing of MIC organizations;

(c) Problems, if any, related to the organizational position of counterpart institutions.

The mission should also review to what extent the planned relations with and involvement of other related organizations have been realized and how these could be improved.

Lessons learned:

The mission will:

- Record the significant lessons learned from the project and, in particular, those aspects which worked well; and

- Record aspects to be avoided in the future.

III COMPOSITION OF THE MISSION

The mission will be composed of the following:

One representative of UNDP
One representative of the Government of Trinidad and Tobago
One representative of UNIDO (Mr. H.H. Heep, Senior Evaluation Officer)

These representatives should not have been directly involved in the designing, appraisal or implementation of the project.

IV. CONSULTATIONS IN THE FIELD

The mission will maintain close liaison with the Resident Representative of UNDP in Port of Spain, the concerned Government organizations, local UNIDO staff, and the project's national and international staff.

The mission is also expected to visit the MIC and establish close contact with its end-users.

Although the mission should feel free to discuss with the authorities concerned all matters relevant to its assignment, it is not authorized to make any commitment on behalf of UNDP or UNIDO.

V. TIMETABLE AND REPORT OF THE MISSION

Insofar as required, the UNDP and UNIDO representative will receive briefings at their respective Headquarters. Upon arrival in Port of Spain the mission will be briefed by the Resident Representative of UNDP, who will also provide the necessary substantive and administrative support. The mission will attempt to complete its work within three weeks, starting in Port of Spain on 2 June 1991. Upon completion of its work, it will be debriefed by the Resident Representative of UNDP. At the end of the mission, the Resident Representative of UNDP will organize a meeting involving senior Government officials at which the mission will present its initial findings, conclusions and recommendations, and be ready to discuss these.

The draft report of the mission will be produced before departure from Trinidad and Tobago, and the final report one month later.

PERSONS INTERVIEWED

GOVERNMENT OF TRINIDAD AND TOBAGO

1. Dr. Bhoe Tewari	Minister - Ministry of Industry, Enterpris and Tourism
2. Mr. Winston Dookeeran	Minister - Ministry of Planning and Mobilization
3. Mr. Neville Blake	Ag. Permanent Secretary - Ministry of Industry, Enterprise and Tourism
4. Mr. Jack Balkeesoon	Deputy General Manager - Industrial Development Corporation (IDC)
5. Mr. Robert Nunes	Economist,Acting Chief - Business Development Division (Backstopping Officer for 85{007 Project)
6. Mrs Beulah Cornwall	Administrative Officer II - Office of the Prime Minister, Technical Cooperation Unit
7. Ms Arlene Mc Comie	Ag. Administrative Officer IV - Office of the Prime Minister, Technical Cooperation Unit

METAL INDUSTRIES COMPANY LIMITED

Board of DIrectors

1. Mr. Leslie Scotland	Chairman - Metal Industrries Co. Ltd General Manager, International Business & Marketing - National Commercial Bank
2. Mr. Justin Paul	Member, Ministry of Environment and National Service, Adviser, formerly Director, Technical Vocational Education Division, Ministry of Education
3. Mr. Louis Frederick	Member - Production Manager - Century Esion Ltd

STAFF

1.	Dave Bhajan	Managing Director
2.	Lionel Owen	National Expert- Maintenance Training
3.	Keith Blackman	Workshop Manager
4.	Vijay Bheekhoo	Tool Designer
5.	Capildeo Maharaj	Senior Engineer
6.	Gerard Charles	Marketing Manager
7.	Sonny Tang Foon	Plastics Technician
8.	John Henry	Press Operator/Handyman
9.	Zorinda ALi-Baksh	Engineer, Heat Treatment
10.	Cipriani Davis	Training Instructor
11.	Terrence Lalla	Project Engineer - Marketing

TRAINEES

1.	Ian L. Charles	1st year
2.	Salim Ghany	2nd year
3.	Allan Mungal	3rd year
4.	Zaid Mohammed	4th year

UNIVERSITY OF THE WEST INDIES

1.	Mr. G.L. Kochar	Assistant Dean, Faculty of Engineering
2.	Mr. Stanley Lau	Senior Lecturer, Department of Mechanical Engineering (ex-General Manager of MIC)

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE(CARIRI)

1. Rammond Durgha	Mechanical Engineer, Engineering Products and Design Program
2. J.D. Cummings	Mechanical Engineer

PRIVATE SECTOR

COMPANY	CONTACT
1. Agos Mfg Co. Ltd	Mr. Pallant Ramsundar Technical Manager
2. Century Eslon Ltd	Mr. Lincoln Humphrey Senior Mould Technician (ex-MIC trainee)
4. Johnson & Johnson	Mr. Garth Duke , Machinist (ex-MIC Trainee)
5. Solo Beverages	Mr. Darin Marshall Plastic Bottle Plant Supervisor
6. Trinidad & Tobago Manufacturers Assoc.	Mr. Clive Teelucksingh General Manager (ex-MIC Trainee)
7. TYE Manufacturing Ltd	Mr. Robert Tang Yuk

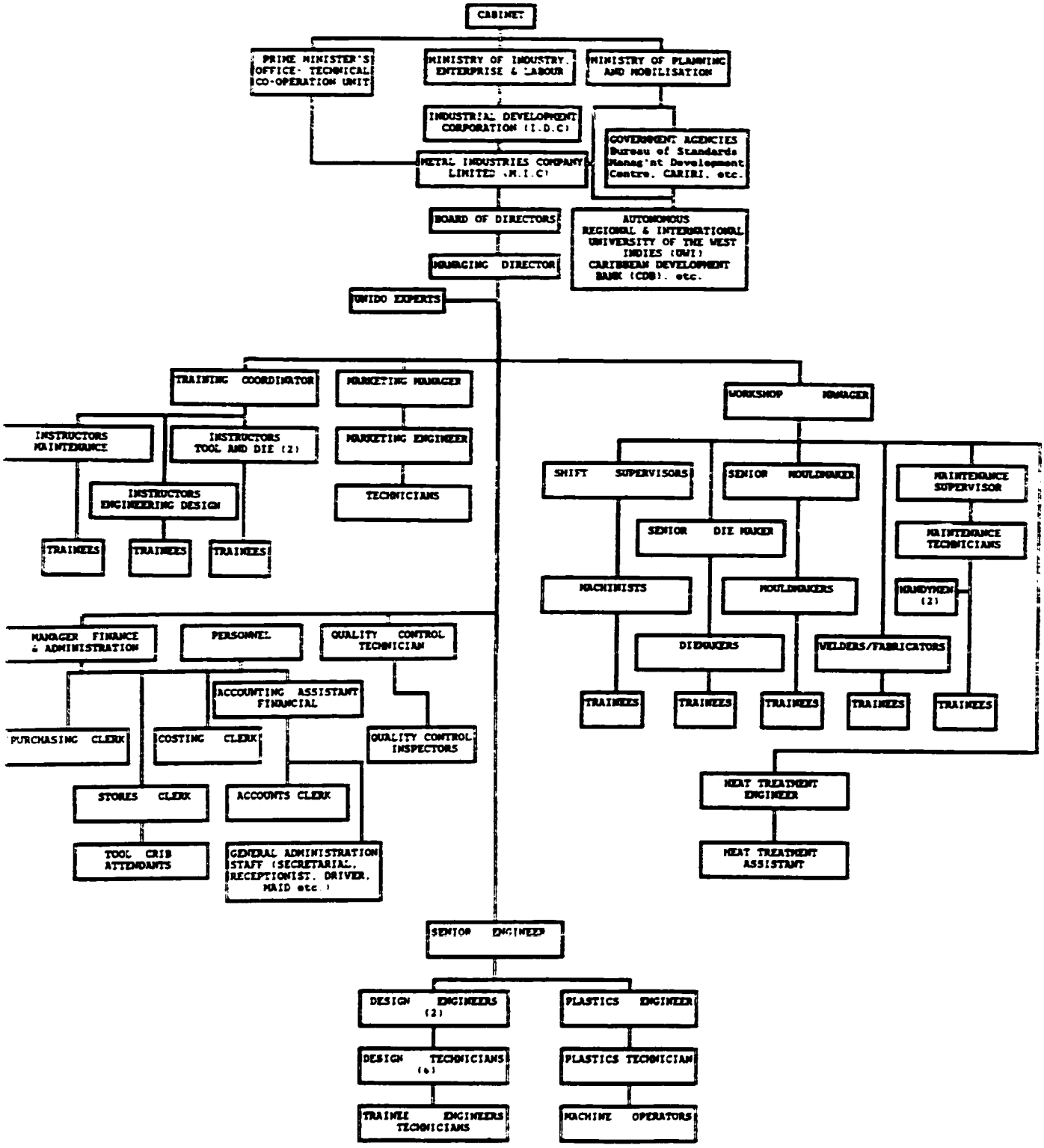
UNDP/UNIDO

1. Mr. Charles L. Perry	Resident Representative
2. Mr. Farouk Tarzi	Deputy Resident Representative
3. Mr. Ram Maharaj	Program Officer
4. Mr. Derek Haniph	UNIDO Country Director
5. Mr. Dominik Bertsch	JPO/UNIDO
6. Mr. Robert Buehler	UNIDO - Machine Tool International Expert
7. Mr. Peter Gough	UNIDO CAD/CAM International Expert

EVALUATION TEAM

1. Mr. Fuat M. Andic	Consultant - UNDP Team Leader
2. Mr. Hans H.Heep	UNIDO Senior Evaluation Officer - Office of the Director General, Team Member
3. Mr. Joseph Howard	Senior Planning Officer Ministry of Planning and Mobilization, Team Member

METAL INDUSTRIES COMPANY LIMITED
ORGANISATION STRUCTURE



METAL INDUSTRIES COMPANY LIMITED

SHARE CAPITAL

Ordinary Shares of $100 each	Amount as at 31/12/90	Percentage
1. Agos Manufacturing Company Limited	133	0.7
2. Alstons Limited	330	1.6
3. Bank of Nova Scotia (T&T) Limited	250	1.2
4. Century Eslon Limited	313	1.6
5. Consolidated Appliances Limited	200	1.0
6. Y. De Lima & Company Limited	200	1.0
7. Geddes Grant Sprostons Limited	188	0.9
8. Genesco	180	0.9
9. Minister of Finance	785)	
10. Minister of Finance	1)	3.9
Minister of Finance	1)	
10. Industrial Development Corporation	8595	42.8
11. National Flour Mills Limited	125	0.6
12. National Insurance Board	1625	8.1
13. Neal & Massy Holdings Limited	350	1.7
14. Ross & Sons Engineering Works Limited	200	1.0
15. T&T Development Finance Company Limited	3000	14.9
16. T&T Oil Company Limited	501	2.5
17. T&T Printing & Packaging Limited	665	3.3
18. T&T Petroleum Company Limited	900	4.5
19. Universal Metal Company Limited	536	2.7
20. Van Leer Containers Limited	180	0.9
21. West Indian Tobacco Co. Ltd.	613	3.1
22. Yorke Structures Limited	226	1.1
	20,097	100

Preference Shares - 6% Cum. $100 each	
National Insurance Board	625 Pref. Shares

LIST OF THE DOCUMENTS REVIEWED BY THE TEAM

1. Report of Evaluation Mission, DP/TRI/85/007 - UNIDO, Vienna, Nov. 1989
2. Project Performance Evaluation Report - July 1990
3. DP/TRI/85/007 Tripartite Review - 10 March , 1990
4. Project Document TRI/74/001 (Signed December, 1974)
5. Project Document TRI/78/005 (signed August,1980)
6. Project Document TRI/85/007 (Signed December 1985/Feb. 1986)
7. Project Revision TRI/85/007/B, (SIgned Oct/Nov. 1986)
8. Mission Report, Prepared by Dr. J. Csikos, Feb. 1990
9. Mission Report, Prepared by R.K. Shenoy, July 1989
10. Mission Report, Prepared by P.J.C. Gough, September 1990
11. Technical Report, Prepared by P.J.C. Gough, October 1990.
12. Technical Report, Prepared by M.J. Noess, September 1989

METAL INDUSTRIES COMPANY LIMITED

LIST OF MIC TRAINED PERSONNEL NOW WORKING IN INDUSTRY

1. ENGINEERS

Name	Date left MIC	Present Occupation
N. Huggins	31/12/77	Consultant, CARIRI
M. Fuller	31/3/78	General Manager, Monogram Products Caribbean Limited
C. Persad	2/8/79	Lecturer, University of Austin, Texas, U.S.A.
N. Sinanan	30/6/80	Engineering Co-ordinator, Development Finance Company Limited (DFC).
W. Hollingsworth	30/6/80	Production Manager, National Petroleum Marketing Company Limited
D. Bhajan	18/7/80	Managing Director, M.I.C.
S. Ragbir	30/9/80	Technical Manager, M.T.S.
P. Alling	31/12/80	Expert, Centre for Development of Industry, Belgium.
K. Chin Cheong	13/3/81	Marketing Director, Dansteel Limited/ Centrin Limited.
V. Tewari	29/10/82	Works Manager, Consolidated Appliances Limited.
T. Dan	9/7/83	
P. Ramsundar	30/5/84	Development Engineer, Agos Manufacturing Limited.
S. Mohammed	21/12/84	M.Sc. Student, Canada
W. Ramoutar	31/5/85	Quality Control Engineer, Centrin
S. Ramcharan	31/5/85	Industrial Engineer, Caribbean Packaging Industries.
Y. Juman	10/6/86	Mechanical Engineer, Mustapha Engineering Works Limited.
H. Johnson	17/1/87	Managing Director, Plastics Products Company Limited.
S. Paltoo	19/1/87	Quality Control Engineer, Appliance Manufacturers Limited.
F. Hyatali	29/4/88	Maintenance Engineer, Super Chem Products Ltd.
M. Chatoor	3/6/88	Maintenance Engineer, Johnson & Johnson Ltd.
C. Blandin	10/6/88	Development Engineer, Complete Computer Systems Limited.
T. Ramdhanie	23/5/88	Project Engineer, Mustapha Engineering Works Limited
J. Ninah	22/6/88	Emigrated to Canada.

Name	Date left MIC	Present Occupation
M. Purcell	8/5/80	Workshop Supervisor, ISCOTT
J. Le Blanc	13/6/80	Technician, CARIRI
C. Jattan	29/8/80	Mouldmaker, Super Chem-Products Ltd.
R. Sinaswee	18/8/80	Supervisor, Mustapha Engineering Works Limited.
A. Gopie	29/8/80	Technician, U.W.I
M. Boodoosingh	19/9/80	Instructor, Rio Claro Secondary School
R. Taylor	19/9/80	Maintenance Supervisor, M.T.S.
R. Murray	10/2/81	Supervisor, ISCOTT
L. Tikasingh	23/6/81	Machinist, ISCOTT
K. Sahibdeen	24/8/81	Ministry of Works
K. Seecharan	20/9/81	Machinist, ISCOTT
M. Ramoutar	14/4/82	Machinist, Centrin Limited
T. David	2/8/82	Machinist, ISCOTT
J. Humphrey	27/8/82	Assistant Workshop Manager, MIC
J. Chin	3/9/82	Manager, Singer Limited
E. Aaron	25/8/82	Instructor, El Dorado Senior Comprehensive School.
R. Nankissoor	8/9/82	
C. Saunders	31/5/83	Machinist, Trinidad Textile Co. Ltd.
E. Adam	31/5/83	Machinist, U.S.A.
A. Thompson	31/5/83	Machinist, Carib Brewery Limited.
A. Hosein	31/5/83	Supervisor Centrin Limited.
C. Boney	30/9/83	Manager, Securicor Limited
K. Brooks	30/9/83	Machinist, ISCOTT
R. Burgen	25/5/84	Technician, BWIA
M. O'Brien	/5/84	Machinist, National Flour Mills Limited
R. Mahabirsingh	18/9/84	Machinist, ISCOTT
K. Blackman	30/6/85	Workshop Manager, M.I.C. (formerly Production Manager, Motorparts Ltd.).
S. Mohammed	31/3/86	Marketing Technician, MIC (formerly Supervisor, Super Chem Products Ltd.).
J. Haynes	2/5/86	Project Engineer, MIC
D. Douglas	25/7/86	Machinist, ISCOTT
R. Joseph	25/7/86	Machinist, ISCOTT
A. Greene	25/7/86	Machinist, ISCOTT
L. Humphrey	16/9/86	Toolmaker, Century Eslon Limited
C. Bassau	23/9/86	Maintenance Mechanic, Dafoe & Dafoe Limited.
A. Muriel		Instructor, Mucurapo Senior Comprehensive School.
H. Smith	30/9/89	Maintenance Technician, B.W.I.A
F. Prentice	28/2/90	Machinist, Carib Glassworks Ltd.
P. Wharton	/3/90	Emigrated to USA
A. Jacelon	31/3/90	Maintenance Technician, Bermudez Biscuit Co.
R. Seunath	31/3/90	Emigrated to Canada
G. Duke		Machinist, Johnson & Johnson Ltd.

Name	Date left MIC	Present Occupation
A. John	13/9/88	Emigrated to the UK
G. Ariyanagam	/8/88	Emigrated to USA
S. Ramdhanie	24/11/89	Maintenance Engineer, Bermudez Biscuit Co.

2. TECHNICIANS

G. Sookhai	/12/78	Proprietor, Sookhai's Hardware
A. Charles	5/4/79	
L. Henry	31/4/79	
F. Regis	9/8/79	
P. Mitchell	5/9/79	
C. Peru	31/10/79	
R. Jardine	5/12/80	Student, University of Florida, USA.
A. Prime	5/12/80	Senior Technician, M.I.C.
V. Chackan	12/3/82	Quality Control Manager, Monogram Products Caribbean Limited
K. Loutan	16/4/82	Senior Technician, M.T.S.
G. Charles	30/1/83	Marketing Manager, M.I.C.
K. Baird	30/6/83	Technician, Factory Inspectorate
G. Peyison	20/10/83	Technician, Plastic Pak Limited
D. Chunisingh	1/7/84	Senior Technician, Central Statistical Office.
N. Ward	2/8/85	Technician, U.W.I.
L. Persad	31/10/85	Teacher, San Fernando
B. Sanderson	30/6/86	Technician, Plastics Limited
M. Radgman	30/6/86	Production Manager, Kanus Mufflers Ltd
S. Tang Foon	8/9/86	Plastics Technician, Monogram Products Caribbean Limited
S. Baksh	30/6/88	Quality Control Technician, Century Eslon Ltd.
R. Mahase	13/7/88	Workshop Technician, Mustapha Engineering Ltd.
R. St. Rose	28/2/89	Emigrated to USA
I. Lawrence	31/1/89	Maintenance Engineer, New Yorker Ltd.

3. WORKSHOP PERSONNEL

J. Ruiz	10/1/80	Chicken Unlimited
R. Solomon	12/2/80	Maintenance Engineer, Trinidad Cement Ltd.
I. Ishmael	21/3/80	
N. Anderson	21/3/80	Machinist, U.S.A
F. Noreiga	9/5/80	Toolmaker, Motorparts Limited

4. Plastics Technicians

S. Mohammed	September 1989	Technician, TRINTOPEK
S. Mahabir	September 1989	Technician, T&TEC

ANNEX 8

METAL INDUSTRIES COMPANY LIMITED

LIST OF CUSTOMERS

Asgarali & Sons Ltd	- Montrose Village, Chaguanas.
K. Achim Trading Limited	- 20 Lucknow Street, St. James.
Advance Plastic Products Ltd	- 2nd Street, Barataria.
Agos Manufacturing Ltd.	- Trincity Industrial Estate, Trincity.
A.D.T. Manufacturers Ltd	- Tissue Drive, Point Lisas.
Albrosco Limited	- O'Meara Ind. Estate, Arima.
Amins Manufacturing Ltd	- Piarco Old Road, Piarco.
Appliance Manufacturers Ltd	- Diamond Vale Ind. Estate, Diego Martin.
Auto Lines Limited	- Southern Main Road, Couva.
Automotive Components Ltd.	- O'Meara Ind. Estate, Arima.
B H Rose Limited	- London Street, Port of Spain.
Bermudez Biscuit Co. Ltd.	- Maloney Street, Mt. Lambert.
Brushrite Industries Ltd.	- High Street, Princess Town.
Carib Glassworks Ltd.	- Eastern Main Road, Champ Fleurs.
Caribbean A & C Ltd.	- Don Miguel Ext. Road, San Juan.
Charles Candy Co. Ltd.	- Bhagoutie Trace, San Juan.
Caribbean Basin Multistat	- C/o Mr. A. Bain C/o D.F.C. Port of Spain.
Caribbean Steel Mills Ltd	- Arima Race Course Road, Arima.
C A Correira T'dad Ltd.	- Old St. Joseph Road, Laventille.
Caribbean Tyre Co. Ltd.	- Point Fortin.
Centrin Ltd	- Point Lisas Industrial Estate.
Century Eslon Limited	- Trincity Ind. Estate, Trincity.
Coconut Growers Association	- Eastern Main Road, Laventille.
Consolidated Appliances Ltd.	- Trincity Ind. Estate, Trincity.
Caribbean Development Bank	- P.O. Box 408, Wildey St. Michael, Barbados.
T'dad & T'bgo Building & Loan Ass.	- 29 Chacon Street, Port of Spain
Canning's Foods. Ltd.	- Churchill Roosevelt Highway, Tunapuna.
Consolidated Biscuit Ltd	- O'Meara Ind. Estate, Arima.
Creative Printery Ltd	- O'Meara Ind. Estate, Arima.
Caribbean Packaging Industries Ltd	- Eastern Main Road, Mount Lambert.
Dafoe & Dafoe (T'dad) Ltd	- 3 Chootoo Road, Aranguez, San Juan.
Diana Investments Ltd.	- Boundry Road, San Juan.
Electrical Industries Ltd.	- O'Meara Ind. Estate, Arima.
Emperor Footwear Ltd.	- Trincity Industrial Estate, Trincity.
Family Toy Shop Ltd.	- Kirpalanis Ind. Park, Arima.
Electric Light Co.	- Diamond Vale Ind. Estate, Diego Martin.
Geddes Grant Sprostons Ltd.	- O'Meara Ind. Estate, Arima.
Santa Rosa Foods Ltd	- O'Meara Ind. Estate, Arima
Hi-Tech Garments Ltd.	- Henry Street, Port of Spain.
Intex Aluminium Ltd.	- Kirpalanis Ind. Park, Arima.
Industrial Development Corp.	- Independence Square, Port of Spain.
Joseph Charles Bottlers Ltd.	- Churchill Roosevelt Highway, San Juan.
Bilmor Ltd	- Borde Street, Port of Spain
S.S. Hosein Ltd	- O'Meara Ind. Estate, Arima.
Johnson & Johnson (T'dad) Ltd	- Trincity Ind. Estate, Trincity.
S .M Jaleel & Co. Ltd.	- Otaheite Ind. Estate, South Oropouche.
John Dickenson & Co. Ltd.	- Diamond Vale Ind. Estate, Diego Martin.
Jupiter Plastics Ltd	- Point Lisas Ind. Estate, Point Lisas.
Kamus Mufflers Works Ltd	- 19-21 First Street, Barataria.
Kenle Industries	- Macoya Ind. Estate, Macoya.

National Fruit Processors Ltd.	-	Trincity Ind. Estate, Trincity.
Nicholas Industries	-	St. Francois Valley Road, Belmont.
Noxelle Caribe Corp.	-	G.P.O. Box 4626, Puerto Rico.
Lake Asphalt Co. Ltd	-	86 D Ind. Square, Port of Spain.
Lewis Manufacturing Ltd.	-	St. Michael, Barbados.
Mecal Fab. Ltd.	-	O'Meara Ind- Estate, Arima.
Amalgamated Manufacturers Ltd	-	Chanka Trace, El Socorro, San Juan.
Bestplate Ltd	-	9 Bergerac Terrace, Maraval.
Mr. N. Bcodai	-	Tarouba Road, St. Clemens.
Caribbean Containers Ltd	-	St. Phillip, Barbados.
Caribbean Ispat Ltd	-	C/o Iscott Complex, Point Lisas.
Century Pipes Ltd	-	Christchurch, Barbados.
Chief Brand Products	-	Princess Margaret Highway, Charlieville.
Chemico Mfg. & Investment Co.	-	Vieux Fort Ind. Estate, Vieux Fort, St. Lucia
Mr. G. Sandhu	-	20 Braemer Road, Cascade.
Maraj Jewellers Ltd	-	Frederick Street, Port-of-Spain.
Industrial Fasteners Ltd.	-	O'Meara Ind. Estate, Arima.
Fertrin Ltd.	-	Point Lisas Ind. Estate.
Caribbean Flexographic Printers	-	Kelly Village, Caroni
Infinity Ind. Ltd	-	#22 Esperanza Village, California.
Simon Galt	-	Woodford Street, Port of Spain.
Chinese Wok	-	Eastern Main Rd, Tunapuna.
General Packaging Ltd	-	O'Meara Ind. Estate, Arima.
Nathan Enterprises Ltd	-	Lp. No. 24 Santa Margarita Cir. Rd, St. Augustine.
Neal & Massy Industries	-	Churchill Roosevelt Highway, Arima.
Amar's Assembly Plant.	-	Las Lomas # 2, Las Lomas.
Export Development Corp.	-	10-14 Phillips Street, Port of Spain
General Post Office	-	Wrightson Road Port of Spain
T & T Electricity Comm.	-	Frederick Street, Port of Spain.
Field Craft Industries	-	P.O. Box 377, Port of Spain
General Packaging Ltd	-	Lot 21D O'Meara Ind. Estate, Arima.
General Radiator Mfg. Ltd	-	102 Gooding Village, San Fernando.
Handy Equipment Co. Ltd	-	Morvant Ind. Estate, Morvant
Hand Arnold Ltd	-	Wrightson Road, Port of Spain
Harris Nail & Wire Works Ltd	-	Harris Complex, St. Michael, Barbados
Impex Ltd	-	St. John's, St. George's, Grenada.
Industrial Cummutator Co.	-	80 Morrow Rd, Barrie, Ontario, Canada.
Brittali Ltd	-	39 Ariapita Avenue, Woodbrook, Port of Spain
Min. of Agriculture & Fisheries	-	C/o Dr. Jones, Barbados.
Maxim Industries Ltd.	-	Henry Street, Port of Spain.
Monogram Products Inc.	-	Largo, Florida.
Nasil & Co. Ltd	-	Point Lisas Ind Estate, Point Lisas.
National Canners Ltd	-	Churchill Roosevelt Highway, Arima
National Flour Mills Ltd.	-	Wrightson Road, Port of Spain.
National Petroleum Mkt. Co.	-	National Drive, Sea Lots.
Ichris Industries	-	#63 School Street, Carenage.

Lever Brothers W.I. Ltd.	- Eastern Main Road Champ Fleurs.
Label House Ltd.	- Trincity Ind. Estate, Trincity.
Long Life Mufflers Ltd	- Eastern Main Road, Laventille.
Lewis Mc Cloud	- Lower Santa Cruz, Jagger Village
K. Mohammed	- Chaguanas.
Motoparts Industries Ltd	- Trincity Ind. Estate, Trincity.
New Yorker (1970) Ltd.	- De Verteuil Street, Chaguanas.
Pix Muffler Works Ltd	- Cipero Street, San Fernando.
Plastics Limited	- Factory Road, Chaguanas.
Pereira & Co. Ltd.	- Queen Street, Port of Spain.
Pan American Std Brands	- Macoya Road, Tunapuna.
Progress Plastics Ltd.	- #3 4th Avenue, Arouca.
Quality Plastics Ltd	- Trincity Ind. Estate, Trincity.
Super Chem Products Ltd.	- Plaisance Park Ind. Estate, Point-a-Pierre.
Special Auto Supplies Ltd	- Eastern Main Road, Petit Bourg
Summit Abrasives Ltd.	- Trincity Ind. Estate, Trincity.
Trinity Footwear Ltd.	- Charlotte Street, St. Joseph.
Trinidad Aggregate Products	- Phillip Agustus Street, Chaguanas.
T'dad Texstyle Ltd.	- 58 Queen Street, Arima.
Trinpet Services	- Lady Hailes Avenue, San Fernando.
TYE Manufacturing Ltd	- Frederick Settlement, Caroni.
Battery Specialists Ltd	- Eastern Main Road, Laventille
T'dad & T'go Development Fin. Co.	- Independence Square, Port-of-Spain.
Trinidad Feed Mills Ltd.	- 7-9 Beetham Highway, Port of Spain.
Trinrico Ltd.	- 2½ Miles South Trunk Road, La Romain.
Tru Fit Garments Ltd	- Trincity Ind. Estate, Trincity.
Turbo Ltd	- Belmont Circular Road, Belmont.
Uniplas Limited	- Eastern Main Road Barataria C/o Chin Fatt's Bakery.
Universal Metal Co. Ltd.	- Trincity Ind. Estate, Trincity.
Van Leer Containers Ltd.	- Brighton, La Brea.
Vulcan Mufflers Ltd.	- O'Meara Ind. Estate, Arima.
WITCO	- Eastern Main Road, Champ Fleurs.
YKK Zippers Ltd.	- Boundry Road, San Juan.
Yorke Structures Ltd.	- O'Meara Ind. Estate, Arima.
Ramak Industries Ltd	- Lot 1C O'Meara Ind. Estate, Arima.
Rainbow Paper Products Ltd.	- St. Michael, Barbados.
K.B.S. Manufacturing Ltd	- IDC Ind. Estate, Arima.
Ray Todd Chemicals Ltd.	- Macoya Ind. Estate, Macoya.
Reed Monza (T'dad) Ltd	- Diamond Vale Ind. Estate, Diego Martin.
Solo Beverages Ltd	- Churchill Roosevelt Highway, San Juan.
Howard Johnson & Co. Ltd.	- D1 Mount View Gardens, St. Augustine.
Eastern Industries Ltd	- 12-14 South Quay, Port of Spain
Sterling Drugs (Int.) Ltd	- Churchill Roosevelt Highway, Tunapuna.
Supreme Industries Ltd.	- Harbour Ind. Park, Bridgetown, Barbados.
Trintoc Ltd.	- Point-A-Pierre.
Trintopec Ltd.	- Santa Flora.
Trinidad Tissues Ltd.	- Trincity Ind. Estate, Trincity.
Telco	- Frederick Street, Port of Spain.
Taurel Industries Ltd.	- Lowlands, Christchurch, Barbados.

Paper Convertors Ltd	- Kirpalanis Complex, Arima
Pereira & Co. Ltd.	- Queen Street, Port of Spain
Plastic Pak Ltd	- Chanka Trace, El Socorro
Polymer Caribbean Ltd	- 227 Western Main Road,Cocorite
Mr. K. Pooran	- Bay Road, La Romain
Leo Rampersad Hardware	- Hutton Street, St. Joseph
Rotoplastics Ltd	- Bhagowtie Trace, San Juan
Securicor Ltd	- 61-61 Edward St, Port of Spain
Secon Ltd	- Dumfries & Smith St, Port of Spain
Special Auto Supplies	- E.M.R. San Juan
Structec Ltd	- Chanka Trace, El Socorro
Sunshine Snacks Ltd	- Bhagowtie Trace, San Juan
Sunspot Plastics	- Diamond Vale Ind. Est. Diego Martin
Sunlight Industries	- Diamond Vale Ind. Estate, Diego Martin
Summit Abrasives	- Trincity Ind. Estate, Trincity
Building Components Ltd	- Point Lisas Ind. Estate, P. Lisas
Tapes & Labels Ltd	- C/o Universal Metal Co. Trincity
Trac Mac Ltd	- Uriah Butler Highway, Chaguanas
Carib Containers Ltd	- Adesh Drive, San Fernando
Trinidad Concrete Products	- Churchill Roosevelt Highway, Tunapuna
Truspec Ltd	- Point Lisas Ind. Estate, Point Lisas
Trinidad Cables Ltd	- Kirpalanis Complex, Arima
Trinidad Cement Ltd	- Southern Main Road, Claxton Bay.
Eastern Foods Ltd	- Mendez Drive, Arima
Trinidad Tissues Ltd	- New Trincity Ind. Estate, Trincity
Terra Mar Ltd	- Otabeite Ind. Estate, South Oropouche
Toylin Manufacturers Ltd	- P.O. Box 293, Vieux Fort, St. Lucia
L.J Williams Ltd	- Trincity Ind. Estate, Trincity
United Agents Ltd	- Warner St. Port of Spain
Water Sewer Fittings Ltd	- E.M.R. Petit Bourg
Aluminium Suppliers Ltd	- Mucurapo Rd, Port of Spain
Automotive & Ind. Radiators Ltd	- Southern Main Road, Chaguanas
Keith Banfield & Co. Ltd	- P.O. Box 343, St. George's, Grenada.
Caribbean Chemicals Ind. Ltd	- Carmichael House, St. George's, Grenada
Chem Clean Ltd	- Pole # 48 Boundry Road, San Juan.
Agricultural Innovators Ltd	- Kirpalani's Ind. park, Arima
Crown Cork & Seal Ltd	- Tumpuna Road, Arima
Cresent Industries Ltd	- Brash Avenue, La Romain
Omni Products	- Kelly Village Caroni
The Ice Connection	- Piarco Roundabout, Piarco
K.C. Confectionery Ltd	- 298 Southern Main Road, Couva
Complete Computer Systems	- Edward Street, Port of Spain
A.V.M Television	- Morvant Ind. Estate, Morvant
Arima Door Centre	- Cleaver Road, Arima
Dynaplas Ltd	- South Trunk Road, La Romain
Goellnicht & Stollmeyer Ltd	- P.O. Box 114, Port of Spain.

Woodworking Industr.es Ltd	- Lot 198 O'Meara Ind. Estate, Arima.
Commissiong & Sons	- Agnes St. Vistabella
B.W.I.A. Ltd,	- Piarco, Golden Grove
Ralph Bagwandass	- Lamp Pole # 148, Lower Diamond, S'Fdo.
Maniram Jankie	- Xavier Street, Chaguanas.
Valgan Industries Ltd	- 955 Middlesfield Rd, Scarborough Ont. Canada.
Eastern Credit Union	- Park Street, Port of Spain
Brick Fource Ltd	- P.O Bag 438, Chaguanas
Belmat Industries Ltd	- La Lune Rd, La Lune Village, Moruga
Mayfair Costmetics Ltd	- Middle Street, Arnosvale, St. Vincent
T'dad & T'bgo Fire Services	- Wrightson Road, Port of Spain
A.C.M. International Ltd	- Lot 16 The Park La Horquetta, Glencoe
Hallmark Cards Inc.	- Kansas City U.S.A.
Lee Co.	- 30-37 48th Ave. Long IslandCity 11101, USA
Marinor Ent. Ltd	- P.O. Box 505, River Estate, Dominica
Victor Look Kin	- C/o IDC, Port of Spain
Mushroom Productions Ltd	- 36A Maraval Rd, Newtown Port of Spain
Ministry of Works	- Agua Santa, Wallerfield, Arima
Ministry of Works	- Eastern Main Rd, Mount Hope
Packaging Center Ltd	- Bank Hall Road, Barbados
Pres-T-Con Ltd	- Tumpuna Road, Arima
Dave Ramcharan	- 290 Southern Main Road, La Romain
Temp Rite Ltd	- 111 Woodford St, Newtown, Port of Spain
Trinidad Wax Products	- Calvary Hill, San Juan
Textel	- Mathura Power Station
T & T Methanol Plant	- Goodrich Bay, Point Lisas Ind. Estate
Video Plus	- Valpark Shopping Plaza, Valsayn
W.A.S.A.	- O'Meara Ind. Estate, Arima
Knogo Caribe	- Box 1378 Cidra, Puerto Rico
Thomas Peake & Co	- 227 Western Main Rd, Port of Spain
F J. Gransaull	- Lady Hailes Avenue, San Fernando
Industrial Agencies Ltd	- Lady Hailes Ave. San Fernando
Tim Yin & Co.	- 23 Sanchez Street, Arima
Colibri Trophies Ltd	- West Mall, West Moorings
Holy Name Convent	- 2 Queen's Park East, Port of Spain
T'dad & T'bgo Match Factory	- P.O. Box 600, Port of Spain
Eric Miller & Co. Ltd.	- Guapo, Point Fortin
Road Transport Engineering Ltd	- Main Road, Point Fortin
Ventura Enterprises Ltd,	- 68 O'Meara Ind. Estate, Arima
Zolaz Muffler Works Ltd	- El Socorro Ext. Road, San Juan
Dean's Auto. & Engineering Services	- 31 Cocorite St. Arima
National Quarries Ltd	- Tunure Rd, Guaico, Sangre Grande
University of the West Indies	- St. Augustine
Emile Elias & Co. Ltd	- Don Miguel Rd, San Juan
Monogram Products caribbean Ltd	- Century Drive, Trincity
Ali's Motor Parts Ltd	- Gopeul lands, Marabella
Applause Inc.	- 6101 Variel Ave, P.O. Box 4183. Woodland Hills, CA. 91365-4183, USA.

Trinidad Ropeworks Ltd	-	O'Meara Ind. Estate. Arima
Caribbean Glass Specialists Ltd	-	Eastern Main Road, Barataria
Maritime Services Ltd	-	St. Vincent Street Jetty, Port of Spain
Printers Ltd.	-	25 Dundonald Street, Port of Spain
Caribbean Shipping Agencies Ltd	-	#2 Madras Street, St. James
Tourist Board of T'dad & T'bgo	-	C/o Piarco Int. Airport, Piarco
Point Lisas Steel Products Ltd	-	Point Lisas Ind. Estate, Couva
Flick Laboratories Barbados Ltd	-	Carmichael House, St. George, Barbados
Omega Fabricon	-	1st Avenue, South Chaguaramus
Diabetes Association of T&T	-	Green Street, Tunapuna
Electric Light Co. Ltd	-	Diamond Vale Ind. Estate, Diego Martin
The Office Works Ltd	-	Ariapita Ave & Luis Street, Woodbrook

EXTERNAL SERVICES PROVIDED BY M.I.C.

NAME	CLIENT	DURATION	PROJECT	COST US$
M. Fuller	L & N Signs ST. LUCIA	Feb'89	Assistance in the production of moulds	1,000
J. Haynes	"	"	"	1,350
J. Haynes	St. Lu MetalWorks ST. LUCIA	April'89	To review the overall production procedure for the Company	1,284
J. Haynes	Chemical Mfg. Investment Co. ST. LUCIA	May'89	To prepare drawings and details of all components	1,172
L. Owen	"	"	To carry out electrical commissioning of a blow moulding machine	1,172
C. Maharaj	Keith Banfield & Co. Ltd GRENADA	May'89	Prepare engineering drawings, specs & tolerances for existing products requiring preparation of tools & Die assembly	1,756
S. Ragoobar	Caribbean Dev. Bank BARBADOS	Oct'89	Advise on data on Metal-working for CDB's library	1,075
K. Blackman	Francis & Francis ST. LUCIA	Oct'89	To establish a properly equipped mechanical workshop	2,408
J. Haynes	Chemical Mfg. Investment Co. ST. LUCIA	May'90	To install and commission die and mandrel	2,035
S. Mohammed	"	"	"	2,275
M. Taitt	Bel-Block Block Making Ent. BELIZE	Jul'90	To diagnose faults and repair a block making machine	5,275
T. Lalla	Francis & Francis ST. LUCIA	Apr'91	To design a Business Plan for an extended operation	3,670

SPECIAL TRAINING

1. Maintenance Fitting

Training programme for Maintenance Fitters

Company: Lever Bros. W.I. Ltd

Duration: September - November 1989

No. of Participants: 14

Venue: M.I.C.

Cost: TT$16,000

2. Machine shop Theory and Practice

Name: G. Jemmott , Barbados

Company: Century Eslon

Duration: six weeks (Oct'89)

Cost; $3,000 TT

3. Seminars

Conducted 3 seminars at UWI on Maintenance Engineering
Seminar sponsored by Caribbean Development Bank

4. Heat Treatment

Name: Harold Beharry , Guyana

Duration: 2 weeks (Feb-March'91)

Venue : M.I.C.

Cost: $17,121.25

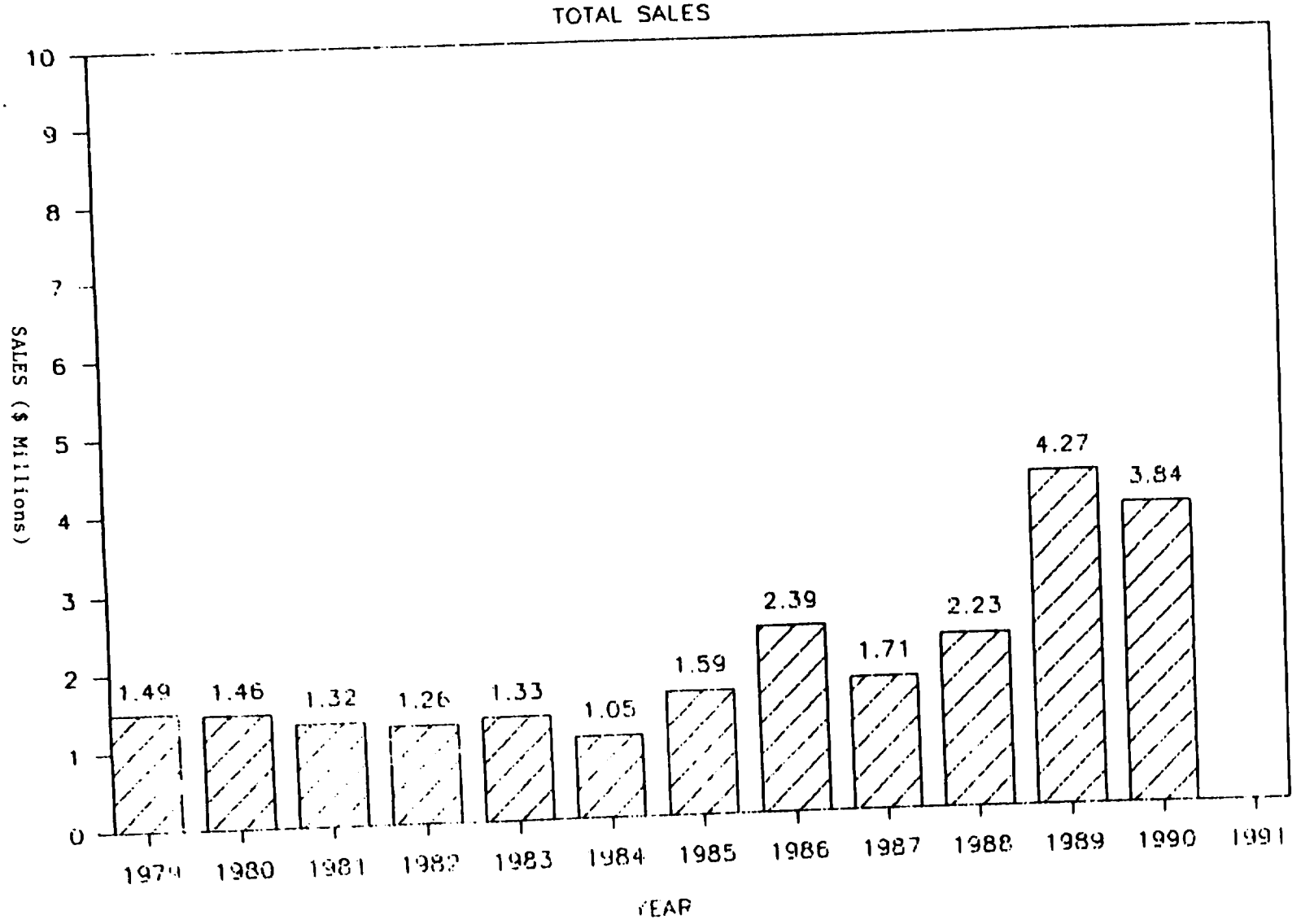
RECORD OF NEW TOOLING ORDERS - MARCH 1988 - APRIL 1991

	1988		1989		1990		1991	
	NEW DIES	NEW MOULDS	NEW DIES	NEW MOULDS	NEW DIES	NEW MOULDS	NEW DIES	NEW MOULDS
JANUARY	-	-	2	0	0	3	1	1
FEBRUARY	-	-	7	4	4	5	2	2
MARCH	3	4	1	5	3	4	0	3
APRIL	5	2	2	5	7	4	4	0
MAY	0	2	2	0	4	1	-	-
JUNE	8	1	4	0	5	1	-	-
JULY	2	3	1	3	4	2	-	-
AUGUST	0	4	3	6	3	0	-	-
SEPTEMBER	2	4	1	5	0	0	-	-
OCTOBER	1	0	5	3	0	4	-	-
NOVEMBER	3	1	0	7	1	2	-	-
DECEMBER	2	6	0	2	0	3		
TOTAL:	**26**	**27**	**28**	**40**	**31**	**29**	**7**	**6**

RECORD OF WORKSHOP ORDERS - MARCH 1988 - APRIL 1991

	NO. OF ORDERS 1988	NO. OF ORDERS 1989	NO. OF ORDERS 1990	NO. OF ORDERS 1991
JANUARY	-	129	106	104
FEBRUARY	-	115	117	92
MARCH	144	118	169	98
APRIL	96	118	124	113
AY	114	103	142	-
JUNE	101	124	97	-
JULY	99	124	94	-
AUGUST	103	143	98	-
SEPTEMBER	86	149	78	-
OCTOBER	106	115	113	-
NOVEMBER	122	95	100	-
DECEMBER	61	67	62	-
TOTAL:	**1032**	**1400**	**1300**	**407**

METAL INDUSTRIES COMPANY LTD.



ANNEX 11

A SAMPLE OF THE SERVICES PROVIDED BY MIC TO INDUSTRY

	CUSTOMER	CONTACT	ADDRESS
1.	Agos Manufacturing Ltd. Manufacturers of light & Electrical Bulbs & Fixtures	Mr. Pallant Ramsundar Manager - Research & Development.	Century Drive Trincity Ind.Estate TRINCITY.

MIC ACTIVITY: Mic has done nine (9) Press Tools and two (2) Compression Moulds over the last year. MIC also assisted in product development and tool manufacture; resulting in further development of product range for export.

2.	Caribbean A&C Co. Ltd. Manufacturers of Blown	Mr. Colin Chan Managing Director.	Don Miguel Extension Road, San Juan.

MIC ACTIVITY: MIC has made four (4) Blow Moulds, that have all been commissioned and working satisfactorily. MIC has provided technical input in the initial start up of customer blow moulding facility.

3.	Electrical Industries Ltd. Manufacturers of Electrical Switchgear, Electrical Wire and Air-conditioning.	Mr. Alfred Burkett Switch Gear Plant Manager.	Tumpuna Road Arima.

MIC ACTIVITY: MIC has made eight (8) Dies over the past Two (2) years commissioned and doing maintence work on exicting machinery. Provided technical assistance in research and product development.

4.	Kenele Industries Ltd. Manufacturers of Staples, Paper Clips & Safety Pins.	Mr. Kenneth Lee Managing Director.	Macoya Ind. Estate Tunapuna.

MIC ACTIVITY: MIC has provided an alternate source of supply for tool and machine parts, which were formerly imported.

5.	Caribbean Containers Ltd, Manufacturers of Metal Containers for Food Industry.	Mr. James C. Huff Manager	6 Cross Roads,Ind. Park, St. Phillip, Barbados.

MIC ACTIVITY: MIC has assisted this overseas company through the manufacture of several precision components and one (1) die over the past two (2) years, thus saving them much needed foreign exchange and time

	CUSTOMER	CONTACT	ADDRESS
6.	Quality Plastics Ltd. Manufacturers of Containers, Bottle Caps, Contract Moulding Services.	Mr. Stephen Scoon Managing Director.	5B Trincity Ind. Estate, Trincity.

MIC ACTIVITY: MIC has provided technical support resulting in the purchase and commisisoning of eight (8) Injection Moulds which are all in use at present by this small company which is presently experiencing rapid growth.

7.	A.M. Jaleel & Co. Ltd. Manufacturers of Carbonated Soft Drinks.	Mr. Aleem Mohammed Chairman.	Otaheite Ind. Estate, South Oropouche.

MIC ACTIVITY: The development and final production of three (3) Injection Moulds for use in the production of Base Cups which were formally imported. MIC still continues to assist this company by providing contract moulding services for the supply of these Base Cups.

8.	Reed Monza (T'dad) Ltd. Manufacturers of Blow Moulded Containers.	Mr. Robert J. Gransaull Managing Director.	Diamond Vale Ind. Estate, Diego Martin.

MIC ACTIVITY: Designed and manufactured three (3 Blow Moulds and one (1) Injection Mould over the last three (3) years which are now in use. The injection mould has been used to complement their 2-Litre PET Bottles Production.

9.	Albrosco Ltd. Manufacturers of Processed Meats, Mosquito Coils & Pre-packaged foods.	Mr. Anthony Aleong Managing Director	O'Meara Ind. Estate Arima.

MIC ACTIVITY: MIC assisted in the development of an in-house capability to produce Coil Stands which were formerly all imported. This necessitated the re-conditioning of old machines and the supply of six (6) Dies which produces the bulk of the coil stands in use at present. MIC is presently working with this company to develop some new product lines that are unrelated to its existing production.

10.	V. X. Nicholas Industries. Manufacturers of Soft Candles & Mastic Cement.	Mr. V.X. Nicholas Managing Director.	8, Upper St. Francois Valley Road, Belmont.

MIC ACTIVITY: Design and production of a machine to mechanize and upgrade

CUSTOMER	CONTACT	ADDRESS

Production of soft candles which enabled this small customer to produce a product of sufficient quality and quantity for export. As a result of this, MIC received an order for another machine of increased capacity. Teething problems in commissioning of machines delayed delivery.

11. Rito ALlen Muffler Works Ltd. Manufacturers of Auto Exhaust Systems. — Mr. Rito Allen, Managing Director. — Lady Young Road Morvant.

MIC ACTIVITY: MIC was instrumental in the selection of machinery and supply of five (5) Dies for the start-up of this small manufacturing operation.

12. Solo Beverages Ltd. Manufacturers of Carbonated Beverages. — Mr. Kenneth S. Charles, Managing Director. — Churchill Roosevelt Highway, San Juan.

MIC ACTIVITY: The supply of high precision components specific to the production of PET Containers which were formerly all imported. Further research and development being done to further identify precision products that MIC can manufacture.

13. Battery Specialists Ltd. Manufacturers of Lead Acid Batteries. — Mr. Leonard Henderson, Managing Director. — Eastern Main Road, Laventille.

MIC ACTIVITY: The design and manufacture of over twenty (20) Moulds for the production of components as used in the manufactre of Auto Batteries MIC also provided technical support in the commissioning and operation of these tools.

14. Keith M. Banfield & Co. Ltd. Manufacturers of ALuminium Windows & Doors. — Mr. Keith Banfield, Director. — P.O. Box 342, Halifax Street, St. George's Grenada.

MIC ACTIVITY: MIC is assisting this overseas client in the establishment of a production capability to initially produce aluminium windows by providing technical support in the selection of appropriate machines and dies of which we are presently working on three (3). This project will be developed on a phased basis.

CUSTOMER	CONTACT	ADDRESS
Lewis Manufacturing Ltd. Manufacturers of Mosquito Coils.	Mr. Richard Kartick Manager.	Warrens, St. Michael, Barbados.

MIC ACTIVITY: MIC has revolutionized the manufacture of their dies by machining them from a solid block as opposed to the old process of hand forming them from sheet. To date, MIC has supplied sixteen (16) of these dies which are more accurate, durable and easier to access since the customer formerly imported them from the Far East.

Trintopec Ltd. Oil Producers.	Mr. Michael Sammy Machineshop.	Santa Flora.

MIC ACTIVITY: MIC has become a supplier of precision machine parts as used in equipment for exploration and oil production. These components have traditionally been imported at great cost and effort prior to MIC's involvement in this industry which is a major revenue earner in this country.

Dr. J.E. Jones Manufacturer of Cockroach Traps.	Dr. J.E. Jones Manager.	30 Earling Park North, Christ Church, Barbados.

MIC ACTIVITY: MIC was involved in the preliminary design and manufacture of this product which is now being marketed throughout the Caribbean by this entrepreneur. The moulds used in the production of this product were manufactured and operated by MIC to produce the final saleable product.

METAL INDUSTRIES COMPANY LIMITED

SUMMARY OF INTER COMPANY CHARGES BETWEEN MIC AND MONOGRAM PRODUCTS CARIBBEAN LIMITED (MPCL)

MIC Charges to MPCL

(1) Management Fees - $21,000.00/month covering the following -:

Management of Accounts Dept and special Accounting services.

Personnel Management, Recruiting, etc.

Foreing Purchasing/Customs Clerk.

1 Maintenance Technician

2 Maintenance Assistants

Transport services

Rental of Forklift, Welding, other equipment as required.

Construction services for expansion projects.

General Support (telephone operator, Methods Engineering, etc.).

(2) Workshop Services - each job is charged directly as for any other customer.

MPCL Charges to MIC

(1) Operation of Moulding Department

Rental of space	-	TT$2,560.00/month
Supervision & general charges	-	3,000.00
Electricity	-	4,000.00 (approx).
		TT$9,560.00/month

(2) Common Fixed Assets

Use of MPCL chiller, cooling tower, compressor, electrical installations, etc. - $3,549.25/month

These charges are netted against MIC Workshop Services provided to MPCL.

3. MIC reimburses MPCL for gross wages of 12 moulding department personnel (1 supervisor, 1 foreman, 10 operators).