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TECHNOLOGY nelsti

Innovation Centre for Capital Goods

Technology Innovation Centre for Capital Goods in Ghana

Opportunity and feasibility study

Annexes*

Prepared to the Government of Ghana by ECORYS Nederland BV, in association with GIBB Africa (Kenya), Bruks Associates (Ghana) & Laryea, Laryea & Company (Ghana)

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Annex 1 Input feasibility model

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1 Feasibility model

1.1 Project identification

For the feasibility study, a financial analysis is performed. Assumed is that the TICCG will eventually be a joint venture company between the Government of Ghana and a private company.

1.2 Planning horizon

For this project, a construction phase of 2 years is assumed. After that, a planning horizon of 20 years has been incorporated as per the Terms of Reference. However, it has to be kept in mind that the model does not allow for additional construction during the operational part of the project. It is therefore assumed that maximal capacity will not increase during this period, other than by increasing the number of operating shifts in the production business unit.

The table below shows the different products and the start and end date of production as well as the expected capacity.

Table 1.1 Capacity per business unit

Product	Start	End	Expected capacity inception	Expected capacity from 2012
Production of capital goods or specialized components	1/2008	12/2027	67200	134,400
Training	1/2008	12/2027	100	100
R&D	1/2008	12/2027	8,320	8,320
Facilities	1/2008	12/2027	720	720
Financing	1/2008	12/2027	-	-
Marketing and logistics	1/2011	12/2027	3,840	3,840

Production of components and parts
The machinery for this production line allows a production of around 20.5 units per hour. It has been assumed that the centre would be operational for 9 hours/day and therefore the nominal capacity is set at 67,200 units. The initial sales are in this model assumed to be 50% of capacity. As the capital goods are scarce and since there is quite a large market

and fast growing market (see annex 8 opportunity study), high growth rates are expected (50% in the first year, 25% in the second year and 7% in the third year (2011) due to capacity restriction. Therefore a second shift will be feasible in 2012. After 2012 a steady growth of 10% is assumed to be feasible and in 2020 the total capacity of those two shifts is assumed to be reached (134.400 units).

Training
The professional training course is assumed to take 12 weeks (1 quarter) and per training course, 25 students can be admitted. Therefore the nominal capacity of training is 100 trainees a year. In the first year 75% of capacity is used (75 students) but it is expected that from year 2 onwards, total capacity will be used due to limited capacity and expected level of demand.

Research and Development
Research and development is assumed to be applied, demand driven Research and Development. Research and Development will be allowed not to make a profit in the first years of production, but after that it will have to start to recover the costs of the department. There will be 4 engineers active in this department, with a weekly capacity of 40 hours to spend on consulting services. Total capacity is therefore set at 52*40*4=8.320 hours.

Capacity will not be used in the first two years due to start-up of the operations, in the third year, it is assumed that 50% of the hours used can be invoiced to clients. This is then expected to grow steadily with 10% per annum until the maximum capacity is reached in 2017.

Facilities
Several testing and CNC machines can be rented for a half day, per machine, capacity is 720 (360 days x 2). There is one Coordinate Measuring Machine for Automated Part Inspection & Reverse Engineering and a number of tools that can be used. It is expected that in the first year, 50% of capacity will be used and demand will grow with an annual 5%.

Financing
To offer finance facilities, a certain amount of funds should be made available at a certain rate which will be lend to the sector at a higher rate. The COMFAR industrial feasibility study software does not provide facilities to take this kind of structure into account, therefore this should be considered in addition to the result of the model.

Marketing and logistics
The TICCG will provide consulting services with regards to marketing and logistics. These consulting services will be charged for per hour, as is common practise for consultancy services. It is expected that these services will start 3 years after the inception of the TICCG. Only one expert is assumed to be working in this department, who will have a capacity of 360 days of 8 hours and who will be supported by 1 support staff member of whom a yearly 120 days of 8 hours are expected to be chargeable to the client, totalling to a capacity of 3840 hours.

In the first 3 year, no chargeable hours are expected to be made as the department will be set up during that period. In 2011 the service unit is assumed to be operational and expected use of 50% of total capacity and a growth rate of 10% is expected. This way, maximal capacity will be reached in 2019.

1.3 Currency

The model uses USD. The rate of exchange is 1 US$ = 9,150 Cedis.

1.4 Joint venture partners

The joint venture partners identified for the TICCG are:

- Government of Ghana;
- UNIDO;
- Private partner.

1.5 Discounting

Discounting should be considering the following sources:

	Rate %	Length (years)
Total investment	12,06%	22
Local equity	16%	22
Foreign equity	18%	22

The discounting rate is depending on the type of risk and the finance plan (WACC).

1.6 Fixed investment costs

The table below shows the initial investments needed for the implementation of the TICCG.

- Investment in land is based on high end price for industrial land in the Kumasi region, being USD 100,000 for a plot of land of 2 acres[1]. The area requirement for the initial TICCG is 7 acre (13,750m²). For purposes of expansion the purchase of 15 acres of land has been budgeted for, leaving 8 acres for future extension or development by the private sector. Total investment costs are therefore USD 750,000 for the purchase of land.
- For details on investment costs of site development and civil works please refer to annex 3 and 4.

[1] Source: Ghana Institure of Surveyors, P.Longdon

- Auxiliary equipment exists of furniture, PC's, fire fighting, electrical equipment, details can be found in annex 4.
- Preproduction expenditures are:
    - This pre-investment study and additional detailed impact assessments, architect cost, setting up a more detailed outline business case and output specifications. For this purpose USD 250,000 has been reserved.
    - Preparatory investigations, a reservation of US$ 100,000 has been made for more detailed investigations with regards to site, engineering, financing etc.
    - Company formation fees are around Cedi 1.6 mln. or 175 USD, please refer to annex 5 for details (source: Laryea, Laryea & Co.).
    - Procurement; consultancy services will be required for procurement and contract negotiations. 75 man days have been estimated:
        - 25 days for a local procurement/legal specialist at US$ 1,000;
        - 25 days for a local technical expert at US$ 500;
        - 25 days for a foreign project manager at US$ 1,200.
    - Marketing will start in the last year of the construction phase in order to be able to sell in the first year of production. A budget of US$ 150,000 has been reserved.
    - Project management for the construction and company set-up phase by a team of 3 local experts and 3 foreign experts.
    - Recruitment and training costs will be made in the pre-production phase. In the first year, the General Management should be recruited as well as the marketing staff that will start securing sales for the first year of production.
- Contingencies, 20% of investments have been reserved for contingencies.
- Initial working capital is for the first year of production, in which half the nominal capacity is expected to be produced.
- For the following cost items, reinvestment is required after depreciation:
    - Machinery and equipment;
    - IT facilities;
    - Transport facilities;
    - Auxiliary and service plant equipment.

Cost item	Currency	No. yrs depreciation	Scrap value %	Cost project year 1	2
Land purchase	US$	-	100	750,000	
Site development	US$	20	10	482,838	
Civil works buildings	US$	20	50	4,989,334	
Machinery and equipment	US$	15	10		12,000,000
IT facilities	US$	5	10		160,000
Transport facilities	US$	5	10		250,000
Auxiliary and service plant equipment	US$	10	10	968,000	185,750
Pre-production expenditures			0	890,800	723,475
Of which Pre investment studies	*US$*	*0*	*0*	*250,000*	
Of which preparatory investigations	*US$*			*100,000*	
Of which company formation fees	*USD*				*175*
Of which procurement/ contracting	*US$*			*80,000*	
Of which preproduction supplies, marketing	*US$*				*150,000*
Of which Project management	*US$*			*453,300*	*453,300*
Of which recruitment and training	*US$*			*7,500*	*120,000*
Initial working capital	US$	-	-		84,000
Subtotal				21,001,359	
Contingencies 10%	US$			2,100,136	
Total investment	US$			23,101,495	

All depreciation is from linear to scrap.

1.7 Production costs

Labour is in the case of TICCG split into 4 categories as shown in the table below:

Description	Type	monthly wages (Cedis)	Specification
Skilled labour	Type 1	27,450,000	General management
Skilled labour	Type 2	10,000,000	Professional staff and team managers
Unskilled labour	Type 1	2,000,000	Operational workers
Unskilled labour	Type 2	1,500,000	Other unskilled staff
Labour overhead		12,5%	

(Source: Bruks Associates: Market survey)

1.7.1 Indirect costs

The only indirect costs identified are labour costs and marketing costs. An annual marketing budget of US$ 30,000 has been reserved for promotional activities, mainly in newspapers and on the radio.

The general management consists of 3 members (skilled labour type 1).

The support staff service unit consists of the following fte's.
Support staff division exists of a number of disciplines, the table below shows the division of its 16 fte's.

Discipline	No. Skilled 1	No. skilled 2	No. unskilled 1	No. unskilled 2
Marketing		2		
Warehouse				2
Security		1	3	
IT		2		
Cooks			2	
Book keeping		2		
Canteen staff				2
Total	0	7	5	4

1.7.2 Production of capital goods or specialized components

Labour
Production is the most labour intensive department of the TICCG. There are 12 CNC machines, which each need to be operated by operational workers (unskilled staff 2). There are enough workers for the shift of 9 hours and operation of 7 days a week under assumption of a 40 hours working week. There are also other machines that need to be operated; therefore there will be 5 extra operational staff. Besides, there will be a team leader on each shift assuming a 40 hours working week (1,5 fte skilled labour 2) and 5,5 fte professional staff that will assist the operational staff, solve problems, repair machines etc.

Description	Type	Monthly wages (Cedis)	Specification	No. production	
				2008	2012
Skilled labour	Type 1	27,450,000	General management	0	0
Skilled labour	Type 2	10,000,000	Professional staff and team managers	7	14
Unskilled labour	Type 1	2,000,000	Operational workers	24	48
Unskilled labour	Type 2	1,500,000	Other unskilled staff	12	24

Labour overhead
Labour overhead is 12.5% per annum, in the model, this is added onto the wages rather than included as a special overhead cost due to restrictions in modelling possibilities of the COMFAR software.

Raw materials
The exact output of the TICCG should be flexible, and therefore the raw materials input are hard to define in great detail. The following assumptions have therefore been made:

- All parts and components are made of the same raw material; stainless steel;
- World stainless steel prices are US$ 4000 / tonne, which means US$4 per kilo (www.meps.co.uk);
- Each part or component is assumed to weight on average 0,5 kilo.

Operating costs; energy
The CNC machines have at least 6 motors per machine, this machine is therefore expensive to use in terms of energy consumption. The operational costs for a CNC machine can easily sum up to about US$ 30 per hour per machine in the USA. There are 12 CNC machines in the TICCG. Therefore energy consumption adds up to US$ 360 per hour and US$ 17.50 per unit output a USA prices. USA electricity prices lay about 11% above electricity prices in Ghana, therefore in Ghana, energy prices of production are estimated to be around US$ 15.60 per unit of output.

Maintenance and repair
Costs of maintenance and repair are estimated to be 5% of total value of machinery and equipment at use of capacity of 67,200 units of output. This means a daily shift of 9 hours full capacity use. As capacity increases, the machines will wear out faster but also more output will be produced. Therefore the repair and maintenance costs have been linked to the number of products. Costs of maintenance and repair is US$ 8.90 per product.

1.7.3 Training

Labour
There will be 4 teachers working in the TICCG, all with different expertise. As there is only a limited number of students, the teachers will not work full time, therefore, the amount of fte for training is only 2.

Description	Type	Monthly wages (Cedis)	Specification	No. Training (Fte)
Skilled labour	Type 1	27,450,000	General management	0
Skilled labour	Type 2	10,000,000	Professional staff and team managers	2
Unskilled labour	Type 1	2,000,000	Operational workers	0
Unskilled labour	Type 2	1,500,000	Other unskilled staff	0

Labour overhead
Labour overhead is 12.5% per annum.

Raw Materials
Students will have to work with the CNC machines in order to optimise their knowledge of the operation of the machinery. Therefore, some raw material is required for tests and classes. Any well prepared outputs, can be sold and production is added to the output of the production business unit. Raw material reserved for tests and mistakes will be 20 kg of steel per student per training course.

1.7.4 Research and development

Labour
The Research and Development department depends highly on skilled professional staff. It is assumed that in this department, 4 professional staff will be attracted supported by 2 support staff.

Description	Type	Monthly wages (Cedis)	Specification	No. R&D
Skilled labour	Type 1	27,450,000	General management	0
Skilled labour	Type 2	10,000,000	Professional staff and team managers	4
Unskilled labour	Type 1	2,000,000	Operational workers	2
Unskilled labour	Type 2	1,500,000	Other unskilled staff	0

Labour overhead
Labour overhead is 12,5% per annum.

Raw Materials
In order to conduct research and development, proto-types need to be built, raw material has to be tested and used for the production of the prototypes. An amount of 30 kg of raw material is reserved per month for these activities.

1.7.5 Facilities

Labour
The machines available for this department will be rented to the sector and there will be 2 skilled staff to assist in the operation of the machinery as well as one unskilled staff member to support.

Description	Type	Monthly wages (Cedis)	Specification	No. Facilities
Skilled labour	Type 1	27,450,000	General management	0
Skilled labour	Type 2	10,000,000	Professional staff and team managers	2
Unskilled labour	Type 1	2,000,000	Operational workers	1
Unskilled labour	Type 2	1,500,000	Other unskilled staff	0

Labour overhead
Labour overhead is 12,5% per annum.

1.7.6 Financing

Labour
In the financing department, an initial number of 4 finance professionals will be attracted. One of them will be the team manager and one will be a junior finance consultant. The TICCG is expected to start giving finance solutions after the first 3 years of operation of the centre, but the staff will start working in 2008, setting up the department, manage relation ships, attract funds etc.

Description	Type	Monthly l wages (Cedis)	Specification	No. Financing
Skilled labour	Type 1	27,450,000	General management	0
Skilled labour	Type 2	10,000,000	Professional staff and team managers	3
Unskilled labour	Type 1	2,000,000	Operational workers	1
Unskilled labour	Type 2	1,500,000	Other unskilled staff	0

Labour overhead
Labour overhead is 12,5% per annum.

1.7.7 Marketing and logistics

Labour
The marketing and logistic department will have 1 professional staff and 1 unskilled staff to begin with. It is expected that marketing and logistic services will be started to be provided after the first three years of operation. However, this staff will start working from the start of 2008 in order to set up the department, obtain expertise etc.

Description	Type	Monthly wages (Cedis)	Specification	No. Marketing and logistics
Skilled labour	Type 1	27,450,000	General management	0
Skilled labour	Type 2	10,000,000	Professional staff and team managers	1
Unskilled labour	Type 1	2,000,000	Operational workers	1
Unskilled labour	Type 2	1,500,000	Other unskilled staff	0

Labour overhead
Labour overhead is 12,5% per annum.

1.8 Sales program

1.8.1 Sales tax

Sales tax in Ghana is 12.5%, this has been applied for each product.

1.8.2 Price setting

Parts and components
During the opportunity study, stakeholders indicated that it is preferable for the TICCG to have a diversified market focus. However taken into account that some prioritization is necessary the TICCG should focus initially on:

1. Food Processing Industry;
2. Agricultural Production Industry;
3. Machine Tooling.

The TICCG has no production line whose output is predictable as details about the outputs the TICCG should produce are flexible. The TICCG should be able to produce capital goods that are currently imported and above the capability of the current players and should be adjusting its output in line with the evolving capacities of the Ghanaian producers. For this purpose, machines that would be flexible enough to produce any shape of metal have been selected. Therefore output is expected to be a wide range of products and will not be discussed in great detail in this study. To determine the price of capital goods, the following cost items have been taken into account:

- Raw material: US$ 2.00 per product;
- Labour: US$ 2.50 per product;
- Depreciation on machines US$ 10.70 per product;
- Maintenance and repair of machines US$ 8.90 per product (refer to section 1.8.2);
- Operating costs per CNC machine: (USA prices) US$ 30 per hour, totaling to 12* US$ 30 = US$ 360 per hour. Production per hour is 20.5 units. Per unit, operating costs will be US$ 17.50,- at USA prices. USA electricity prices lay around 12%

above Ghanaian electricity prices, therefore in Ghana operating costs per unit are set at US$15.60;

- Consequently, the direct cost price of the products is US$ 39.70;
- Reservations should be made for the cost of capital, profit etc. Besides, the uniqueness of the products in Ghana allows to use skimming prices;
- The initial sales price is therefore set at US$ 100 per part/component.

The outcome of the sales plan (nominal production x price of product) has been checked against relevant import figures of the above mentioned three sectors taking the 2004 market size as a reference. No price increase has been taken into account for ease of reference. This analysis helps determining the feasibility of selling the amount produced. The result of this analysis is shown in the table below. It can be concluded that the sales projections of this model are feasible.

Growth of the production and sales is set up as follows:
In the first year of production, 50% of the capacity is expected to be sold. As the market is a fast expanding one, a growth in sales numbers of 50% in the first year is considered feasible. This way, the total capacity of the factory operating with one 9-hours shift is reached in 2011. In 2012, a second shift will be necessary to meet demand. After 2012, a more moderate annual growth rate of 10% has been accounted for. In 2020 the factory will be producing at the top of its capacity when operating in 2 shifts. At that time extra investment can be considered or an extra shift can be implemented, starting to operate 24 hours a day. In this feasibility study, neither of these actions is considered.

Year	TICCG Gross Sales Revenue parts and components	Percentage of 2004 market
2008	3,360,000	4.0 %
2012	8,944,320	10,7%
2018	13,095,400	15.6%
2023	13,440,000	16.1%
2027	13,440,000	16.1%

Training
The TICCG has a facility to train 25 students at a time. It is assumed that each training takes 12 weeks or 1 quarter. The costs of training are built up as follows:

- Investment in equipment and furniture for training facility and students dorms and canteen facility = US$ 91,750, this will be depreciated in 10 years, leaving a scrap value of 10%. Therefore, this will be a depreciation of US$ 82,58 per student;
- Costs of staff = US$ 413,- per student (4 teachers with monthly income of Cedis 10,000,000 and 12.5% overhead on labour);
- Cost of raw material per student = US$ 80.00;
- Total costs of the training per student is US$ 575.58;
- Reservation of 17% for profit and 15% for contingencies leads to a price per training of **US$ 760,- per student**.

In the first year 75% of capacity is used (75 students) but it is expected that from year 2 onwards, total capacity will be used due to limited capacity and expected level of demand.

Research and Development
Research and Development services are demand driven, applied research and development. The client pays the researcher per hour for consulting services and materials will be added to this. Rates for consultancy services are around US$ 300,- per day in Ghana. As technology and industrial R&D requires high skilled and continuously educated professional staff, a price of US$ 400 per day/ US$ 50 per hour can be justified for Research and Development services, including use of raw materials. Yearly nominal R&D capacity is 8,320 hours (4 engineers, having 40 available hours per week for R&D activities).

Capacity will not be used in the first two years due to start-up of the operations, in the third year, it is assumed that 50% of the hours used can be invoiced to clients. This is then expected to grow steadily with 10% per annum until the maximum capacity is reached in 2017.

Facilitiy Rental Services
For the facility rental services,, several testing and CNC machines can be rented for a half day, per machine, capacity is 720 (360 days x 2). There is one Coordinate Measuring Machine for Automated Part Inspection & Reverse Engineering and a number of tools that can be used. It is expected that in the first year, 50% of capacity will be used and demand will grow with an annual 5%.

For each half day, the costs are:

Depreciation:	US$ 31,25 per half day;
Labour:	US$ 32,80 per half day;
Energy consumption:	US$ 40 per half day;
Total costs:	US$ 104,00;
Contingencies:	15%;
Profit margin:	15%;
Price of a half day:	US$ 125.

Finance
Sales of finance are hard to estimate at this point. The TICCG can attract the funds that are required by the sector, pay a certain amount of interest and charge a certain amount of interest. These are fluctuating and no research has been done about the finance demand in the sector, stakeholders have however indicated that a financing facility would be needed. Income from financing activities has not been taken into account in this model.

Marketing and logistics
These are consulting services, for which an hourly rate will be charged. At the start, the business unit will be set up by one professional staff member and one support staff member. According to the demand, additional staff will be attracted at a later stage. In the beginning, one professional staff member will have the capacity of 40 hours a week for

consulting services. Charges for consulting services in Ghana are around US$ 300 per day/ 37.50 per hour.

In the first 3 year, no chargeable hours are expected to be made as the department will be set up during that period. In 2011 the service unit is assumed to be operational and expected use of 50% of total capacity and a growth rate of 10% is expected. This way, maximal capacity will be reached in 2019.

1.8.3 Sales numbers

The table below shows the project assumption on sales numbers. As production of capital goods is the main driver for the results of the TICCG, a more dynamic trend in sales numbers has been assumed. The assumptions are based on the expansion of the production capacity in 2012 by introducing an extra shift of 9 hours. After 2012 production grows steadily with 10% per annum to the maximum capacity, which is assumed to be reached in 2020.
For the other business units, very rough estimates have been used, linked to the capacity available at the first year of production and no capacity expansion have been accounted for.

	2008	2013	2018	2023	2027	Sales price US$
Production of capital goods or specialized components	33,600	81,312	130,954	134,400	134,400	115
Training	75	100	100	100	100	760
R & D	0	5,537	7,500	7,500	7,500	50
Facilities	360	540	720	720	720	125
Finance	N/A	N/A	N/A	N/A	N/A	Interest
Marketing and logistics	0	2,323	3,742	3,840	3,840	37,50

1.9 Working capital

Working capital requirements during the production phase are defined in terms of minimum day's coverage and the coefficient of turnover is the number of yearly rotations raw materials in stock. This is only applicable for the production business unit. As the raw material (stainless steel) has to be imported which may cause delays, it was assumed that a stock of 90 days would be a safeguard to stay in production at all times. This means the minimum day's coverage is set at 90 resulting in 4 rotations per annum.

It is assumed that the work in process can cover a maximum of 2 days and that the finished products will be sold after 60 days.
For the other business units, for which raw material is used (training and Research and Development), the same minimum coverage days are used as raw material is identical and can be ordered in one lot.

1.10 Sources of finance

It is in this project assumed that debt/equity for initial investments will be divided on a 50/50 basis.

Source of finance	Interest/return on equity	Percentage of total	Repayment
Local equity	16%	25%	
Foreign equity	18%	25%	
Development bank loan	5%	25%	10 instalments, starting 2013
Foreign long term debt	12%	25%	15 instalments starting 2008

The weighted average costs of capital is 11,56%.

No local debt is assumed to be attracted as the interest rate in Ghana is too high; lending rate is 28% in September 2005 according to Bank of Ghana.

For reinvestment, no finance plan is prepared yet.

1.11 Taxes, allowances etc.

Corporate tax in Ghana is set at 28% in 2005.

VAT is 12,5% in Ghana.

No allowances have been taken into account.

No depreciation adjustment has been taken into account.

Annex 2 Output feasibility model

SUMMARY SHEET

Project title:	Technology Centre for Capital Goods - Ghana
Date and time:	4 September 2005
Project classification:	New project Joint-venture project
Construction phase:	1-2006 - 12-2007
Length:	2 years
Production phase:	1-2008 - 12-2027
Length:	20 years
Accounting currency:	United States Dollars (USD)
Units:	Absolute
Local currency:	Cedis (C)
Exchange rate:	1,0000 USD = 9.150,0000 C

INVESTMENT COSTS

	Total construction	Total production	Total investment
Total fixed investment costs	21.352.219,00	15.956.330,85	37.308.549,85
Total pre-production expenditures	3.031.594,53	0,00	3.031.594,53
Pre-production expenditures (net of interest)	*1.614.229,52*	*0,00*	*1.614.229,52*
Interest	*1.417.365,01*	*0,00*	*1.417.365,01*
Increase in net working capital	84.000,00	375.403,93	459.403,93
TOTAL INVESTMENT COSTS	24.467.813,53	16.331.734,79	40.799.548,32

SOURCES OF FINANCE

	Total construction	Total production	Total inflow
Total equity capital	11.771.770,83	15.787.500,00	27.559.270,83
Foreign	*0,00*	*0,00*	*0,00*
Local	*11.771.770,83*	*15.787.500,00*	*27.559.270,83*
Total long-term loans	12.750.815,50	0,00	12.750.815,50
Foreign	*12.750.815,50*	*0,00*	*12.750.815,50*
Local	*0,00*	*0,00*	*0,00*
Total short-term loans	0,00	0,00	0,00
Foreign	*0,00*	*0,00*	*0,00*

SUMMARY SHEET

Local	*0,00*	*0,00*	*0,00*
Accounts payable	0,00	13.063,31	13.063,31
TOTAL SOURCES OF FINANCE	24.522.586,33	15.800.563,31	40.323.149,64

INCOME AND COSTS, OPERATIONS

	First year 2008	Reference year 2008	Last year 2027
SALES REVENUE	3.462.000,00	3.462.000,00	14.125.000,00
Factory costs	1.272.361,15	1.272.361,15	4.506.156,48
Administrative overhead costs	121.500,00	121.500,00	44.262,30
OPERATING COSTS	1.393.861,15	1.393.861,15	4.550.418,78
Depreciation	1.092.939,32	1.092.939,32	1.107.451,09
Financial costs	1.083.819,32	1.083.819,32	0,00
TOTAL PRODUCTION COSTS	3.570.619,79	3.570.619,79	5.657.869,87
Marketing costs	91.967,21	91.967,21	91.967,21
COSTS OF PRODUCTS	3.662.587,00	3.662.587,00	5.749.837,08
Interest on short-term deposits	0,00	0,00	0,00
GROSS PROFIT FROM OPERATIONS	-200.587,00	-200.587,00	8.375.162,92
Extraordinary income	0,00	0,00	0,00
Extraordinary loss	0,00	0,00	0,00
Depreciation allowances	0,00	0,00	0,00
GROSS PROFIT	-200.587,00	-200.587,00	8.375.162,92
Investment allowances	0,00	0,00	0,00
TAXABLE PROFIT	0,00	0,00	8.375.162,92
Income (corporate) tax	0,00	0,00	2.345.045,62
NET PROFIT	-200.587,00	-200.587,00	6.030.117,30

RATIOS

Net Present Value of Total Capital Invested	at 12,06%	7.943.650,66
Internal rate of return on investment (IRR)	16,68%	
Modified IRR on investment	16,68%	
Net Present Value of Total Equity Capital Invested	at 16,00%	3.379.744,22
Internal rate of return on equity (IRRE)	20,09%	
Modified IRRE on equity	20,09%	
Net present values discounted to	1-2006	

FIXED INVESTMENT COSTS - TOTAL
United States Dollars

	Total construction	Total production	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011
Land purchase	750.000,00	0,00	750.000,00	0,00	0,00	0,00	0,00	0,00
Site preparation and development	482.838,00	0,00	482.838,00	0,00	0,00	0,00	0,00	0,00
Civil works, structures and buildings	4.506.495,00	0,00	4.506.495,00	0,00	0,00	0,00	0,00	0,00
Plant machinery and equipment	12.164.000,00	12.648.830,85	0,00	12.164.000,00	0,00	0,00	0,00	0,00
Auxiliary and service plant equipment	1.403.750,00	3.307.500,00	968.000,00	435.750,00	0,00	0,00	0,00	0,00
Environmental protection	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Incorporated fixed assets (project overheads)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Contingencies	2.045.136,00	0,00	0,00	2.045.136,00	0,00	0,00	0,00	0,00
TOTAL FIXED INVESTMENT COSTS	21.352.219,00	15.956.330,85	6.707.333,00	14.644.886,00	0,00	0,00	0,00	0,00
Foreign share (%)	84,65	100,00	81,62	86,04	0,00	0,00	0,00	0,00

FIXED INVESTMENT COSTS - TOTAL
United States Dollars

	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019
Land purchase	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Site preparation and development	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Civil works, structures and buildings	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Plant machinery and equipment	0,00	190.189,72	0,00	0,00	0,00	0,00	215.182,21	0,00
Auxiliary and service plant equipment	250.000,00	0,00	0,00	0,00	0,00	1.218.000,00	185.750,00	0,00
Environmental protection	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Incorporated fixed assets (project overheads)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Contingencies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL FIXED INVESTMENT COSTS	250.000,00	190.189,72	0,00	0,00	0,00	1.218.000,00	400.932,21	0,00
Foreign share (%)	100,00	100,00	0,00	0,00	0,00	100,00	100,00	0,00

FIXED INVESTMENT COSTS - TOTAL
United States Dollars

	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Land purchase	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Site preparation and development	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Civil works, structures and buildings	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Plant machinery and equipment	0,00	0,00	0,00	12.243.458,92	0,00	0,00	0,00	0,00
Auxiliary and service plant equipment	0,00	0,00	250.000,00	0,00	0,00	0,00	968.000,00	435.750,00
Environmental protection	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Incorporated fixed assets (project overheads)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Contingencies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL FIXED INVESTMENT COSTS	0,00	0,00	250.000,00	12.243.458,92	0,00	0,00	968.000,00	435.750,00
Foreign share (%)	0,00	0,00	100,00	100,00	0,00	0,00	100,00	100,00

PRE-PRODUCTION EXPENDITURES - TOTAL
United States Dollars

	Total construction	Total production	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011
Pre-investment studies	250.000,00	0,00	250.000,00	0,00	0,00	0,00	0,00	0,00
Preparatory investigations	100.000,00	0,00	100.000,00	0,00	0,00	0,00	0,00	0,00
Company formation, fees etc.	172,14	0,00	0,00	172,14	0,00	0,00	0,00	0,00
Technology acquisition	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Detailed engineering, contracting	80.000,00	0,00	80.000,00	0,00	0,00	0,00	0,00	0,00
Pre-production supplies, marketing	150.000,00	0,00	0,00	150.000,00	0,00	0,00	0,00	0,00
Other capital (issue) expenditures	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Contingencies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Project management	906.557,38	0,00	453.278,69	453.278,69	0,00	0,00	0,00	0,00
Recruitment and training	127.500,00	0,00	7.500,00	120.000,00	0,00	0,00	0,00	0,00
Pre-production expenditures (net of interest)	1.614.229,52	0,00	890.778,69	723.450,83	0,00	0,00	0,00	0,00
Interest	1.417.365,01	0,00	333.545,70	1.083.819,32	0,00	0,00	0,00	0,00
TOTAL PRE-PRODUCTION EXPENDITURES	3.031.594,53	0,00	1.224.324,38	1.807.270,15	0,00	0,00	0,00	0,00
Foreign share (%)	79,74	0,00	72,17	84,87	0,00	0,00	0,00	0,00

PRE-PRODUCTION EXPENDITURES - TOTAL
United States Dollars

	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019
Pre-investment studies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Preparatory investigations	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Company formation, fees etc.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Technology acquisition	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Detailed engineering, contracting	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pre-production supplies, marketing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other capital (issue) expenditures	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Contingencies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Project management	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Recruitment and training	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pre-production expenditures (net of interest)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Interest	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL PRE-PRODUCTION EXPENDITURES	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRE-PRODUCTION EXPENDITURES - TOTAL
United States Dollars

	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Pre-investment studies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Preparatory investigations	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Company formation, fees etc.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Technology acquisition	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Detailed engineering, contracting	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pre-production supplies, marketing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other capital (issue) expenditures	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Contingencies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Project management	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Recruitment and training	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pre-production expenditures (net of interest)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Interest	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL PRE-PRODUCTION EXPENDITURES	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

NET WORKING CAPITAL REQUIREMENTS - TOTAL
United States Dollars

	Coefficient of turnover	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012
Total inventory	0,00	0,00	84.000,00	129.730,61	178.176,45	215.111,43	227.578,72	265.759,27
Accounts receivable	0,00	0,00	0,00	3.794,67	5.272,62	6.231,33	6.954,40	8.045,16
Cash-in-hand	360,00	0,00	0,00	2.296,35	2.807,38	3.141,54	3.417,87	4.184,38
CURRENT ASSETS	0,00	0,00	84.000,00	135.821,64	186.256,44	224.484,30	237.950,99	277.988,81
Accounts payable	0,00	0,00	0,00	4.388,84	5.622,32	6.551,45	6.985,94	8.096,93
CURRENT LIABILITIES	0,00	0,00	0,00	4.388,84	5.622,32	6.551,45	6.985,94	8.096,93
TOTAL NET WORKING CAPITAL REQUIREMENTS	0,00	0,00	84.000,00	131.432,80	180.634,12	217.932,85	230.965,05	269.891,88
INCREASE IN NET WORKING CAPITAL	0,00	0,00	84.000,00	47.432,80	49.201,32	37.298,73	13.032,20	38.926,84
Foreign share (%)	0,00	0,00	100,00	18,37	19,29	19,83	19,79	18,66

NET WORKING CAPITAL REQUIREMENTS - TOTAL
United States Dollars

	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019	Production 2020
Total Inventory	287.917,15	312.258,01	338.998,84	368.352,10	400.637,62	436.089,77	446.450,82	447.128,40
Accounts receivable	8.630,51	9.273,17	9.978,84	10.740,17	11.573,97	12.489,16	12.779,72	12.816,83
Cash-in-hand	4.409,20	4.655,28	4.924,72	5.206,44	5.512,12	5.846,67	5.951,09	5.981,10
CURRENT ASSETS	300.956,86	326.186,46	353.902,40	384.298,70	417.723,71	454.425,60	465.181,63	465.926,33
Accounts payable	8.687,19	9.335,52	10.047,42	10.815,52	11.656,95	12.580,38	12.805,03	12.816,41
CURRENT LIABILITIES	8.687,19	9.335,52	10.047,42	10.815,52	11.656,95	12.580,38	12.805,03	12.816,41
TOTAL NET WORKING CAPITAL REQUIREMENTS	292.269,67	316.850,95	343.854,98	373.483,18	406.066,76	441.845,22	452.376,61	453.109,92
INCREASE IN NET WORKING CAPITAL	22.377,79	24.581,28	27.004,04	29.628,20	32.583,58	35.778,47	10.531,38	733,31
Foreign share (%)	18,96	19,24	19,50	19,75	19,98	20,20	20,17	20,10

NET WORKING CAPITAL REQUIREMENTS - TOTAL
United States Dollars

	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Total inventory	448.047,58	449.012,09	450.022,94	451.083,87	452.197,85	453.367,53	453.344,16
Accounts receivable	12.855,73	12.896,50	12.935,97	12.976,36	13.018,77	13.063,31	12.895,52
Cash-In-hand	6.020,00	6.060,77	6.100,23	6.140,62	6.183,03	6.227,57	6.059,78
CURRENT ASSETS	466.923,32	467.969,36	469.059,15	470.200,86	471.399,66	472.658,40	472.299,45
Accounts payable	12.855,74	12.896,51	12.935,97	12.976,36	13.018,77	13.063,31	12.895,52
CURRENT LIABILITIES	12.855,74	12.896,51	12.935,97	12.976,36	13.018,77	13.063,31	12.895,52
TOTAL NET WORKING CAPITAL REQUIREMENTS	454.067,57	455.072,85	456.123,17	457.224,49	458.380,89	459.595,10	459.403,93
INCREASE IN NET WORKING CAPITAL	957,65	1.005,28	1.050,32	1.101,32	1.156,39	1.214,21	-191,16
Foreign share (%)	20,06	20,02	19,97	19,92	19,87	19,82	19,83

INVESTMENT COSTS - TOTAL
United States Dollars

	Total construction	Total production	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011
Total fixed investment costs	21.352.219,00	15.956.330,85	6.707.333,00	14.644.886,00	0,00	0,00	0,00	0,00
Total pre-production expenditures	3.031.594,53	0,00	1.224.324,38	1.807.270,15	0,00	0,00	0,00	0,00
Increase in net working capital	84.000,00	375.403,93	0,00	84.000,00	47.432,80	49.201,32	37.298,73	13.032,20
TOTAL INVESTMENT COSTS	24.467.813,53	16.331.734,79	7.931.657,38	16.536.156,15	47.432,80	49.201,32	37.298,73	13.032,20
Foreign share (%)	84,09	97,74	80,16	85,98	-126,20	21,76	22,43	19,22

INVESTMENT COSTS - TOTAL
United States Dollars

	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019
Total fixed investment costs	250.000,00	190.189,72	0,00	0,00	0,00	1.218.000,00	400.932,21	0,00
Total pre-production expenditures	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Increase in net working capital	38.926,84	22.377,79	24.581,28	27.004,04	29.628,20	32.583,58	35.778,47	10.531,38
TOTAL INVESTMENT COSTS	288.926,84	212.567,51	24.581,28	27.004,04	29.628,20	1.250.583,58	436.710,68	10.531,38
Foreign share (%)	88,14	91,84	22,54	22,57	22,62	97,98	93,66	18,92

INVESTMENT COSTS - TOTAL
United States Dollars

	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Total fixed investment costs	0,00	0,00	250.000,00	12.243.458,92	0,00	0,00	968.000,00	435.750,00
Total pre-production expenditures	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Increase in net working capital	733,31	957,65	1.005,28	1.050,32	1.101,32	1.156,39	1.214,21	-191,16
TOTAL INVESTMENT COSTS	733,31	957,65	251.005,28	12.244.509,24	1.101,32	1.156,39	969.214,21	435.558,84
Foreign share (%)	-19,22	-0,04	99,60	99,99	0,00	0,00	99,87	100,04

ANNUAL COSTS OF PRODUCTS - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016
Raw materials	72.800,66	103.655,58	128.160,90	135.166,91	149.033,51	163.936,78	180.329,92	198.362,22	218.178,07
Factory supplies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Utilities	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Energy	568.750,00	809.375,00	1.000.781,25	1.055.468,75	1.163.750,00	1.280.125,00	1.408.134,11	1.548.942,71	1.703.740,89
Spare parts consumed	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Repair, maintenance, material	323.960,00	461.020,00	570.045,00	601.195,00	662.872,00	729.159,20	802.073,19	882.277,77	970.450,81
Royalties	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Labour	381.227,05	428.135,74	439.409,03	507.736,88	722.004,99	736.652,22	752.328,27	769.122,86	782.367,70
Labour overhead costs (taxes etc.)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Factory overhead costs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
FACTORY COSTS	1.346.737,71	1.802.186,32	2.138.396,19	2.299.567,54	2.697.660,50	2.909.873,20	3.142.865,50	3.398.705,55	3.674.737,47
Administrative overhead costs	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00
OPERATING COSTS	1.468.237,71	1.923.686,32	2.259.896,19	2.421.067,54	2.819.160,50	3.031.373,20	3.264.365,50	3.520.205,55	3.796.237,47
Depreciation	1.092.939,32	1.092.939,32	1.092.939,32	1.092.939,32	1.092.939,32	976.508,48	1.010.742,63	1.010.742,63	1.010.742,63
Financial costs	1.083.819,32	1.032.816,06	981.812,79	930.809,53	879.806,27	796.925,97	714.045,67	631.165,37	548.285,07
TOTAL PRODUCTION COSTS	3.644.996,35	4.049.441,70	4.334.648,30	4.444.816,40	4.791.906,09	4.804.807,65	4.989.153,80	5.162.113,55	5.355.265,16
Direct marketing costs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Marketing overhead costs	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
COSTS OF PRODUCTS	3.736.963,56	4.141.408,91	4.426.615,51	4.536.783,61	4.883.873,30	4.896.774,86	5.081.121,01	5.254.080,77	5.447.232,38
Foreign share (%)	57,87	51,73	47,80	45,67	41,66	39,56	37,49	35,02	32,62
Variable share (%)	34,74	39,92	44,77	47,07	51,71	55,73	58,12	60,90	63,63

ANNUAL COSTS OF PRODUCTS - TOTAL
United States Dollars

	Production 2017	Production 2018	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025
Raw materials	240.002,07	263.991,40	269.473,57	268.899,23	268.899,23	268.899,23	268.899,23	268.899,23	268.899,23
Factory supplies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Utilities	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Energy	1.874.240,89	2.061.657,55	2.104.486,98	2.100.000,00	2.100.000,00	2.100.000,00	2.100.000,00	2.100.000,00	2.100.000,00
Spare parts consumed	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Repair, maintenance, material	1.067.567,61	1.174.320,14	1.198.715,78	1.196.160,00	1.196.160,00	1.196.160,00	1.196.160,00	1.196.160,00	1.196.160,00
Royalties	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Labour	795.296,39	808.982,42	822.177,24	835.536,71	849.540,66	864.217,76	878.424,01	892.964,17	908.232,40
Labour overhead costs (taxes etc.)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Factory overhead costs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
FACTORY COSTS	3.977.106,95	4.308.951,51	4.394.853,57	4.400.595,94	4.414.599,90	4.429.276,99	4.443.483,25	4.458.023,41	4.473.291,63
Administrative overhead costs	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00	121.500,00
OPERATING COSTS	4.098.606,95	4.430.451,51	4.516.353,57	4.522.095,94	4.536.099,90	4.550.776,99	4.564.983,25	4.579.523,41	4.594.791,63
Depreciation	1.010.742,63	994.025,13	1.015.241,28	1.015.241,28	1.015.241,28	1.015.241,28	295.241,28	1.020.331,09	1.020.331,09
Financial costs	465.404,77	382.524,46	299.644,16	216.763,86	133.883,56	51.003,26	0,00	0,00	0,00
TOTAL PRODUCTION COSTS	5.574.754,35	5.807.001,11	5.831.239,02	5.754.101,09	5.685.224,74	5.617.021,53	4.860.224,53	5.599.854,50	5.615.122,72
Direct marketing costs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Marketing overhead costs	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
COSTS OF PRODUCTS	5.666.721,56	5.898.968,32	5.923.206,23	5.846.068,30	5.777.191,95	5.708.988,75	4.952.191,74	5.691.821,71	5.707.089,93
Foreign share (%)	30,28	27,81	26,75	25,67	24,54	23,38	11,39	22,65	22,59
Variable share (%)	66,31	69,15	70,12	70,94	71,81	72,69	83,81	72,92	72,72

ANNUAL COSTS OF PRODUCTS - TOTAL
United States Dollars

	Production -2026	Production -2027
Raw materials	268.899,23	268.899,23
Factory supplies	0,00	0,00
Utilities	0,00	0,00
Energy	2.100.000,00	2.100.000,00
Spare parts consumed	0,00	0,00
Repair, maintenance, material	1.196.160,00	1.196.160,00
Royalties	0,00	0,00
Labour	924.264,03	941.097,25
Labour overhead costs (taxes etc.)	0,00	0,00
Factory overhead costs	0,00	0,00
FACTORY COSTS	4.489.323,27	4.506.156,48
Administrative overhead costs	121.500,00	44.262,30
OPERATING COSTS	4.610.823,27	4.550.418,78
Depreciation	1.020.331,09	1.107.451,09
Financial costs	0,00	0,00
TOTAL PRODUCTION COSTS	5.631.154,36	5.657.869,87
Direct marketing costs	0,00	0,00
Marketing overhead costs	91.967,21	91.967,21
COSTS OF PRODUCTS	5.723.121,57	5.749.837,08
Foreign share (%)	22,52	23,94
Variable share (%)	72,52	72,18

PRODUCTION AND SALES PROGRAMME - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016
Gross sales revenue	3.894.750,00	6.042.656,25	7.486.228,13	8.068.303,13	8.863.650,00	9.738.267,19	10.700.268,75	11.758.485,94	12.887.381,25
Less sales tax	432.750,00	671.406,25	831.803,13	896.478,13	984.850,00	1.082.029,69	1.188.918,75	1.306.498,44	1.431.931,25
Net sales revenue	3.462.000,00	5.371.250,00	6.654.425,00	7.171.825,00	7.878.800,00	8.656.237,50	9.511.350,00	10.451.987,50	11.455.450,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	3.462.000,00	5.371.250,00	6.654.425,00	7.171.825,00	7.878.800,00	8.656.237,50	9.511.350,00	10.451.987,50	11.455.450,00
Foreign share (%)	0,00	0,00	0,00	1,00	1,01	1,01	1,01	1,01	1,01

PRODUCTION AND SALES PROGRAMME - TOTAL
United States Dollars

	Production 2017	Production 2018	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025
Gross sales revenue	14.122.335,94	15.479.971,88	15.876.000,00	15.880.359,38	15.884.859,38	15.889.500,00	15.890.625,00	15.890.625,00	15.890.625,00
Less sales tax	1.569.148,44	1.719.996,88	1.764.000,00	1.764.484,38	1.764.984,38	1.765.500,00	1.765.625,00	1.765.625,00	1.765.625,00
Net sales revenue	12.553.187,50	13.759.975,00	14.112.000,00	14.115.875,00	14.119.875,00	14.124.000,00	14.125.000,00	14.125.000,00	14.125.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	12.553.187,50	13.759.975,00	14.112.000,00	14.115.875,00	14.119.875,00	14.124.000,00	14.125.000,00	14.125.000,00	14.125.000,00
Foreign share (%)	1,02	1,02	1,02	1,02	1,02	1,02	1,02	1,02	1,02

PRODUCTION AND SALES PROGRAMME - TOTAL
United States Dollars

	Production 2026	Production 2027
Gross sales revenue	15.510.937,50	15.890.625,00
Less sales tax	1.723.437,50	1.765.625,00
Net sales revenue	13.787.500,00	14.125.000,00
Subsidy	0,00	0,00
SALES REVENUE	13.787.500,00	14.125.000,00
Foreign share (%)	1,04	1,02

PRODUCTION AND SALES PROGRAMME - PRODUCTION OF PARTS AND COMPONENTS - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016
Stock brought forward	0,00	2.800,00	4.200,00	5.250,00	5.600,00	6.160,00	6.776,00	7.453,58	8.198,92
Quantity produced	36.400,00	51.800,00	64.050,00	67.550,00	74.480,00	81.928,00	90.120,58	99.132,33	109.039,42
Stock carried over	2.800,00	4.200,00	5.250,00	5.600,00	6.160,00	6.776,00	7.453,58	8.198,92	9.018,33
Quantity sold	33.600,00	50.400,00	63.000,00	67.200,00	73.920,00	81.312,00	89.443,00	98.387,00	108.220,00
Gross unit price (average)	112,50	112,50	112,50	112,50	112,50	112,50	112,50	112,50	112,50
Gross sales revenue	3.780.000,00	5.670.000,00	7.087.500,00	7.560.000,00	8.316.000,00	9.147.600,00	10.062.337,50	11.068.537,50	12.174.750,00
Less sales tax	420.000,00	630.000,00	787.500,00	840.000,00	924.000,00	1.016.400,00	1.118.037,50	1.229.837,50	1.352.750,00
Net sales revenue	3.360.000,00	5.040.000,00	6.300.000,00	6.720.000,00	7.392.000,00	8.131.200,00	8.944.300,00	9.838.700,00	10.822.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	3.360.000,00	5.040.000,00	6.300.000,00	6.720.000,00	7.392.000,00	8.131.200,00	8.944.300,00	9.838.700,00	10.822.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - PRODUCTION OF PARTS AND COMPONENTS - TOTAL
United States Dollars

	Production 2017	Production 2018	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025
Stock brought forward	9.018,33	9.920,75	10.912,83	11.200,00	11.200,00	11.200,00	11.200,00	11.200,00	11.200,00
Quantity produced	119.951,42	131.946,08	134.687,17	134.400,00	134.400,00	134.400,00	134.400,00	134.400,00	134.400,00
Stock carried over	9.920,75	10.912,83	11.200,00	11.200,00	11.200,00	11.200,00	11.200,00	11.200,00	11.200,00
Quantity sold	119.049,00	130.954,00	134.400,00	134.400,00	134.400,00	134.400,00	134.400,00	134.400,00	134.400,00
Gross unit price (average)	112,50	112,50	112,50	112,50	112,50	112,50	112,50	112,50	112,50
Gross sales revenue	13.393.012,50	14.732.325,00	15.120.000,00	15.120.000,00	15.120.000,00	15.120.000,00	15.120.000,00	15.120.000,00	15.120.000,00
Less sales tax	1.488.112,50	1.636.925,00	1.680.000,00	1.680.000,00	1.680.000,00	1.680.000,00	1.680.000,00	1.680.000,00	1.680.000,00
Net sales revenue	11.904.900,00	13.095.400,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	11.904.900,00	13.095.400,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00	13.440.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - PRODUCTION OF PARTS AND COMPONENTS - TOTAL
United States Dollars

	Production 2026	Production 2027
Stock brought forward	11.200,00	11.200,00
Quantity produced	134.400,00	134.400,00
Stock carried over	11.200,00	11.200,00
Quantity sold	134.400,00	134.400,00
Gross unit price (average)	112,50	112,50
Gross sales revenue	15.120.000,00	15.120.000,00
Less sales tax	1.680.000,00	1.680.000,00
Net sales revenue	13.440.000,00	13.440.000,00
Subsidy	0,00	0,00
SALES REVENUE	13.440.000,00	13.440.000,00
Foreign share (%)	0,00	0,00

PRODUCTION AND SALES PROGRAMME - TRAINING - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019
Stock brought forward	0,00	0,21	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
Quantity produced	75,21	100,07	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Stock carried over	0,21	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
Quantity sold	75,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Gross unit price (average)	855,00	855,00	855,00	855,00	855,00	855,00	855,00	855,00	855,00	855,00	855,00	855,00
Gross sales revenue	64.125,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00
Less sales tax	7.125,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00
Net sales revenue	57.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	57.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - TRAINING - TOTAL
United States Dollars

	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Stock brought forward	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
Quantity produced	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Stock carried over	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
Quantity sold	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Gross unit price (average)	855,00	855,00	855,00	855,00	855,00	855,00	855,00	855,00
Gross sales revenue	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00	85.500,00
Less sales tax	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00	9.500,00
Net sales revenue	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00	76.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - RESEARCH AND DEVELOPMENT - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018
Stock brought forward	0,00	0,00	11,56	12,71	13,98	15,38	16,92	18,61	20,47	20,83	20,83
Quantity produced	0,00	4.171,56	4.577,16	5.035,27	5.538,40	6.092,54	6.700,69	7.371,86	7.500,36	7.500,00	7.500,00
Stock carried over	0,00	11,56	12,71	13,98	15,38	16,92	18,61	20,47	20,83	20,83	20,83
Quantity sold	0,00	4.160,00	4.576,00	5.034,00	5.537,00	6.091,00	6.699,00	7.370,00	7.500,00	7.500,00	7.500,00
Gross unit price (average)	0,00	56,25	56,25	56,25	56,25	56,25	56,25	56,25	56,25	56,25	56,25
Gross sales revenue	0,00	234.000,00	257.400,00	283.162,50	311.456,25	342.618,75	376.818,75	414.562,50	421.875,00	421.875,00	421.875,00
Less sales tax	0,00	26.000,00	28.600,00	31.462,50	34.606,25	38.068,75	41.868,75	46.062,50	46.875,00	46.875,00	46.875,00
Net sales revenue	0,00	208.000,00	228.800,00	251.700,00	276.850,00	304.550,00	334.950,00	368.500,00	375.000,00	375.000,00	375.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	0,00	208.000,00	228.800,00	251.700,00	276.850,00	304.550,00	334.950,00	368.500,00	375.000,00	375.000,00	375.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - RESEARCH AND DEVELOPMENT - TOTAL
United States Dollars

	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Stock brought forward	20,83	20,83	20,83	20,83	20,83	20,83	20,83	20,83	20,83
Quantity produced	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00
Stock carried over	20,83	20,83	20,83	20,83	20,83	20,83	20,83	20,83	20,83
Quantity sold	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00	7.500,00
Gross unit price (average)	56,25	56,25	56,25	56,25	56,25	56,25	56,25	5,63	56,25
Gross sales revenue	421.875,00	421.875,00	421.875,00	421.875,00	421.875,00	421.875,00	421.875,00	42.187,50	421.875,00
Less sales tax	46.875,00	46.875,00	46.875,00	46.875,00	46.875,00	46.875,00	46.875,00	4.687,50	46.875,00
Net sales revenue	375.000,00	375.000,00	375.000,00	375.000,00	375.000,00	375.000,00	375.000,00	37.500,00	375.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	375.000,00	375.000,00	375.000,00	375.000,00	375.000,00	375.000,00	375.000,00	37.500,00	375.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - FACILITIES - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018
Stock brought forward	0,00	1,00	1,05	1,10	1,16	1,22	1,28	1,34	1,41	1,48	1,55
Quantity produced	361,00	378,05	397,05	417,06	438,06	459,06	482,06	507,07	532,07	558,07	586,08
Stock carried over	1,00	1,05	1,10	1,16	1,22	1,28	1,34	1,41	1,48	1,55	1,63
Quantity sold	360,00	378,00	397,00	417,00	438,00	459,00	482,00	507,00	532,00	558,00	586,00
Gross unit price (average)	140,63	140,63	140,63	140,63	140,63	140,63	140,63	140,63	140,63	140,63	140,63
Gross sales revenue	50.625,00	53.156,25	55.828,13	58.640,63	61.593,75	64.546,88	67.781,25	71.296,88	74.812,50	78.468,75	82.406,25
Less sales tax	5.625,00	5.906,25	6.203,13	6.515,63	6.843,75	7.171,88	7.531,25	7.921,88	8.312,50	8.718,75	9.156,25
Net sales revenue	45.000,00	47.250,00	49.625,00	52.125,00	54.750,00	57.375,00	60.250,00	63.375,00	66.500,00	69.750,00	73.250,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	45.000,00	47.250,00	49.625,00	52.125,00	54.750,00	57.375,00	60.250,00	63.375,00	66.500,00	69.750,00	73.250,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - FACILITIES - TOTAL
United States Dollars

	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Stock brought forward	1,63	1,71	1,80	1,89	1,98	2,00	2,00	2,00	2,00
Quantity produced	616,08	647,09	679,09	712,09	720,02	720,00	720,00	720,00	720,00
Stock carried over	1,71	1,80	1,89	1,98	2,00	2,00	2,00	2,00	2,00
Quantity sold	616,00	647,00	679,00	712,00	720,00	720,00	720,00	720,00	720,00
Gross unit price (average)	140,63	140,63	140,63	140,63	140,63	140,63	140,63	140,63	140,63
Gross sales revenue	86.625,00	90.984,38	95.484,38	100.125,00	101.250,00	101.250,00	101.250,00	101.250,00	101.250,00
Less sales tax	9.625,00	10.109,38	10.609,38	11.125,00	11.250,00	11.250,00	11.250,00	11.250,00	11.250,00
Net sales revenue	77.000,00	80.875,00	84.875,00	89.000,00	90.000,00	90.000,00	90.000,00	90.000,00	90.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	77.000,00	80.875,00	84.875,00	89.000,00	90.000,00	90.000,00	90.000,00	90.000,00	90.000,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - FINANCING - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019
Stock brought forward	0,00	0,00	0,00	0,00	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Quantity produced	0,00	0,00	0,00	12,03	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00
Stock carried over	0,00	0,00	0,00	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Quantity sold	0,00	0,00	0,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00
Gross unit price (average)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gross sales revenue	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Less sales tax	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Net sales revenue	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - FINANCING - TOTAL
United States Dollars

	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Stock brought forward	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Quantity produced	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00
Stock carried over	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Quantity sold	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00
Gross unit price (average)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gross sales revenue	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Less sales tax	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Net sales revenue	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

PRODUCTION AND SALES PROGRAMME - MARKETING AND LOGISTICS - TOTAL
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018
Stock brought forward	0,00	0,00	0,00	0,00	5,33	5,87	6,45	7,10	7,81	8,59	9,45
Quantity produced	0,00	0,00	0,00	1.925,33	2.112,53	2.323,59	2.556,65	2.811,71	3.092,78	3.401,86	3.742,95
Stock carried over	0,00	0,00	0,00	5,33	5,87	6,45	7,10	7,81	8,59	9,45	10,39
Quantity sold	0,00	0,00	0,00	1.920,00	2.112,00	2.323,00	2.556,00	2.811,00	3.092,00	3.401,00	3.742,00
Gross unit price (average)	0,00	0,00	0,00	42,19	42,19	42,19	42,19	42,19	42,19	42,19	42,19
Gross sales revenue	0,00	0,00	0,00	81.000,00	89.100,00	98.001,56	107.831,25	118.589,06	130.443,75	143.479,69	157.865,63
Less sales tax	0,00	0,00	0,00	9.000,00	9.900,00	10.889,06	11.981,25	13.176,56	14.493,75	15.942,19	17.540,63
Net sales revenue	0,00	0,00	0,00	72.000,00	79.200,00	87.112,50	95.850,00	105.412,50	115.950,00	127.537,50	140.325,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	0,00	0,00	0,00	72.000,00	79.200,00	87.112,50	95.850,00	105.412,50	115.950,00	127.537,50	140.325,00
Foreign share (%)	0,00	0,00	0,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

PRODUCTION AND SALES PROGRAMME - MARKETING AND LOGISTICS - TOTAL
United States Dollars

	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Stock brought forward	10,39	10,67	10,67	10,67	10,67	10,67	10,67	10,67	10,67
Quantity produced	3.840,27	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00
Stock carried over	10,67	10,67	10,67	10,67	10,67	10,67	10,67	10,67	10,67
Quantity sold	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00	3.840,00
Gross unit price (average)	42,19	42,19	42,19	42,19	42,19	42,19	42,19	42,19	42,19
Gross sales revenue	162.000,00	162.000,00	162.000,00	162.000,00	162.000,00	162.000,00	162.000,00	162.000,00	162.000,00
Less sales tax	18.000,00	18.000,00	18.000,00	18.000,00	18.000,00	18.000,00	18.000,00	18.000,00	18.000,00
Net sales revenue	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00
Subsidy	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES REVENUE	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00	144.000,00
Foreign share (%)	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

FINANCIAL FLOW - TOTAL
United States Dollars

	Total Inflow	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013
Total equity capital	27.559.270,83	4.007.590,38	7.764.180,45	0,00	0,00	0,00	0,00	250.000,00	160.000,00
Total long-term loans	12.750.815,50	3.924.067,00	8.826.748,50	-425.027,18	-425.027,18	-425.027,18	-425.027,18	-1.062.567,96	-1.062.567,96
TOTAL LONG-TERM FINANCE	40.310.086,33	7.931.657,38	16.590.928,95	-425.027,18	-425.027,18	-425.027,18	-425.027,18	-812.567,96	-902.567,96
Total short-term finance	13.063,31	0,00	0,00	4.388,84	1.233,49	929,13	434,49	1.110,99	590,26
TOTAL FINANCIAL FLOW	40.323.149,64	7.931.657,38	16.590.928,95	-420.638,35	-423.793,70	-424.098,06	-424.592,69	-811.456,97	-901.977,70
Foreign share (%)	31,62	49,47	53,20	100,98	100,28	100,20	100,10	130,94	117,80

FINANCIAL FLOW - TOTAL
United States Dollars

	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019	Production 2020	Production 2021	Production 2022
Total equity capital	0,00	0,00	0,00	1.218.000,00	345.750,00	0,00	0,00	0,00	250.000,00
Total long-term loans	-1.062.567,96	-1.062.567,96	-1.062.567,96	-1.062.567,96	-1.062.567,96	-1.062.567,96	-1.062.567,96	-1.062.567,96	-425.027,18
TOTAL LONG-TERM FINANCE	-1.062.567,96	-1.062.567,96	-1.062.567,96	155.432,04	-716.817,96	-1.062.567,96	-1.062.567,96	-1.062.567,96	-175.027,18
Total short-term finance	648,33	711,90	768,10	841,43	923,42	224,65	11,38	39,33	40,77
TOTAL FINANCIAL FLOW	-1.061.919,63	-1.061.856,05	-1.061.799,86	156.273,47	-715.894,53	-1.062.343,31	-1.062.556,58	-1.062.528,62	-174.986,41
Foreign share (%)	100,06	100,06	100,07	-679,90	148,42	100,02	100,00	100,00	242,89

FINANCIAL FLOW - TOTAL
United States Dollars

	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027	Scrap 2028
Total equity capital	12.345.750,00	0,00	0,00	968.000,00	250.000,00	0,00
Total long-term loans	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL LONG-TERM FINANCE	12.345.750,00	0,00	0,00	968.000,00	250.000,00	0,00
Total short-term finance	39,46	40,39	42,41	44,53	-167,79	-12.895,52
TOTAL FINANCIAL FLOW	12.345.789,46	40,39	42,41	968.044,53	249.832,21	-12.895,52
Foreign share (%)	0,00	0,00	0,00	0,00	0,00	5,79

DEBT SERVICE - TOTAL
United States Dollars

	Total inflow	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012
Total long-term loans								
Disbursement	*12.750.815,50*	*3.924.067,00*	*8.826.748,50*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*12.750.815,50*	*0,00*	*0,00*	*425.027,18*	*425.027,18*	*425.027,18*	*425.027,18*	*1.062.567,96*
Debt balance	*0,00*	*3.924.067,00*	*12.750.815,50*	*12.325.788,32*	*11.900.761,13*	*11.475.733,95*	*11.050.706,77*	*9.988.138,81*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*10.566.075,13*	*333.545,70*	*1.083.819,32*	*1.083.819,32*	*1.032.816,06*	*981.812,79*	*930.809,53*	*879.806,27*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Total short-term loans								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Debt balance	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
TOTAL DEBT SERVICE								
Disbursement	*12.750.815,50*	*3.924.067,00*	*8.826.748,50*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*12.750.815,50*	*0,00*	*0,00*	*425.027,18*	*425.027,18*	*425.027,18*	*425.027,18*	*1.062.567,96*
Debt balance	*0,00*	*3.924.067,00*	*12.750.815,50*	*12.325.788,32*	*11.900.761,13*	*11.475.733,95*	*11.050.706,77*	*9.988.138,81*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*10.566.075,13*	*333.545,70*	*1.083.819,32*	*1.083.819,32*	*1.032.816,06*	*981.812,79*	*930.809,53*	*879.806,27*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*

DEBT SERVICE - TOTAL
United States Dollars

	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019	Production 2020
Total long-term loans								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*
Debt balance	*8.925.570,85*	*7.863.002,89*	*6.800.434,93*	*5.737.866,97*	*4.675.299,02*	*3.612.731,06*	*2.550.163,10*	*1.487.595,14*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*796.925,97*	*714.045,67*	*631.165,37*	*548.285,07*	*465.404,77*	*382.524,46*	*299.644,16*	*216.763,86*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Total short-term loans								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Debt balance	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
TOTAL DEBT SERVICE								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*	*1.062.567,96*
Debt balance	*8.925.570,85*	*7.863.002,89*	*6.800.434,93*	*5.737.866,97*	*4.675.299,02*	*3.612.731,06*	*2.550.163,10*	*1.487.595,14*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*796.925,97*	*714.045,67*	*631.165,37*	*548.285,07*	*465.404,77*	*382.524,46*	*299.644,16*	*216.763,86*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*

DEBT SERVICE - TOTAL
United States Dollars

	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027	Scrap 2028
Total long-term loans								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*1.062.567,96*	*425.027,18*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Debt balance	*425.027,18*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*133.883,56*	*51.003,26*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Total short-term loans								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Debt balance	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
TOTAL DEBT SERVICE								
Disbursement	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Repayment	*1.062.567,96*	*425.027,18*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Debt balance	*425.027,18*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Exchange rate adjustments	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Capitalized interest	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Interest payable	*133.883,56*	*51.003,26*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Other financial costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*

CASH FLOW FOR FINANCIAL PLANNING - TOTAL
United States Dollars

	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013
TOTAL CASH INFLOW	7.848.134,00	16.590.928,95	3.466.388,84	5.372.483,49	6.655.354,13	7.172.259,49	8.129.910,99	8.883.227,76
Inflow funds	7.848.134,00	16.590.928,95	4.388,84	1.233,49	929,13	434,49	251.110,99	160.590,26
Inflow operation	0,00	0,00	3.462.000,00	5.371.250,00	6.654.425,00	7.171.825,00	7.878.800,00	8.656.237,50
Other income	0,00	0,00	0,00	0,00	0,00	0,00	0,00	66.400,00
TOTAL CASH OUTFLOW	7.931.657,38	16.536.156,15	3.046.496,50	3.841.469,95	4.400.656,92	4.613.344,52	5.971.413,01	6.236.864,98
Increase in fixed assets	7.598.111,69	15.368.336,83	0,00	0,00	0,00	0,00	250.000,00	190.189,72
Increase in current assets	0,00	84.000,00	51.821,64	50.434,80	38.227,86	13.466,69	40.037,83	22.968,05
Operating costs	0,00	0,00	1.393.861,15	1.886.440,31	2.232.033,73	2.411.615,83	2.804.290,73	3.015.016,71
Marketing costs	0,00	0,00	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
Income (corporate) tax	0,00	0,00	0,00	354.784,39	631.588,14	740.458,07	842.743,01	1.057.229,35
Financial costs	333.545,70	1.083.819,32	1.083.819,32	1.032.816,06	981.812,79	930.809,53	879.806,27	796.925,97
Loan repayment	0,00	0,00	425.027,18	425.027,18	425.027,18	425.027,18	1.062.567,96	1.062.567,96
Dividends	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Equity capital refund	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SURPLUS (DEFICIT)	-83.523,38	54.772,80	419.892,34	1.531.013,53	2.254.697,20	2.558.914,97	2.158.497,98	2.646.362,79
CUMULATIVE CASH BALANCE	-83.523,38	-28.750,58	391.141,76	1.922.155,29	4.176.852,49	6.735.767,47	8.894.265,45	11.540.628,23
Foreign surplus (deficit)	-2.433.973,70	-5.390.820,82	-1.516.184,85	-1.569.351,28	-1.541.207,41	-1.420.741,65	-2.265.670,30	-2.130.232,87
Local surplus (deficit)	2.350.450,31	5.445.593,62	1.936.077,18	3.100.364,82	3.795.904,61	3.979.656,62	4.424.168,28	4.776.595,66
Foreign cumulative cash balance	-2.433.973,70	-7.824.794,51	-9.340.979,36	-10.910.330,64	-12.451.538,05	-13.872.279,69	-16.137.949,99	-18.268.182,86
Local cumulative cash balance	2.350.450,31	7.796.043,93	9.732.121,11	12.832.485,93	16.628.390,54	20.608.047,16	25.032.215,44	29.808.811,10
Net flow of funds	7.514.588,30	15.507.109,63	-1.504.457,66	-1.456.609,75	-1.405.910,85	-1.355.402,22	-1.691.263,24	-1.698.903,66

CASH FLOW FOR FINANCIAL PLANNING - TOTAL
United States Dollars

	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019	Production 2020	Production 2021
TOTAL CASH INFLOW	9.511.998,33	10.452.699,40	11.456.218,10	13.772.028,93	14.175.223,42	14.112.224,65	14.115.886,38	14.119.914,33
Inflow funds	648,33	711,90	768,10	1.218.841,43	346.673,42	224,65	11,38	39,33
Inflow operation	9.511.350,00	10.451.987,50	11.455.450,00	12.553.187,50	13.759.975,00	14.112.000,00	14.115.875,00	14.119.875,00
Other income	0,00	0,00	0,00	0,00	68.575,00	0,00	0,00	0,00
TOTAL CASH OUTFLOW	6.385.686,06	6.774.786,68	7.196.098,89	8.880.942,81	8.560.170,65	8.268.663,28	8.209.682,75	8.161.463,98
Increase in fixed assets	0,00	0,00	0,00	1.218.000,00	400.932,21	0,00	0,00	0,00
Increase in current assets	25.229,60	27.715,94	30.396,30	33.425,01	36.701,89	10.756,03	744,69	996,99
Operating costs	3.246.373,84	3.500.414,95	3.774.492,95	4.074.663,13	4.404.128,63	4.508.731,47	4.522.092,06	4.536.095,89
Marketing costs	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
Income (corporate) tax	1.245.501,78	1.460.955,25	1.688.389,40	1.934.914,73	2.181.348,28	2.294.996,45	2.315.546,96	2.335.952,38
Financial costs	714.045,67	631.165,37	548.285,07	465.404,77	382.524,46	299.644,16	216.763,86	133.883,56
Loan repayment	1.062.567,96	1.062.567,96	1.062.567,96	1.062.567,96	1.062.567,96	1.062.567,96	1.062.567,96	1.062.567,96
Dividends	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Equity capital refund	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SURPLUS (DEFICIT)	3.126.312,27	3.677.912,72	4.260.119,21	4.891.086,12	5.615.052,78	5.843.561,37	5.906.203,63	5.958.450,35
CUMULATIVE CASH BALANCE	14.666.940,50	18.344.853,22	22.604.972,43	27.496.058,55	33.111.111,33	38.954.672,70	44.860.876,33	50.819.326,68
Foreign surplus (deficit)	-1.865.190,74	-1.791.189,98	-1.718.043,82	-2.863.913,45	-1.975.720,41	-1.489.004,22	-1.403.990,85	-1.321.251,12
Local surplus (deficit)	4.991.503,00	5.469.102,70	5.978.163,04	7.754.999,57	7.590.773,19	7.332.565,59	7.310.194,48	7.279.701,47
Foreign cumulative cash balance	-20.133.373,60	-21.924.563,58	-23.642.607,41	-26.506.520,85	-28.482.241,26	-29.971.245,48	-31.375.236,33	-32.696.487,45
Local cumulative cash balance	34.800.314,10	40.269.416,80	46.247.579,84	54.002.579,41	61.593.352,59	68.925.918,18	76.236.112,66	83.515.814,13
Net flow of funds	-1.775.965,30	-1.693.021,42	-1.610.084,92	-309.131,29	-1.098.419,00	-1.361.987,47	-1.279.320,44	-1.196.412,19

CASH FLOW FOR FINANCIAL PLANNING - TOTAL
United States Dollars

	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027	Scrap 2028
TOTAL CASH INFLOW	14.374.040,77	27.720.789,46	14.125.040,39	14.125.042,41	14.755.544,53	14.375.000,00	14.787.743,95
Inflow funds	250.040,77	12.345.789,46	40,39	42,41	968.044,53	250.000,00	0,00
Inflow operation	14.124.000,00	14.125.000,00	14.125.000,00	14.125.000,00	13.787.500,00	14.125.000,00	0,00
Other income	0,00	1.250.000,00	0,00	0,00	0,00	0,00	14.787.743,95
TOTAL CASH OUTFLOW	7.726.020,87	19.469.884,75	7.033.922,26	7.044.972,47	7.930.075,19	7.422.990,45	12.895,52
Increase in fixed assets	250.000,00	12.243.458,92	0,00	0,00	968.000,00	435.750,00	0,00
Increase in current assets	1.046,05	1.089,78	1.141,71	1.198,80	1.258,74	-358,95	0,00
Operating costs	4.550.772,86	4.564.982,24	4.579.523,41	4.594.791,63	4.610.823,27	4.550.418,78	0,00
Marketing costs	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	0,00
Income (corporate) tax	2.356.204,31	2.568.386,59	2.361.289,92	2.357.014,82	2.258.025,96	2.345.045,62	0,00
Financial costs	51.003,26	0,00	0,00	0,00	0,00	0,00	0,00
Loan repayment	425.027,18	0,00	0,00	0,00	0,00	167,79	12.895,52
Dividends	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Equity capital refund	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SURPLUS (DEFICIT)	6.648.019,90	8.250.904,71	7.091.118,13	7.080.069,94	6.825.469,35	6.952.009,55	14.774.848,44
CUMULATIVE CASH BALANCE	57.467.346,57	65.718.251,28	72.809.369,42	79.889.439,36	86.714.908,71	93.666.918,26	108.441.766,70
Foreign surplus (deficit)	-850.830,45	-12.368.258,92	-124.800,00	-124.800,00	-1.092.800,00	-560.550,00	4.559.989,65
Local surplus (deficit)	7.498.850,34	20.619.163,63	7.215.918,13	7.204.869,94	7.918.269,35	7.512.559,55	10.214.858,79
Foreign cumulative cash balance	-33.547.317,90	-45.915.576,82	-46.040.376,82	-46.165.176,82	-47.257.976,82	-47.818.526,82	-43.258.537,18
Local cumulative cash balance	91.014.664,47	111.633.828,10	118.849.746,24	126.054.616,18	133.972.885,53	141.485.445,08	151.700.303,88
Net flow of funds	-225.989,68	12.345.789,46	40,39	42,41	968.044,53	249.832,21	-12.895,52

DISCOUNTED CASH FLOW - TOTAL CAPITAL INVESTED
United States Dollars

	Construction 2006	Construction 2007	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012
TOTAL CASH INFLOW	0,00	0,00	3.462.000,00	5.371.250,00	6.654.425,00	7.171.825,00	7.878.800,00
Inflow operation	0,00	0,00	3.462.000,00	5.371.250,00	6.654.425,00	7.171.825,00	7.878.800,00
Other income	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL CASH OUTFLOW	7.598.111,69	15.452.336,83	1.533.261,16	2.382.393,23	2.992.887,82	3.257.073,31	4.027.927,79
Increase in fixed assets	7.598.111,69	15.368.336,83	0,00	0,00	0,00	0,00	250.000,00
Increase in net working capital	0,00	84.000,00	47.432,80	49.201,32	37.298,73	13.032,20	38.926,84
Operating costs	0,00	0,00	1.393.861,15	1.886.440,31	2.232.033,73	2.411.615,83	2.804.290,73
Marketing costs	0,00	0,00	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
Income (corporate) tax	0,00	0,00	0,00	354.784,39	631.588,14	740.458,07	842.743,01
NET CASH FLOW	-7.598.111,69	-15.452.336,83	1.928.738,84	2.988.856,77	3.661.537,18	3.914.751,69	3.850.872,21
CUMULATIVE NET CASH FLOW	-7.598.111,69	-23.050.448,52	-21.121.709,68	-18.132.852,91	-14.471.315,73	-10.556.564,04	-6.705.691,83
Net present value	-6.780.395,94	-12.305.320,51	1.370.634,22	1.895.407,66	2.072.098,32	1.976.971,97	1.735.420,73
Cumulative net present value	-6.780.395,94	-19.085.716,45	-17.715.082,23	-15.819.674,57	-13.747.576,25	-11.770.604,28	-10.035.183,56
NET PRESENT VALUE	at 12,06%	7.943.650,66					
INTERNAL RATE OF RETURN	16,68%						
MODIFIED INTERNAL RATE OF RETURN	16,68%						
NORMAL PAYBACK	at 0,00%	8.48 years	= 2014				
DYNAMIC PAYBACK	at 12,06%	13.19 years	= 2019				
NPV RATIO	0,37						
Net present values discounted to	1-2006						

DISCOUNTED CASH FLOW - TOTAL CAPITAL INVESTED
United States Dollars

	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018	Production 2019
TOTAL CASH INFLOW	8.722.637,50	9.511.350,00	10.451.987,50	11.455.450,00	12.553.187,50	13.828.550,00	14.112.000,00
Inflow operation	8.656.237,50	9.511.350,00	10.451.987,50	11.455.450,00	12.553.187,50	13.759.975,00	14.112.000,00
Other income	66.400,00	0,00	0,00	0,00	0,00	68.575,00	0,00
TOTAL CASH OUTFLOW	4.376.780,79	4.608.424,11	5.080.341,45	5.584.477,76	7.352.128,66	7.114.154,80	6.906.226,51
Increase in fixed assets	190.189,72	0,00	0,00	0,00	1.218.000,00	400.932,21	0,00
Increase in net working capital	22.377,79	24.581,28	27.004,04	29.628,20	32.583,58	35.778,47	10.531,38
Operating costs	3.015.016,71	3.246.373,84	3.500.414,95	3.774.492,95	4.074.663,13	4.404.128,63	4.508.731,47
Marketing costs	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
Income (corporate) tax	1.057.229,35	1.245.501,78	1.460.955,25	1.688.389,40	1.934.914,73	2.181.348,28	2.294.996,45
NET CASH FLOW	4.345.856,71	4.902.925,89	5.371.646,05	5.870.972,24	5.201.058,84	6.714.395,20	7.205.773,49
CUMULATIVE NET CASH FLOW	-2.359.835,12	2.543.090,77	7.914.736,82	13.785.709,06	18.986.767,90	25.701.163,11	32.906.936,60
Net present value	1.747.714,37	1.759.542,52	1.720.288,18	1.677.850,37	1.326.430,04	1.528.089,76	1.463.430,00
Cumulative net present value	-8.287.469,18	-6.527.926,67	-4.807.638,48	-3.129.788,11	-1.803.358,07	-275.268,32	1.188.161,68
NET PRESENT VALUE							
INTERNAL RATE OF RETURN							
MODIFIED INTERNAL RATE OF RETURN							
NORMAL PAYBACK							
DYNAMIC PAYBACK							
NPV RATIO							
Net present values discounted to							

DISCOUNTED CASH FLOW - TOTAL CAPITAL INVESTED
United States Dollars

	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026
TOTAL CASH INFLOW	14.115.875,00	14.119.875,00	14.124.000,00	15.375.000,00	14.125.000,00	14.125.000,00	13.787.500,00
Inflow operation	14.115.875,00	14.119.875,00	14.124.000,00	14.125.000,00	14.125.000,00	14.125.000,00	13.787.500,00
Other income	0,00	0,00	0,00	1.250.000,00	0,00	0,00	0,00
TOTAL CASH OUTFLOW	6.930.339,55	6.964.973,13	7.249.949,66	19.469.845,29	7.033.881,87	7.044.930,06	7.930.030,65
Increase in fixed assets	0,00	0,00	250.000,00	12.243.458,92	0,00	0,00	968.000,00
Increase in net working capital	733,31	957,65	1.005,28	1.050,32	1.101,32	1.156,39	1.214,21
Operating costs	4.522.092,06	4.536.095,89	4.550.772,86	4.564.982,24	4.579.523,41	4.594.791,63	4.610.823,27
Marketing costs	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21	91.967,21
Income (corporate) tax	2.315.546,96	2.335.952,38	2.356.204,31	2.568.386,59	2.361.289,92	2.357.014,82	2.258.025,96
NET CASH FLOW	7.185.535,45	7.154.901,87	6.874.050,34	-4.094.845,29	7.091.118,13	7.080.069,94	5.857.469,35
CUMULATIVE NET CASH FLOW	40.092.472,05	47.247.373,92	54.121.424,26	50.026.578,97	57.117.697,10	64.197.767,04	70.055.236,39
Net present value	1.302.266,49	1.157.161,01	992.092,58	-527.383,30	814.991,31	726.148,07	536.101,53
Cumulative net present value	2.490.428,17	3.647.589,18	4.639.681,75	4.112.298,46	4.927.289,76	5.653.437,83	6.189.539,35
NET PRESENT VALUE							
INTERNAL RATE OF RETURN							
MODIFIED INTERNAL RATE OF RETURN							
NORMAL PAYBACK							
DYNAMIC PAYBACK							
NPV RATIO							
Net present values discounted to							

DISCOUNTED CASH FLOW - TOTAL CAPITAL INVESTED
United States Dollars

	Production 2027	Scrap 2028
TOTAL CASH INFLOW	14.125.000,00	14.774.848,44
Inflow operation	14.125.000,00	0,00
Other income	0,00	14.774.848,44
TOTAL CASH OUTFLOW	7.422.990,45	0,00
Increase in fixed assets	435.750,00	0,00
Increase in net working capital	-191,16	0,00
Operating costs	4.550.418,78	0,00
Marketing costs	91.967,21	0,00
Income (corporate) tax	2.345.045,62	0,00
NET CASH FLOW	6.702.009,55	14.774.848,44
CUMULATIVE NET CASH FLOW	76.757.245,95	91.532.094,38
Net present value	547.383,17	1.206.728,13
Cumulative net present value	6.736.922,53	7.943.650,66
NET PRESENT VALUE		
INTERNAL RATE OF RETURN		
MODIFIED INTERNAL RATE OF RETURN		
NORMAL PAYBACK		
DYNAMIC PAYBACK		
NPV RATIO		
Net present values discounted to		

NET INCOME STATEMENT
United States Dollars

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015
Sales revenue	3.462.000,00	5.371.250,00	6.654.425,00	7.171.825,00	7.878.800,00	8.656.237,50	9.511.350,00	10.451.987,50
Less variable costs	1.223.984,01	1.615.841,66	1.954.090,81	2.125.961,42	2.510.539,25	2.712.763,31	2.935.193,42	3.179.861,18
VARIABLE MARGIN	2.238.015,99	3.755.408,34	4.700.334,19	5.045.863,58	5.368.260,75	5.943.474,19	6.576.156,58	7.272.126,32
in % of sales revenue	64,65	69,92	70,63	70,36	68,14	68,66	69,14	69,58
Less fixed costs	1.354.783,67	1.455.505,18	1.462.849,46	1.470.560,95	1.478.658,01	1.370.729,09	1.413.890,26	1.423.263,62
OPERATIONAL MARGIN	883.232,32	2.299.903,16	3.237.484,74	3.575.302,63	3.889.602,73	4.572.745,09	5.162.266,32	5.848.862,70
in % of sales revenue	25,51	42,82	48,65	49,85	49,37	52,83	54,27	55,96
Interest on short-term deposits	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Financial costs	1.083.819,32	1.032.816,06	981.812,79	930.809,53	879.806,27	796.925,97	714.045,67	631.165,37
GROSS PROFIT FROM OPERATIONS	-200.587,00	1.267.087,10	2.255.671,94	2.644.493,10	3.009.796,46	3.775.819,12	4.448.220,65	5.217.697,33
in % of sales revenue	-5,79	23,59	33,90	36,87	38,20	43,62	46,77	49,92
Extraordinary income	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Extraordinary loss	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Depreciation allowances	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
GROSS PROFIT	-200.587,00	1.267.087,10	2.255.671,94	2.644.493,10	3.009.796,46	3.775.819,12	4.448.220,65	5.217.697,33
Investment allowances	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TAXABLE PROFIT	0,00	1.267.087,10	2.255.671,94	2.644.493,10	3.009.796,46	3.775.819,12	4.448.220,65	5.217.697,33
Income (corporate) tax	0,00	354.784,39	631.588,14	740.458,07	842.743,01	1.057.229,35	1.245.501,78	1.460.955,25
NET PROFIT	-200.587,00	912.302,71	1.624.083,80	1.904.035,03	2.167.053,45	2.718.589,77	3.202.718,87	3.756.742,08
in % of sales revenue	-5,79	16,98	24,41	26,55	27,50	31,41	33,67	35,94
Dividends	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
RETAINED PROFIT	-200.587,00	912.302,71	1.624.083,80	1.904.035,03	2.167.053,45	2.718.589,77	3.202.718,87	3.756.742,08
RATIOS								
Net profit to equity (%)	-1,72	7,81	13,90	16,29	18,15	22,47	26,47	31,05
Net profit to net worth (%)	-1,73	7,31	11,51	11,89	11,76	12,76	13,07	13,29
Net profit+interest to investment (%)	3,60	7,92	10,59	11,52	12,23	14,00	15,58	17,43

NET INCOME STATEMENT
United States Dollars

	Production 2016	Production 2017	Production 2018	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023
Sales revenue	11.455.450,00	12.553.187,50	13.759.975,00	14.112.000,00	14.115.875,00	14.119.875,00	14.124.000,00	14.125.000,00
Less variable costs	3.444.097,14	3.733.933,19	4.052.547,84	4.145.757,30	4.147.154,84	4.148.597,46	4.150.085,16	4.150.445,82
VARIABLE MARGIN	8.011.352,86	8.819.254,31	9.707.427,16	9.966.242,70	9.968.720,16	9.971.277,54	9.973.914,84	9.974.554,18
in % of sales revenue	69,93	70,26	70,55	70,62	70,62	70,62	70,62	70,62
Less fixed costs	1.433.105,66	1.443.439,79	1.437.573,13	1.470.182,66	1.482.145,72	1.494.706,92	1.507.896,19	801.744,92
OPERATIONAL MARGIN	6.578.247,20	7.375.814,52	8.269.854,03	8.496.060,04	8.486.574,45	8.476.570,62	8.466.018,65	9.172.809,26
in % of sales revenue	57,42	58,76	60,10	60,20	60,12	60,03	59,94	64,94
Interest on short-term deposits	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Financial costs	548.285,07	465.404,77	382.524,46	299.644,16	216.763,86	133.883,56	51.003,26	0,00
GROSS PROFIT FROM OPERATIONS	6.029.962,14	6.910.409,76	7.887.329,56	8.196.415,88	8.269.810,58	8.342.687,06	8.415.015,39	9.172.809,26
in % of sales revenue	52,64	55,05	57,32	58,08	58,59	59,08	59,58	64,94
Extraordinary income	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Extraordinary loss	0,00	0,00	96.800,00	0,00	0,00	0,00	0,00	0,00
Depreciation allowances	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
GROSS PROFIT	6.029.962,14	6.910.409,76	7.790.529,56	8.196.415,88	8.269.810,58	8.342.687,06	8.415.015,39	9.172.809,26
Investment allowances	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TAXABLE PROFIT	6.029.962,14	6.910.409,76	7.790.529,56	8.196.415,88	8.269.810,58	8.342.687,06	8.415.015,39	9.172.809,26
Income (corporate) tax	1.688.389,40	1.934.914,73	2.181.348,28	2.294.996,45	2.315.546,96	2.335.952,38	2.356.204,31	2.568.386,59
NET PROFIT	4.341.572,74	4.975.495,02	5.609.181,28	5.901.419,43	5.954.263,62	6.006.734,68	6.058.811,08	6.604.422,67
in % of sales revenue	37,90	39,64	40,76	41,82	42,18	42,54	42,90	46,76
Dividends	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
RETAINED PROFIT	4.341.572,74	4.975.495,02	5.609.181,28	5.901.419,43	5.954.263,62	6.006.734,68	6.058.811,08	6.604.422,67
RATIOS								
Net profit to equity (%)	35,89	37,36	41,06	43,20	43,58	43,97	43,55	25,15
Net profit to net worth (%)	13,31	12,82	12,53	11,65	10,52	9,59	8,79	7,52
Net profit+interest to investment (%)	19,41	20,57	22,29	23,06	22,94	22,83	22,51	16,77

NET INCOME STATEMENT
United States Dollars

	Production 2024	Production 2025	Production 2026	Production 2027
Sales revenue	14.125.000,00	14.125.000,00	13.787.500,00	14.125.000,00
Less variable costs	4.150.445,82	4.150.445,82	4.150.445,82	4.150.445,82
VARIABLE MARGIN	9.974.554,18	9.974.554,18	9.637.054,18	9.974.554,18
in % of sales revenue	70,62	70,62	69,90	70,62
Less fixed costs	1.541.375,89	1.556.644,11	1.572.675,75	1.599.391,26
OPERATIONAL MARGIN	8.433.178,29	8.417.910,07	8.064.378,43	8.375.162,92
in % of sales revenue	59,70	59,60	58,49	59,29
Interest on short-term deposits	0,00	0,00	0,00	0,00
Financial costs	*0,00*	*0,00*	*0,00*	*0,00*
GROSS PROFIT FROM OPERATIONS	8.433.178,29	8.417.910,07	8.064.378,43	8.375.162,92
in % of sales revenue	59,70	59,60	58,49	59,29
Extraordinary income	0,00	0,00	0,00	0,00
Extraordinary loss	0,00	0,00	0,00	0,00
Depreciation allowances	0,00	0,00	0,00	0,00
GROSS PROFIT	8.433.178,29	8.417.910,07	8.064.378,43	8.375.162,92
Investment allowances	0,00	0,00	0,00	0,00
TAXABLE PROFIT	8.433.178,29	8.417.910,07	8.064.378,43	8.375.162,92
Income (corporate) tax	2.361.289,92	2.357.014,82	2.258.025,96	2.345.045,62
NET PROFIT	6.071.888,37	6.060.895,25	5.806.352,47	6.030.117,30
in % of sales revenue	42,99	42,91	42,11	42,69
Dividends	0,00	0,00	0,00	0,00
RETAINED PROFIT	6.071.888,37	6.060.895,25	5.806.352,47	6.030.117,30
RATIOS				
Net profit to equity (%)	23,12	23,08	21,33	21,95
Net profit to net worth (%)	6,46	6,06	5,44	5,33
Net profit+interest to investment (%)	15,41	15,39	14,38	14,78

PROJECTED BALANCE SHEET
United States Dollars

	2006	2007	2008	2009	2010	2011	2012
TOTAL ASSETS	7.931.657,38	24.522.586,33	24.101.947,99	24.590.457,00	25.589.855,74	27.069.298,08	28.424.894,57
Total current assets	0,00	138.772,80	610.486,78	2.191.935,11	4.484.860,18	7.057.241,84	9.255.777,64
Total fixed assets, net of depreciation	7.931.657,38	24.383.813,53	23.290.874,21	22.197.934,89	21.104.995,57	20.012.056,24	19.169.116,92
Accumulated losses brought forward	0,00	0,00	0,00	200.587,00	0,00	0,00	0,00
Loss in current year	0,00	0,00	200.587,00	0,00	0,00	0,00	0,00
TOTAL LIABILITIES	7.931.657,38	24.522.586,33	24.101.947,99	24.590.457,00	25.589.855,74	27.069.298,08	28.424.894,57
Total current liabilities	0,00	0,00	4.388,84	5.622,32	6.551,45	6.985,94	8.096,93
Total long-term debt	3.924.067,00	12.750.815,50	12.325.788,32	11.900.761,13	11.475.733,95	11.050.706,77	9.988.138,81
Total equity capital	4.007.590,38	11.771.770,83	11.771.770,83	11.771.770,83	11.771.770,83	11.771.770,83	12.021.770,83
Reserves, retained profit brought forward	0,00	0,00	0,00	0,00	711.715,71	2.335.799,51	4.239.834,54
Retained profit	0,00	0,00	0,00	912.302,71	1.624.083,80	1.904.035,03	2.167.053,45
Net worth	4.007.590,38	11.771.770,83	11.571.183,83	12.483.486,55	14.107.570,34	16.011.605,37	18.428.658,83
RATIOS							
Equity to total liabilities (%)	50,53	48,00	48,84	47,87	46,00	43,49	42,29
Net worth to total liabilities (%)	50,53	48,00	48,01	50,77	55,13	59,15	64,83
Long-term debt to net worth	0,98	1,08	1,07	0,95	0,81	0,69	0,54
Current assets to current liabilities	0,00	0,00	139,10	389,86	684,56	1.010,21	1.143,12

PROJECTED BALANCE SHEET
United States Dollars

	2013	2014	2015	2016	2017	2018	2019
TOTAL ASSETS	30.241.506,64	32.382.305,87	35.077.191,90	38.356.964,78	43.488.733,28	48.382.020,03	53.221.096,15
Total current assets	11.925.108,48	15.076.650,35	18.782.279,00	23.072.794,52	27.997.305,65	33.649.060,32	39.503.377,72
Total fixed assets, net of depreciation	18.316.398,16	17.305.655,53	16.294.912,90	15.284.170,26	15.491.427,63	14.732.959,71	13.717.718,43
Accumulated losses brought forward	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Loss in current year	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL LIABILITIES	30.241.506,64	32.382.305,87	35.077.191,90	38.356.964,78	43.488.733,28	48.382.020,03	53.221.096,15
Total current liabilities	8.687,19	9.335,52	10.047,42	10.815,52	11.656,95	12.580,38	12.805,03
Total long-term debt	8.925.570,85	7.863.002,89	6.800.434,93	5.737.866,97	4.675.299,02	3.612.731,06	2.550.163,10
Total equity capital	12.181.770,83	12.181.770,83	12.181.770,83	12.181.770,83	13.399.770,83	13.745.520,83	13.745.520,83
Reserves, retained profit brought forward	6.406.887,99	9.125.477,76	12.328.196,63	16.084.938,71	20.426.511,45	25.402.006,48	31.011.187,76
Retained profit	2.718.589,77	3.202.718,87	3.756.742,08	4.341.572,74	4.975.495,02	5.609.181,28	5.901.419,43
Net worth	21.307.248,60	24.509.967,46	28.266.709,55	32.608.282,29	38.801.777,31	44.756.708,59	50.658.128,02
RATIOS							
Equity to total liabilities (%)	40,28	37,62	34,73	31,76	30,81	28,41	25,83
Net worth to total liabilities (%)	70,46	75,69	80,58	85,01	89,22	92,51	95,18
Long-term debt to net worth	0,42	0,32	0,24	0,18	0,12	0,08	0,05
Current assets to current liabilities	1.372,72	1.614,98	1.869,36	2.133,30	2.401,77	2.674,73	3.084,99

PROJECTED BALANCE SHEET
United States Dollars

	2020	2021	2022	2023	2024	2025	2026
TOTAL ASSETS	58.112.803,19	63.057.009,25	68.940.833,91	87.891.046,04	93.962.974,80	100.023.912,46	106.798.309,47
Total current assets	45.410.326,04	51.369.773,38	58.018.839,32	66.270.833,81	73.363.093,66	80.444.362,41	87.271.090,50
Total fixed assets, net of depreciation	12.702.477,15	11.687.235,87	10.921.994,59	21.620.212,23	20.599.881,15	19.579.550,06	19.527.218,97
Accumulated losses brought forward	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Loss in current year	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL LIABILITIES	58.112.803,19	63.057.009,25	68.940.833,91	87.891.046,04	93.962.974,80	100.023.912,46	106.798.309,47
Total current liabilities	12.816,41	12.855,74	12.896,51	12.935,97	12.976,36	13.018,77	13.063,31
Total long-term debt	1.487.595,14	425.027,18	0,00	0,00	0,00	0,00	0,00
Total equity capital	13.745.520,83	13.745.520,83	13.995.520,83	26.341.270,83	26.341.270,83	26.341.270,83	27.309.270,83
Reserves, retained profit brought forward	36.912.607,19	42.866.870,81	48.873.605,49	54.932.416,57	61.536.839,24	67.608.727,61	73.669.622,85
Retained profit	5.954.263,62	6.006.734,68	6.058.811,08	6.604.422,67	6.071.888,37	6.060.895,25	5.806.352,47
Net worth	56.612.391,64	62.619.126,32	68.927.937,40	87.878.110,07	93.949.998,44	100.010.893,69	106.785.246,16
RATIOS							
Equity to total liabilities (%)	23,65	21,80	20,30	29,97	28,03	26,33	25,57
Net worth to total liabilities (%)	97,42	99,31	99,98	99,99	99,99	99,99	99,99
Long-term debt to net worth	0,03	0,01	0,00	0,00	0,00	0,00	0,00
Current assets to current liabilities	3.543,14	3.995,86	4.498,80	5.122,99	5.653,59	6.179,10	6.680,63

PROJECTED BALANCE SHEET
United States Dollars

	2027
TOTAL ASSETS	113.078.258,98
Total current assets	94.222.741,10
Total fixed assets, net of depreciation	18.855.517,88
Accumulated losses brought forward	0,00
Loss in current year	0,00
TOTAL LIABILITIES	113.078.258,98
Total current liabilities	12.895,52
Total long-term debt	0,00
Total equity capital	27.559.270,83
Reserves, retained profit brought forward	79.475.975,33
Retained profit	6.030.117,30
Net worth	113.065.363,46
RATIOS	
Equity to total liabilities (%)	24,37
Net worth to total liabilities (%)	99,99
Long-term debt to net worth	0,00
Current assets to current liabilities	7.306,63

FINANCIAL RATIOS

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Long-term debt to net worth	0,98	1,08	1,07	0,95	0,81	0,69	0,54	0,42	0,32	0,24	0,18	0,12
Current assets to current liabilities	0,00	0,00	139,10	389,86	684,56	1.010,21	1.143,12	1.372,72	1.614,98	1.869,36	2.133,30	2.401,77
Cash flow to long-term debt	0,00	0,29	0,15	0,24	0,31	0,34	0,37	0,45	0,55	0,68	0,86	1,12
Accounts receivable to accounts payable	0,00	0,00	0,86	0,94	0,95	1,00	0,99	0,99	0,99	0,99	0,99	0,99
Cash flow to long-term debt service	0,75	1,05	1,28	2,05	2,60	2,89	2,11	2,42	2,76	3,17	3,64	4,20

FINANCIAL RATIOS

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Long-term debt to net worth	0,08	0,05	0,03	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Current assets to current liabilities	2.674,73	3.084,99	3.543,14	3.995,86	4.498,80	5.122,99	5.653,59	6.179,10	6.680,63	7.306,63
Cash flow to long-term debt	1,51	1,99	2,82	4,81	16,76	0,00	0,00	0,00	0,00	0,00
Accounts receivable to accounts payable	0,99	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Cash flow to long-term debt service	4,89	5,29	5,62	5,98	14,97	0,00	0,00	0,00	0,00	0,00

EFFICIENCY RATIOS

	Production 2008	Production 2009	Production 2010	Production 2011	Production 2012	Production 2013	Production 2014	Production 2015	Production 2016	Production 2017	Production 2018
Sales to total capital investment	0,14	0,22	0,27	0,29	0,32	0,34	0,38	0,42	0,45	0,47	0,51
Investment to personnel cost	43,42	40,17	39,50	35,62	27,50	27,30	26,87	26,42	26,09	27,02	27,09
Inventory to sales	0,04	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Net cash flow to total sales	0,56	0,56	0,55	0,55	0,49	0,50	0,52	0,51	0,51	0,41	0,49

EFFICIENCY RATIOS

	Production 2019	Production 2020	Production 2021	Production 2022	Production 2023	Production 2024	Production 2025	Production 2026	Production 2027
Sales to total capital investment	0,52	0,52	0,52	0,52	0,36	0,36	0,36	0,34	0,35
Investment to personnel cost	26,74	26,39	26,04	25,91	37,10	36,60	36,09	36,44	38,96
Inventory to sales	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Net cash flow to total sales	0,51	0,51	0,51	0,49	-0,29	0,50	0,50	0,42	0,47

Annex 3 Civil Engineering

GHANA TECHNOLOGY CENTRE

AREA REQUIREMENTS

Ref	Item description	Basic area			Office space/tool room			Toilet facilities			Total area
		Length m	Breadth m	Area m^2	Length m	Breadth m	Area m^2	Length m	Breadth m	Area m^2	m^2
1	CNC Shop	35	35	1225	35	10	350			0	1575
2	Recon lab/Welding	35	35	1225	35	10	350			0	1575
3	CAD-CAM-CAE centre	35	35	1225	35	10	350			0	1575
4	Teaching facility	15	10	150			0			0	150
5	Staff offices	10	10	100			0	3	3	9	109
6	Stores/warehouses	45	35	1575			0			0	1575
7	Wash room block1	10	10	100			0			0	100
8	Wash room block2	5	10	50			0			0	50
9	Pump room	10	10	100			0			0	100
10	Fire figthing facilities	10	10	100			0			0	100
11	Health facility	5	10	50			0			0	50
12	Containment tank	10	10	100			0			0	100
13	*Water tanks*	*10*	10	*100*			*0*			*0*	*100*
14	Solid waste collection	10	10	100			0			0	100
15	Kitchen/Canteen	10	10	100			0			0	100
16	Foundry shop	10	10	100			0			0	100
17	Garage	15	10	150			0			0	150
18	Maintenance yard	15	10	150			0			0	150
19	Effluent treatment	10	10	100			0			0	100
20	Boiler room	10	10	100			0			0	100
21	Fuel storage	10	5	50			0			0	50
22	Standby genset room	10	5	50			0			0	50
23	Transformer room	10	5	50			0			0	50
24	Switch room	10	5	50			0			0	50
24	Gate house	5	5	25			0			0	25
25	Compressed air room	10	5	50			0			0	50
26	Maitenance store	10	10	100			0			0	100
27	Pavement	lumpsum									17000
28	Bare land	lumpsum									4000
	TOTAL Area industrial centre										**29334**
27	Student dorm	15	16,7	250,5			0				250,5
28	*Bungalow 3x*	*10*	15	*150*							*450*
29	Future extentions 3x	35	35	1225	35	10	350				4725
	TOTAL area for accomodationand future extentions										**5425,5**
	Total m2 area required										**64093,5**
	Total area required in acres (1 acre is 4046 m2)										**15,84**

GHANA TECHNOLOGY CENTRE

SITE EQUIPMENT

	Main plant item or plant unit					Currency:	US$ and GC		
Ref	Item description	Units	Quantity	unit cost		Costs			Year of investment
				Foreign US$	Local GC	Foreign US$	Local GC	Total US$	
	ELECTRICAL EQUIPMENT								
1	Standby generator	No.	1	200.000,00		200.000,00	-	200.000,00	
2	Transformer	No.	1	70.000,00		70.000,00	-	70.000,00	
3	LV substation	No.	1	55.000,00		55.000,00	-	55.000,00	
4	LV Reticulation and Submains	No.	1	70.000,00		70.000,00	-	70.000,00	
5	Access control system	Lumpsum	1	10.000,00		10.000,00	-	10.000,00	
6	Electric fence	Lm	720	50,00		36.000,00	-	36.000,00	
	MECHANICAL EQUIPMENT								
7	Boiler equipment	No.	1	40.000,00		40.000,00	-	40.000,00	
8	Foundry equipment	No.	1	40.000,00		40.000,00	-	40.000,00	
9	Fire fighting - 100000 litres steel tank	No.	1	40.000,00		40.000,00	-	-	
10	Fire fighting - Hose reels 100 mm dia	No.	100	20,00		2.000,00	-	-	
11	Fire fighting - Hydrant valves	No.	20	500,00		10.000,00	-	10.000,00	
12	Fire fighting - Pumps	No.	2	70.000,00		140.000,00	-	140.000,00	
13	20000 Litres high level water tank	No.	1	20.000,00		20.000,00	-	20.000,00	
14	30000 Litres high low water tank	No.	1	35.000,00		35.000,00	-	35.000,00	
15	Pumps	No.	2	70.000,00		140.000,00	-	140.000,00	
	OTHER FACILITIES		1						
	Air Conditioning for CNC Facilities	Lumpsum	1	30.000,00		30.000,00	-	30.000,00	
	Air Conditioning for PC Facilities	Lumpsum	1	30.000,00		30.000,00	-	30.000,00	
	TOTAL COST					**968.000,00**	**-**	**968.000,00**	

GHANA TECHNOLOGY CENTRE

Furniture

Main plant item or plant unit — **Currency:** US$ and GC

Ref	Item description	Units	Quantity	unit cost		Costs			Year of investment
				Foreign US$	Local GC	Foreign US$	Local GC	Total US$	
	STAFF OFFICES								
1	Tables	No.	15	300,00		4.500,00	-	4.500,00	
2	Chairs	No.	30	100,00		3.000,00	-	3.000,00	
3	Computers	No.	25	1.500,00		37.500,00	-	37.500,00	
4	Shelving	No.	10	500,00		5.000,00	-	5.000,00	
5	Stationery	Lumpsum	1	15.000,00		15.000,00	-	15.000,00	
	Sub-total					**65.000,00**	-	**65.000,00**	
	STUDENT DORMS								
1.	Beds	No.	25	150,00		3.750,00		3.750,00	
2	Chairs	No.	25	20,00		500,00		500,00	
3	Tables	No.	25	100,00		2.500,00		2.500,00	
4.	Lockers / shelving	No.	25	200,00		5.000,00		5.000,00	
	Sub-total					**11.750,00**		**11.750,00**	
	TEACHING FACILITY								
1	Tables	No.	20	200,00		4.000,00	-	4.000,00	
2	Chairs	No.	40	100,00		4.000,00	-	4.000,00	
3	Computers	No.	20	1.500,00		30.000,00	-	30.000,00	
4	Stationery	Lumpsum	1	15.000,00		15.000,00	-	15.000,00	
	Sub-total					**53.000,00**	-	**53.000,00**	
	KITCHEN CANTEEN EQUIPMENT								
1	Tables	No.	25	200,00		5.000,00	-	5.000,00	
2	Chairs	No.	100	20,00		2.000,00	-	2.000,00	
3.	Kitchen equipment	Lumpsum	1	20.000,00		20.000,00	-	20.000,00	
	Sub-total					**27.000,00**		**27.000,00**	
	HEALTH FACILITY								
1	Tables	No.	5	200,00		1.000,00	-	1.000,00	
2	Chairs	No.	5	100,00		500,00	-	500,00	
3	Computers	No.	5	1.500,00		7.500,00	-	7.500,00	
4	Medicines	Lumpsum	1	15.000,00		15.000,00	-	15.000,00	
5	Stationery	Lumpsum	1	5.000,00		5.000,00	-	5.000,00	
	Sub-total					**29.000,00**	-	**29.000,00**	

GRAND TOTAL 185.750,00

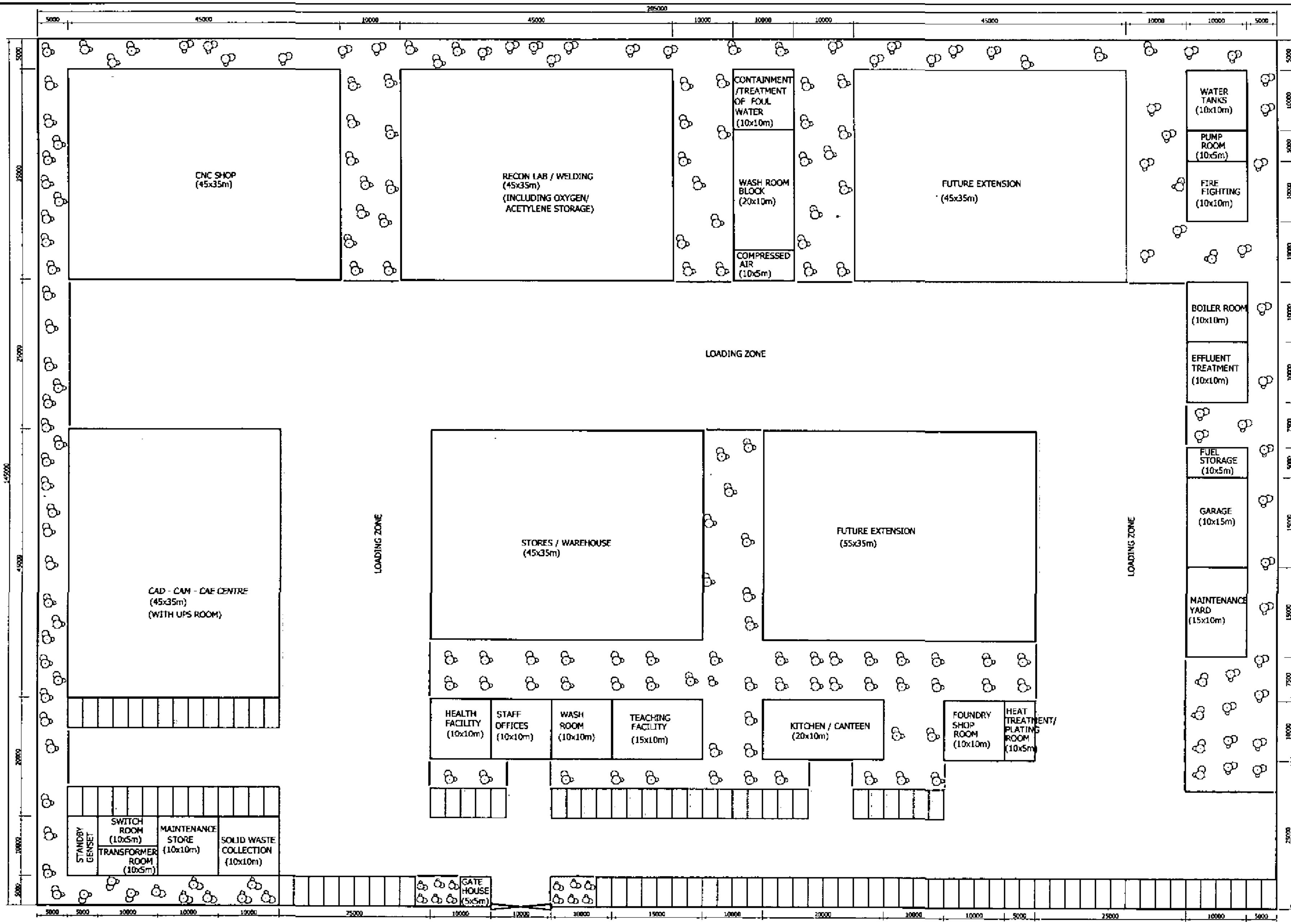
GHANA TECHNOLOGY CENTRE

	ESTIMATE OF CIVIL ENGINEERING COSTS (V I 3/1)								
	Civil engineering works								
	Source: Barbissotti Ltd and Consultant's calculations								
	Main plant item or plant unit					Currency:	US$ and GC		
Ref	Item description	Units	Quantity	unit cost		Costs			Year of investiment
				Foreign US$	Local GC	Foreign US$	Local GC	Total US$	
1	Structures					-	-	-	
2	Stores/Warehouse/Showroom	sm	1575	362,50		570.937,50	-	570.937,50	
3	Factory buildings	sm	4725	362,50		1.712.812,50	-	1.712.812,50	
5	Office buildings	sm	109	575,00		62.675,00	-	62.675,00	
6	Teaching facility building	sm	150	575,00		86.250,00	-	86.250,00	
7	Health facility building	sm	50	575,00		28.750,00	-	28.750,00	
8	Kitchen/canteen building	sm	100	575,00		57.500,00	-	57.500,00	
9	Washrooms	sm	150	575,00		86.250,00	-	86.250,00	
10	Containment tank	No.	2	5.000,00		10.000,00	-	10.000,00	
11	Solid waste collection	sm	100	362,50		36.250,00	-	36.250,00	
12	Fencing	Lm	1100	150,00		165.000,00	-	165.000,00	
	TOTAL buildings industrial Centre							**2.816.425,00**	
13	Student dorms	sm	250	575,00		143.750,00		143.750,00	
15	Management bungalow	sm	150	575,00		86.250,00		86.250,00	
16	Management bungalow	sm	150	575,00		86.250,00		86.250,00	
17	Management bungalow	sm	150	575,00		86.250,00		86.250,00	
	TOTAL Buildings Accomodation							**402.500,00**	
15	Civil works	Lumpsum	40%	3.218.925,00		1.287.570,00	-	1.287.570,00	
16	Landscaping	Lumpsum	15,0%	3.218.925,00		482.838,75	-	482.838,75	
	TOTAL civil works							**1.770.408,75**	
	Sub-Total					**4.989.333,75**	-	**4.989.333,75**	
	Total amount					**4.506.495,00**		**4.989.333,75**	

GHANA TECHNOLOGY CENTRE

	ESTIMATE OF CIVIL ENGINEERING COSTS (V I)								
	Land / site preparation								
					Currency:				
Ref	Item description	Units	Quantity	unit cost		Costs			Year of investment
				Foreign US$	Local GC	Foreign US$	Local GC	Total US$	
1	Purchase of land	acres	15	50.000,00		750.000,00	-	750.000,00	
2	Taxes					-	-	-	
3	Legal expenses					-	-	-	
4	Site preparation works					-	-	-	
5									
	Total investment cost					750.000,00	-	750.000,00	

Annex 4 Lay-out of the TICCG



NOTES:

LAND REQUIRED IS ABOUT 7 ACRES (ASSUME 10 ACRES)

ASSUMPTIONS

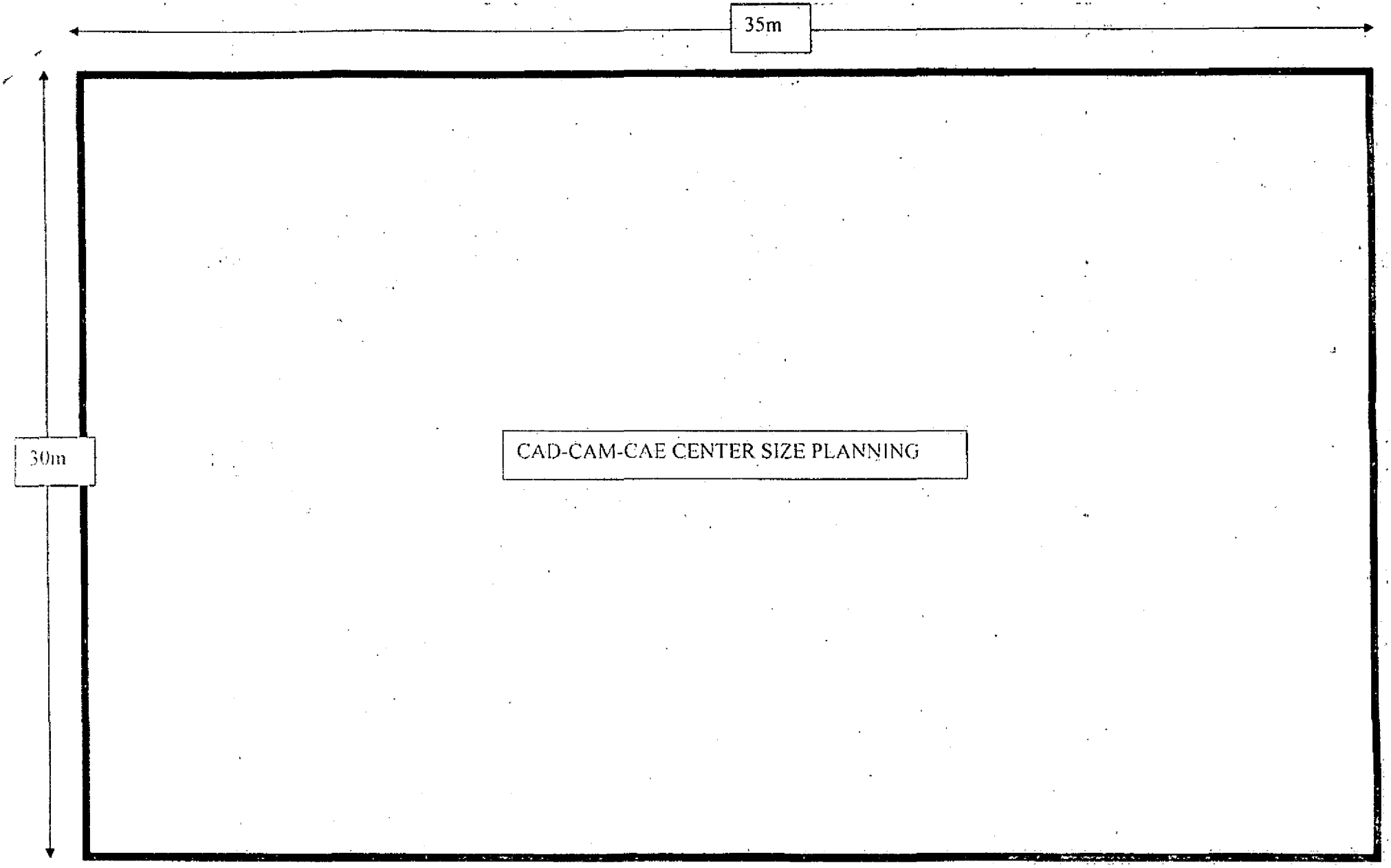
1) WATER SUPPLY IS AVAILABLE AT OR NEAR THE SITE
2) THE AREA IS SERVED BY ALL WEATHER ROADS AND OR RAILWAY LINES
3) THE SITE IS SERVED WITH MAIN SEWER
4) 33/11KV , 3 PHASE , 50 HZ ELECTRICAL SUPPLY IS AVAILABLE AT OR NEAR THE SITE

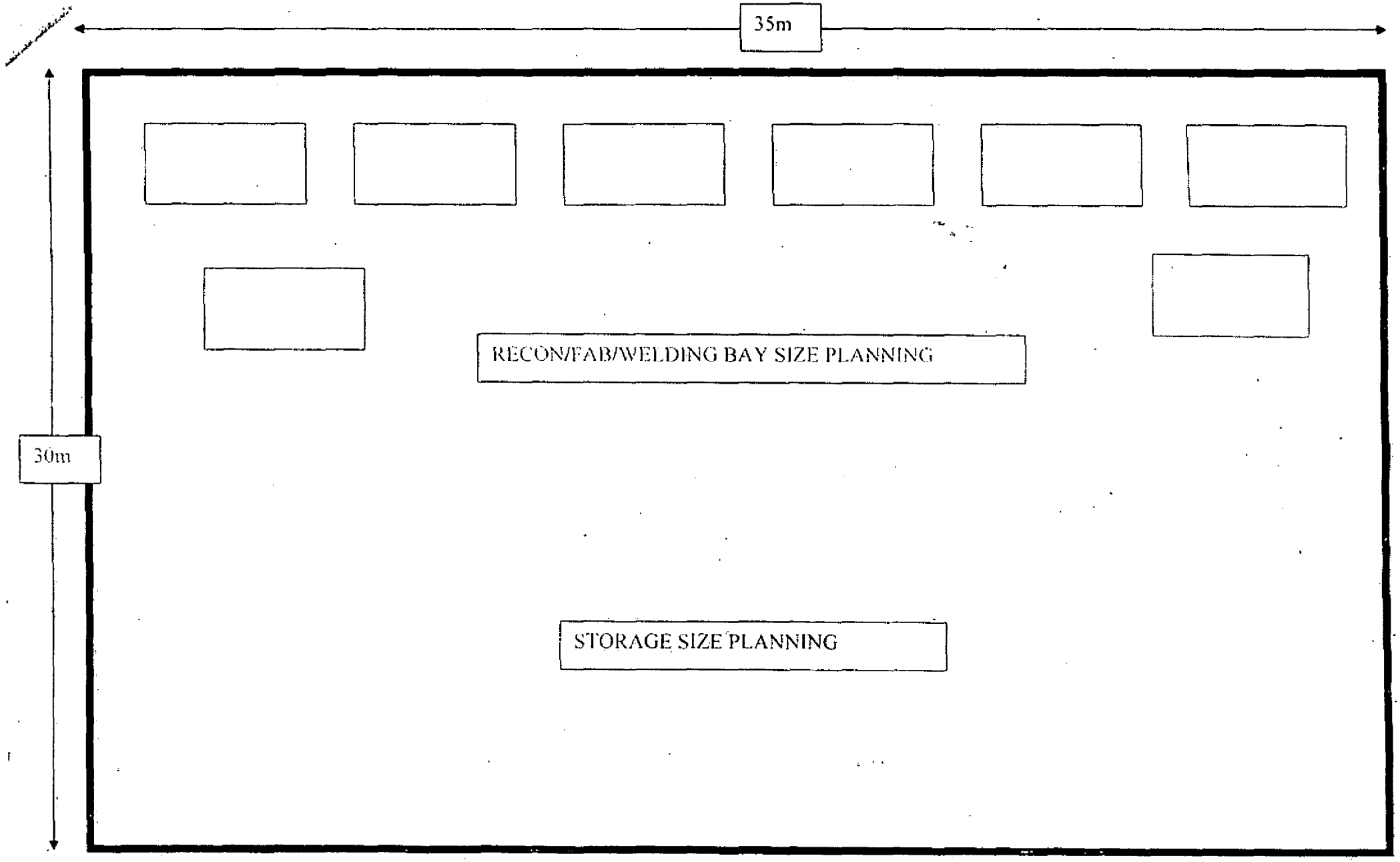
NO	DESCRIPTION	DATE	NO	DESCRIPTION	DATE

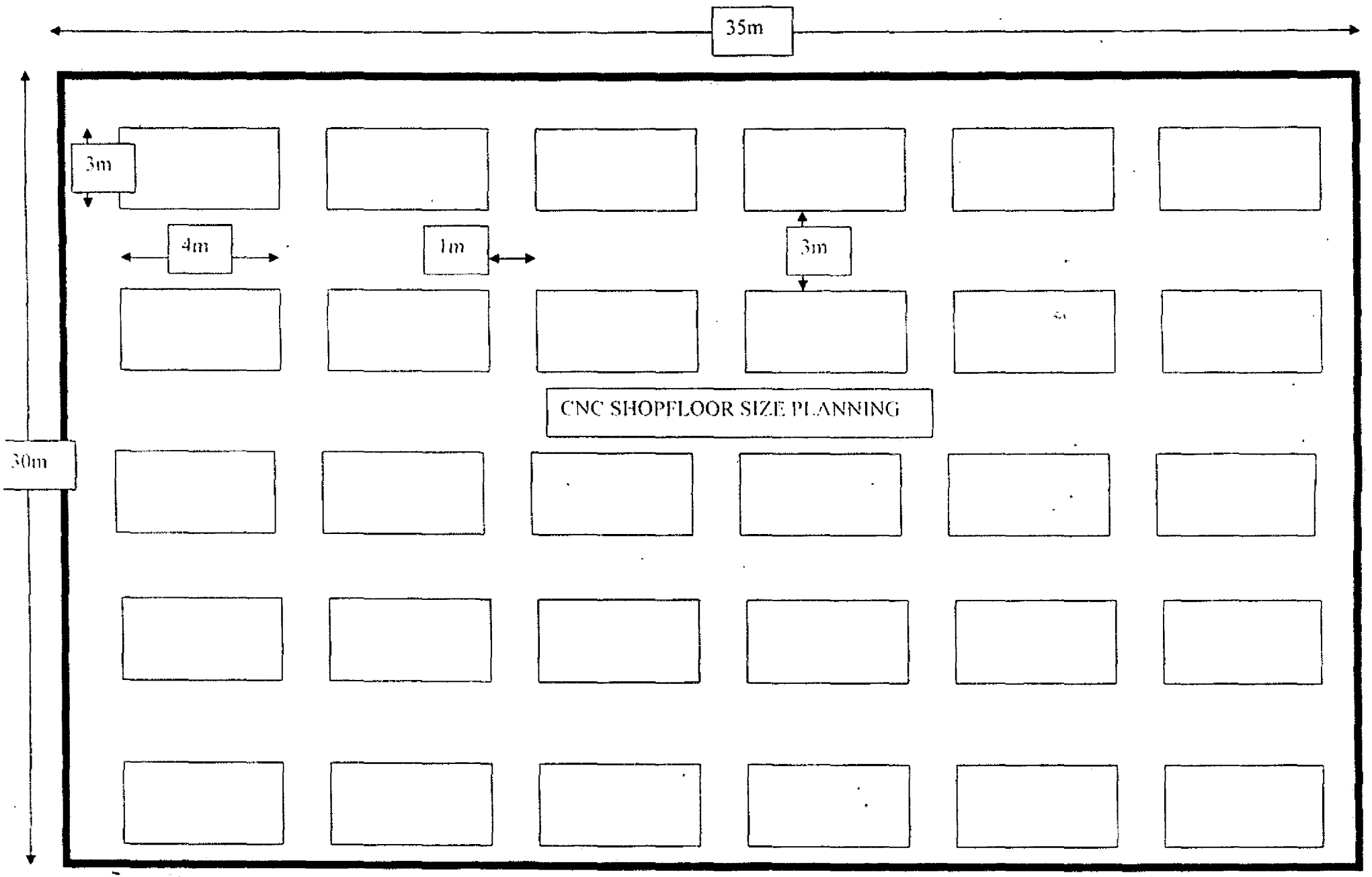
GIBB Africa
CONSULTING • DESIGN • MANAGEMENT

P.O. BOX 30020
NAIROBI, KENYA
TEL : 33045000
FAX : 210694

CLIENT	PROJECT	DRG TITLE				
THE GOVERNMENT OF GHANA C/O UNIDO	TECHNOLOGY CENTRE FOR CAPITAL GOODS	PROPOSED SITE LAYOUT PLAN	Date:	AUGUST 2005	Signature	JOB No. PJ0700
			Designed:	BNN		
			Drawn:	PAM		
			Checked:	BNN		DRG. No.
			Approved:	BNN		
			Scale:	1:300 (A1)		CIV 01
		Cad-Filename PJ700/cad/Ghana_	Revision	0		


35m
30m
CAD-CAM-CAE CENTER SIZE PLANNING


35m
30m
RECON/FAB/WELDING BAY SIZE PLANNING
STORAGE SIZE PLANNING


35m
30m
3m
4m
1m
3m
CNC SHOPFLOOR SIZE PLANNING

Annex 5 List of machinery

GHANA TECHNOLOGY INNOVATION CENTRE - List of machinery

FACTORY EQUIPMENT

Main plant item or plant unit					Currency:
Item description	Units	Quantity	unit cost		
			Foreign US$	Local GC	Foreign US$
CNC SOFT MACHINE CELL					
3-Axis CNC Vertical Milling Centre Machine Tool With dual Pallet Load	No.	1	400.000,00		400.000,00
2-Axis CNC Turning Machine Tool With Long Bead	No.	1	250.000,00		250.000,00
2-Axis CNC Turning Machine Tool With Bar Feeder	No.	1	250.000,00		250.000,00
Large CNC Boring Machine Tool for "Heavy Machinery"	No.	1	500.000,00		500.000,00
Cutting Tools	Lumpsum	1	75.000,00		75.000,00
Tool Holding Devices	Lumpsum	1	75.000,00		75.000,00
Working Holding, Fixtures & Clamping Devices	Lumpsum	1	75.000,00		75.000,00
CNC HAND MACHINE CELL					
3-Axis CNC VMC Machine Tool With 4-Axis Rotary Table	No.	1	350.000,00		350.000,00
2-Axis CNC Turning Machine Tool With SuperTurn	No.	1	250.000,00		250.000,00
Cutting Tools	Lumpsum	1	50.000,00		50.000,00
Tool Holding Devices	Lumpsum	1	50.000,00		50.000,00
Working Holding, Fixtures & Clamping Devices	Lumpsum	1	50.000,00		50.000,00
CNC COMPLEX & PRISMATIC MACHINE CELL					
5-Axis CNC Mill- Turn Machine Tool For "Wrap Technology"	No.	1	500.000,00		500.000,00
5-Axis CNC Milling Machine Tool For "Mold Technology"	No.	1	400.000,00		400.000,00
4-Axis CNC Horizontal Milling Centre Machine Tool for "Prismatic Tech	No.	1	400.000,00		400.000,00
Cutting Tools	Lumpsum	1	75.000,00		75.000,00
Tool Holding Devices	Lumpsum	1	75.000,00		75.000,00
Working Holding, Fixtures & Clamping Devices	Lumpsum	1	75.000,00		75.000,00
CNC GRINDING CELL					
CNC Gam-Jig Grinding Machine Tool	No.	1	200.000,00		200.000,00
CNC Form Grinding Machine Tool	No.	1	200.000,00		200.000,00
CNC Centerless Grinding Machine Tool	No.	1	150.000,00		150.000,00
CNC Surface Grinding Machine Tool	No.	1	150.000,00		150.000,00
CNC Ring Grinding Machine Tool	No.	1	250.000,00		250.000,00
CNC External Cylindrical Grinding Machine Tool	No.	1	200.000,00		200.000,00
CNC Internal Cylindrical Grinding Machine Tool	No.	1	150.000,00		150.000,00
CNC Barrel/Tube Horning Machine Tool	No.	1	200.000,00		200.000,00

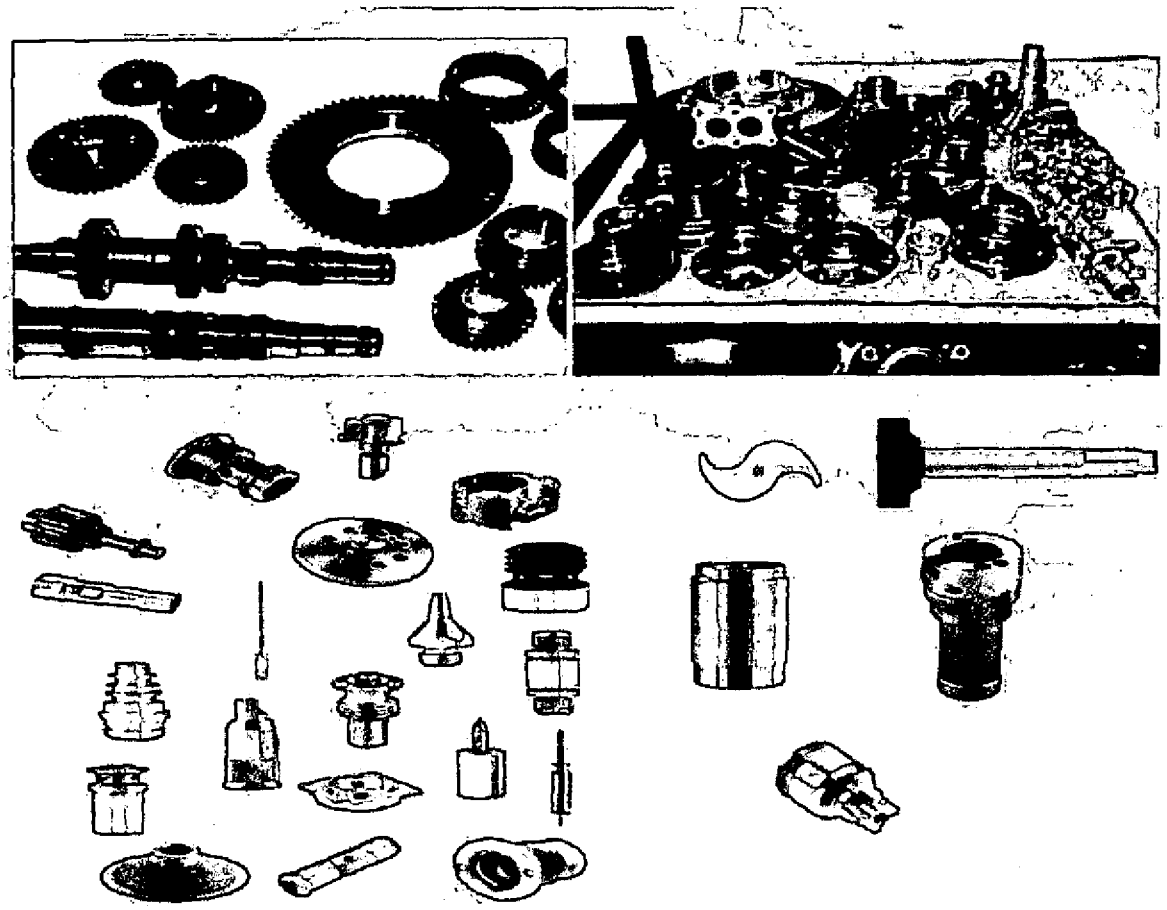
6-Axis CNC Universal Cutter Flute Grinding Machine Tool	No.	1	100.000,00		100.000,00
Grinding Tools	Lumpsum	1	75.000,00		75.000,00
Tool Holding Devices	Lumpsum	1	75.000,00		75.000,00
Working Holding, Fixtures & Clamping Devices	Lumpsum	1	75.000,00		75.000,00
CNC SHEET METAL & COLD FORMING CELL					
CNC Sheet metal Cutting Machine	No.	1	150.000,00		150.000,00
CNC Sheet Metal Bending Machine	No.	1	120.000,00		120.000,00
CNC Tube/Pipe Bending Machine	No.	1	120.000,00		120.000,00
CNC Press	No.	1	120.000,00		120.000,00
Cold Forming Machine for "Fastening Technology"	No.	1	200.000,00		200.000,00
Grinding Tools	Lumpsum	1	50.000,00		50.000,00
Tool Holding Devices	Lumpsum	1	50.000,00		50.000,00
Working Holding, Fixtures & Clamping Devices	Lumpsum	1	50.000,00		50.000,00
FABRICATION & RECONDITIONING CELL					
Manual Press for Assembly/ Disassembly	No.	1	20.000,00		20.000,00
Hydraulic Press for Assembly/ Disassembly	No.	1	30.000,00		30.000,00
Pneumatic Press for Assembly/ Disassembly	No.	1	30.000,00		30.000,00
CNC Cutting Saw Machine	No.	1	80.000,00		80.000,00
CNC Slitting Machine	No.	1	80.000,00		80.000,00
Manual Cutting Saw Machine	No.	1	20.000,00		20.000,00
Universal Saw Cutting Machine Tool	No.	1	20.000,00		20.000,00
Hydraulic Test-Assembling-Stripping-Bench	No.	1	70.000,00		70.000,00
Welding Sets(TIG/MIG & ARC)	Lumpsum	1	20.000,00		20.000,00
Cutting Touch Set	Lumpsum	1	10.000,00		10.000,00
Shop-Floor Miscellaneous	Lumpsum	1	100.000,00		100.000,00
QUALITY ASSURANCE "QA" & INSPECTION CELL					
"CMM" Coordinate Measuring Machine for Automated Part Inspection &	No.	1	200.000,00		200.000,00
Inspection & Measuring Instruments	Lumpsum	1	50.000,00		50.000,00
Calibration Instruments	Lumpsum	1	50.000,00		50.000,00
OTHERS		1			
Heat Treatment Plant "Hardening"	No.	1	300.000,00		300.000,00
Coating / Plating / Chroming	No.	1	100.000,00		100.000,00
Destructive Testing Plant	No.	1	200.000,00		200.000,00
Polishing machine "Roughs & Finish"	No.	1	20.000,00		20.000,00
Crane	No.	1	50.000,00		50.000,00

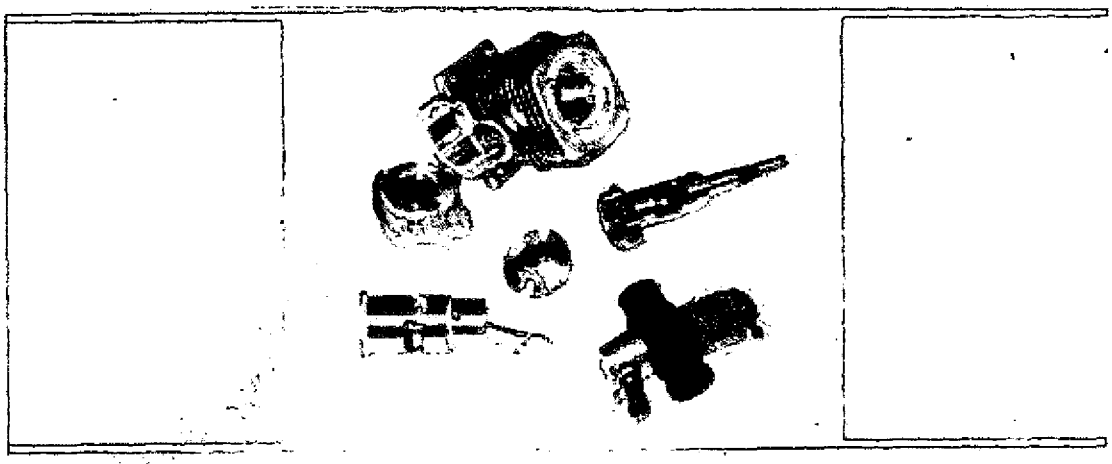
	Air-Compressor	No.	1	100.000,00		100.000,00
	Fork Lift	No.	1	20.000,00		20.000,00
	Equipment Miscellaneous	Lumpsum	1	100.000,00		100.000,00
	Machines Miscellaneous	Lumpsum	1	3.745.000,00		3.745.000,00
	TOTAL MACHINES					
	IT FACILITIES					
	PC Hardware For Main Designing Centre	Lumpsum	1	20.000,00		20.000,00
	PC Hardware For R&D "Collaboration with KNUST"	Lumpsum	1	20.000,00		20.000,00
	CAD Software Applications for 2D Drawing / 3D Solid Modelling	Lumpsum	1	20.000,00		20.000,00
	CAM Software Applications for NC Code Generation	Lumpsum	1	20.000,00		20.000,00
	CAD/CAM Software Applications :"Virtual Reality Stimulation of CNC M	Lumpsum	1	20.000,00		20.000,00
	CAE Software Applications for Engineering Verification	Lumpsum	1	20.000,00		20.000,00
	DNC Software Applications for CNC Machines connections	Lumpsum	1	20.000,00		20.000,00
	Other Software Applications	Lumpsum	1	20.000,00		20.000,00
	OTHER FACILITIES		1			
	Air Conditioning for CNC Facilities	Lumpsum	1	30.000,00		30.000,00
	Air Conditioning for PC Facilities	Lumpsum	1	30.000,00		30.000,00
	TRANSPORT FACILITIES					
	Truck	No.	1	50.000,00		50.000,00
	Mini Van	No.	1	20.000,00		20.000,00
	Cars and laptops for sales personnel	No.	6	30.000,00		180.000,00
	Total facilities					
	TOTAL COST					**12.470.000,00**

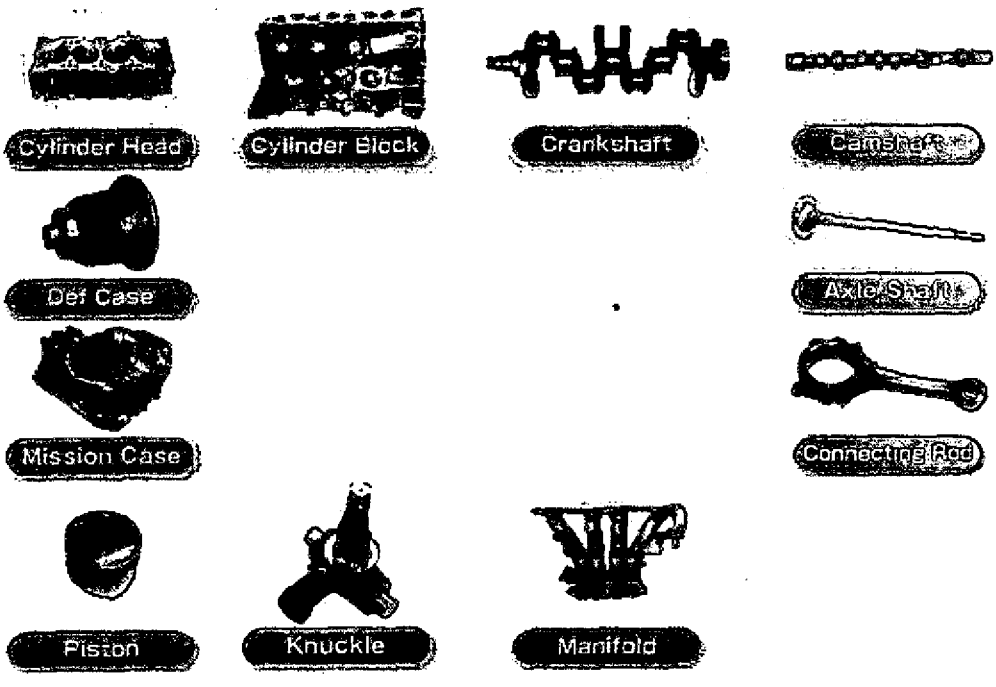
Annex 6 Description of CNC machines

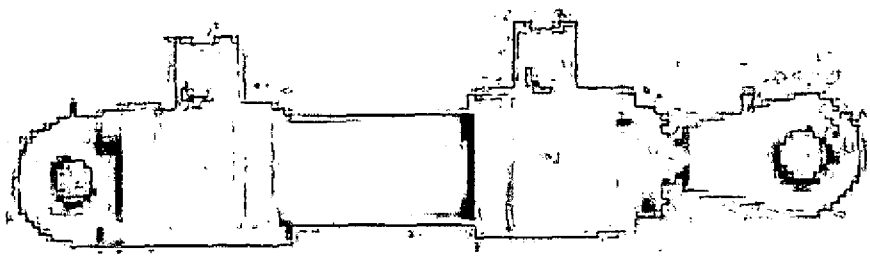
GALLERY OF PARTS

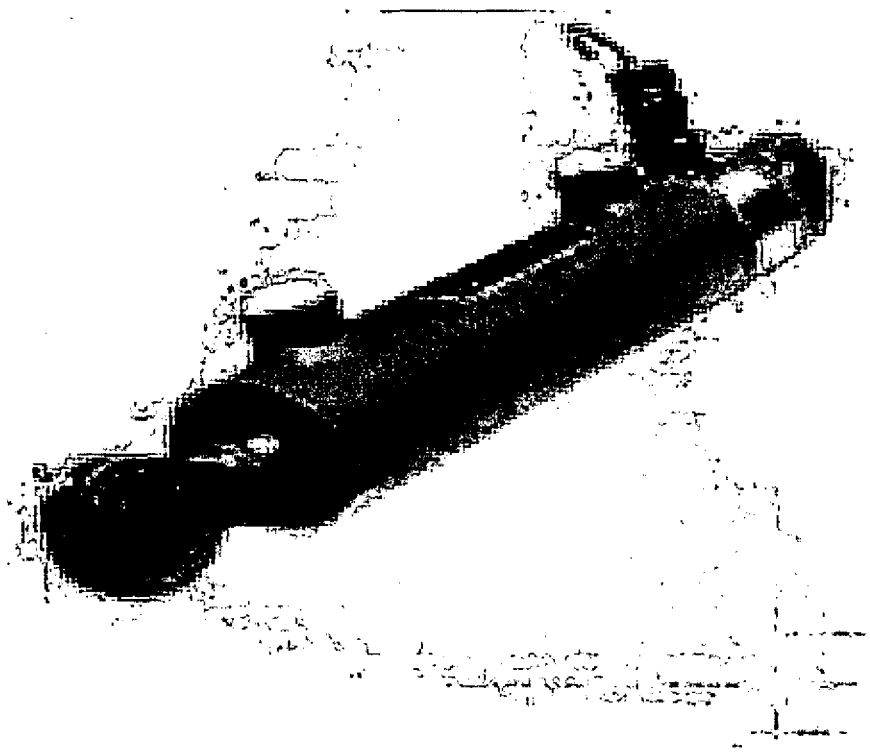
Attached is a small selection of typical components that we design/machine/recondition and product.

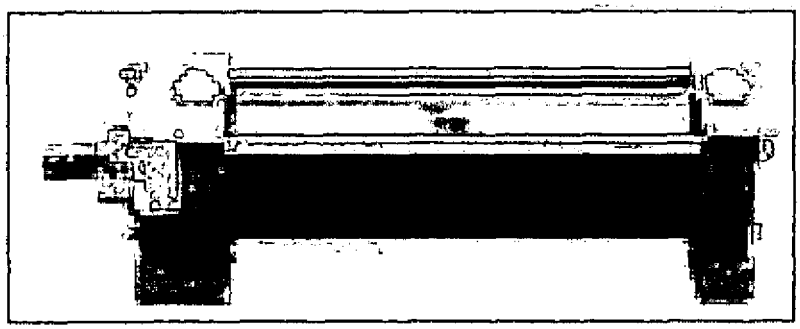


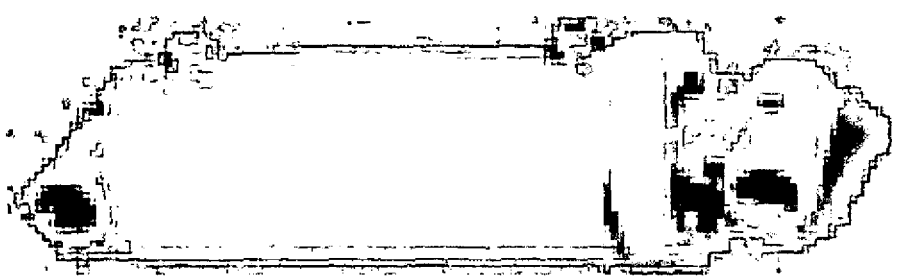



Cylinder Head
Cylinder Block
Crankshaft
Camshaft
Def Case
Axle Shaft
Mission Case
Connecting Rod
Piston
Knuckle
Manifold







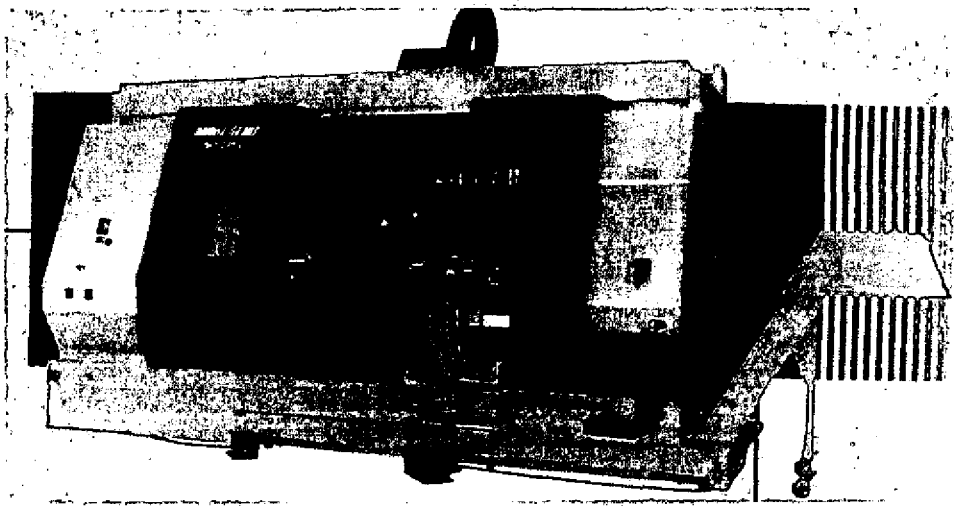


CAD-CAM-CAE Suite

Company	Description	Comments
AutoDesk	AutoCAD 2000. 2D/3D solid Modelling, Designing Software Application	
AutoDesk	AutoCAD Mechanical 2000 Power Pack. 2D Parametric Designing Software Application with standards parts and Finite Element Analysis.	
AutoDesk	Mechanical Desktop R5 Power Pack. 2D/3D solid Modelling, Parametric Designing Software Application with standards parts and Finite Element Analysis.	
AutoDesk	*Hyper* MILL V5.0.1 for AutoCAD 2000 and Mechanical Desktop R5.0. CAM / NC-Code Generation Software Application.	
AutoDesk	AutoDesk Inventor 4. 2D/3D solid Modelling, Parametric Designing Software Application, for large assembling models.	
PTC	Pro ENGINEER. Proe2000i2. 2D/3D solid Modelling, Parametric Designing Software Application with standards parts, kinematics simulations and Finite Element Analysis. CAM / NC-Code Generation Software Application.	
	Solid Works 2000. 2D/3D solid Modelling, Parametric Designing Software Application, for large assembling models	
Morningstar	GIBBS CAM, Virtual Gibbs 3D Milling & Turning Software Application.	
Pathrace	Master Cam 8. Design 8 - 2D/3D solid Modelling, Parametric Designing Software Application. Mill 8 - CAM / NC-Code Generation Software Application for 2-axis, 3-axis, 4-axis, 5-axis *Milling* Toolpaths. Lathe 8 - CAM / NC-Code Generation Software Application for 2-axis Turning Toolpaths.	
IBM Dassault	IBM Catia V5. 2D/3D solid Modelling, Parametric Designing Software Application with standards parts, kinematics simulations and Finite Element Analysis. CAM / NC-Code Generation Software Application for milling and lathe operations.	
CGTech	CGTech VERICUT version 4.4 / 5.0 - NC- Code and metal removal process verification, simulation and optimisation CAD/CAM 3D solid Modelling software. Combined machine tool simulation, NC-Code, fixture, workpiece stock and design verification for the most virtual realistic and accurate CNC error and collision checking. Opti Path for toolpath optimisation. AUTO-DIFF for the most virtual realistic and accurate machined component measurement checking.	
PLANSEE	PLANSEE TIZIT Applications. Formel – Formula collection for machining. PTWirt – Techno-Economics for cutting materials.	
ISIS	*ISIS Tooling Management system.*	
IFS	IFS Applications 2003. For integrating all HCT business processes, including engineering & financials.	

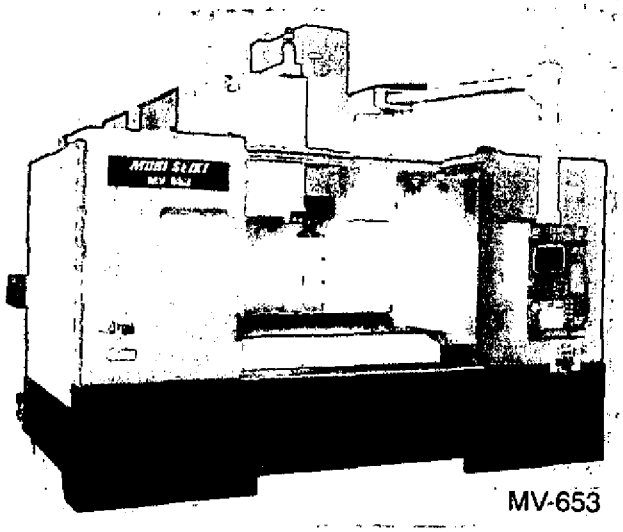
Equipment Line

- **5-Axis CNC MillTurn Machining Centre**



Next generation multi-axis turning centers with lathes and milling machining centers that fuse multi-dimensionality. Because turning operations can be followed by real milling operation with one chucking, changeover setup is not required, and major improvements are achieved in intensive processing.

- **3-Axis CNC Vertical Machining Centre**



MV-653

A traditional compact "box way VMC" vertical milling, boring, drilling, tapping machining centers that maintain reputation of accuracy, rigidity, and reliability.

The VMC integrates with a flexible manufacturing cell "FMS" which *consist of automatic pallet loader, component loading-unloading* workstation, pallets storage, and manually driven pallet cart.

The Solution Is Palletized Workholding: Save 1 Hour Of Machine Downtime Per Changeover By Switching Low-Cost Pallets In 1 Minute

Old Way | **New Way**

Changeover on Table			Changeover With Pallets
1. Blow off chips, tear down old setup	10 min's	2 min's	1. Blow off chips
2. Clean table, rails, store tools	5 min's	1 min	2. Switch pallets in 1 minute
3. Gather items for new setup	5 min's		
4. Check plan chart for table layout	5 min's		
5. Store fixture bumps, assemble setup	5 min's		
6. Rough position fixtures, snug bolts	5 min's		
7. Mount dial indicator, start indicating	5 min's		
8. Tap fixtures to move, indicate again	5 min's		
9. Tram, tap, tram, tighten bolts	5 min's		
10. Check tool alignment	5 min's		
11. Final fixture position check	5 min's		
Total Elapsed Time Before Machining First Part			
Make 1 Setup/Changeover Per Day	60 min's	3 min's	
Make 2 Setups/Changeovers Per Day	120 min's	6 min's	
Make 3 Setups/Changeovers Per Day	180 min's	9 min's	

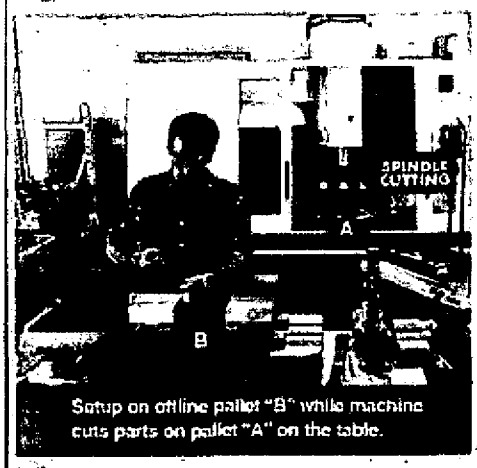
System 1

Short-Runner™

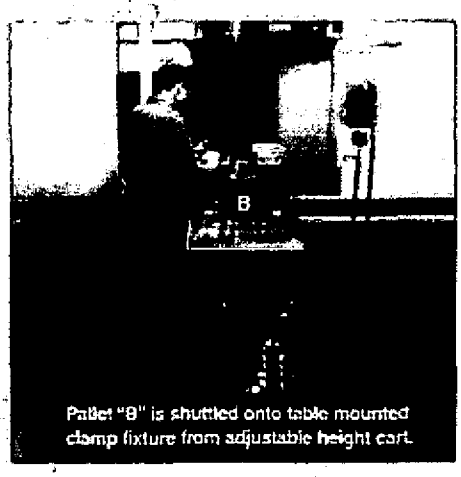
Low-Cost System For Short Runs

Slashes setup downtime by 90%
Switch pallets with fixtures or vises in 2 min.

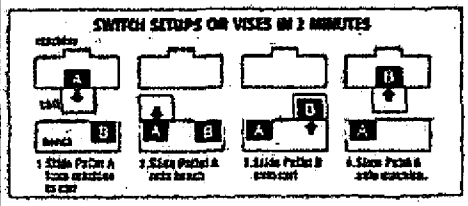
- Includes 3 pallets, power clamp base, and cart. Storage shelves optional.
- Easily upgraded to full Setup•Switcher by adding System 2 pallet switching unit.

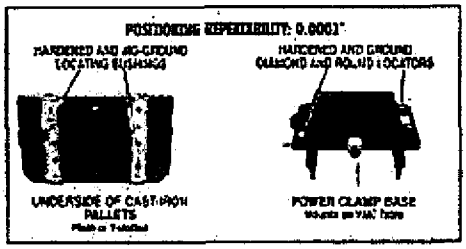


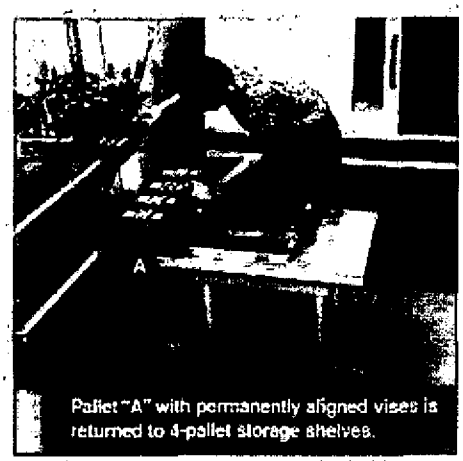
Setup on offline pallet "B" while machine cuts parts on pallet "A" on the table.



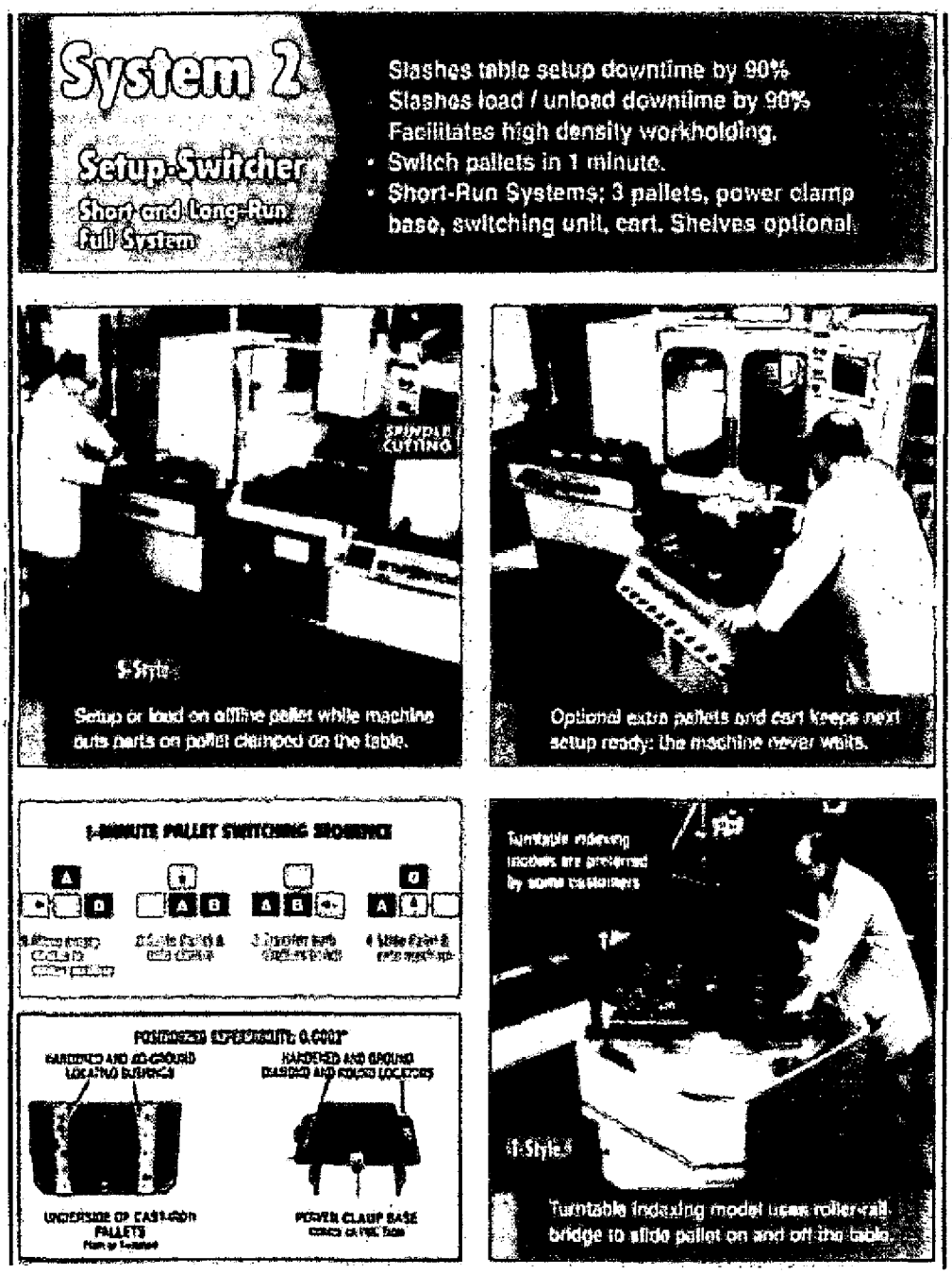
Pallet "B" is shuttled onto table mounted clamp fixture from adjustable height cart.





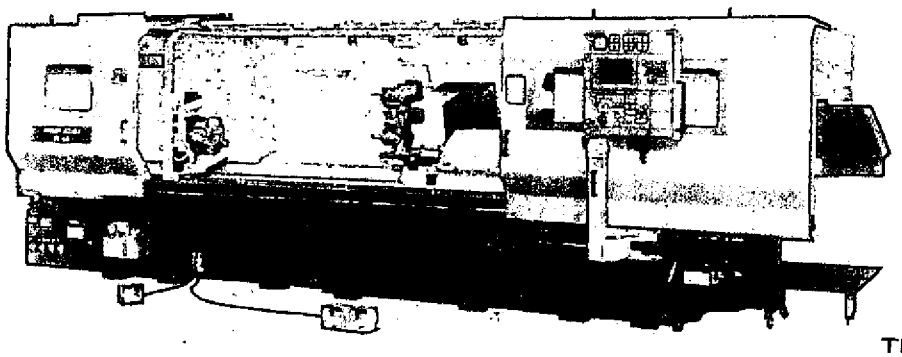


Pallet "A" with permanently aligned vises is returned to 4-pallet storage shelves.


System 2
Setup-Switcher
Short and Long-Run
Full System
Slashes table setup downtime by 90%
Slashes load / unload downtime by 90%
Facilitates high density workholding.
• Switch pallets in 1 minute.
• Short-Run Systems: 3 pallets, power clamp base, switching unit, cart. Shelves optional.
SPINDLE CUTTING
Setup or load on offline pallet while machine cuts parts on pallet clamped on the table.
Optional extra pallets and cart keeps next setup ready: the machine never waits.
1-MINUTE PALLET SWITCHING SEQUENCE
A
B
HARDENED AND GROUND LOCATING SURFACES
HARDENED AND GROUND DATUMED AND POWER LOCATORS
UNDERSIDE OF CAST-IRON PALLETS
POWER CLAMP BASE
Turntable indexing
T-Style
Turntable indexing model uses roller-rail bridge to slide pallet on and off the table.

CAD/CAM/CNC PRECISION COMPONENT MACHINING

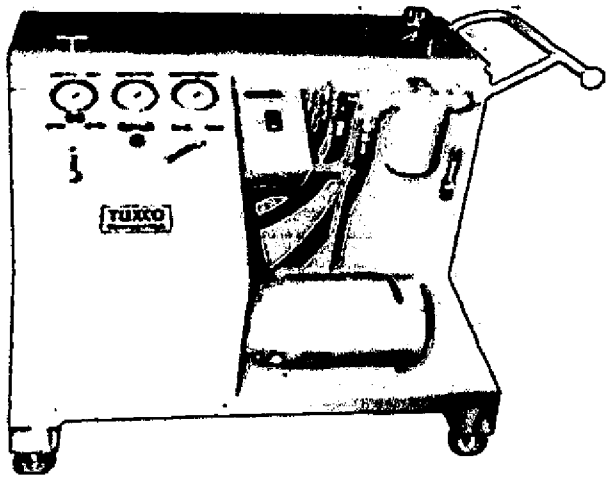
- **2-Axis CNC Lathe Turning Centre**



TI

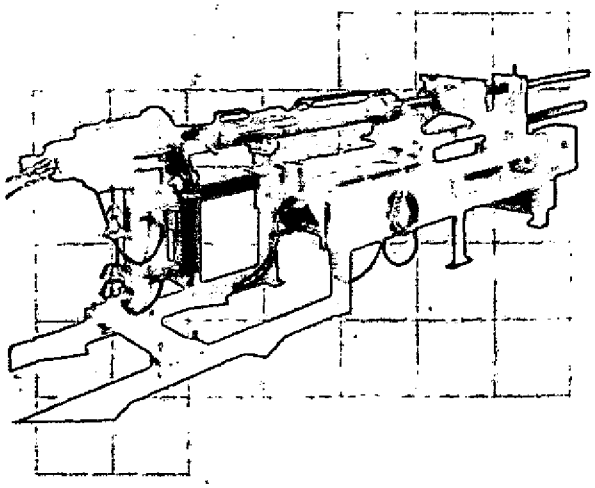
Large capacity machine for small parts and long shaft. This machine is for machining hydraulic cylinders, cylinder heads and many other complex parts.

Hydraulic Cylinder Tester



When your business is replacing hydraulic cylinders for your own equipment or that of a customer, knowing that each cylinder repair is perfect before it is reinstalled is essential. Being able to guarantee that there are no rod or piston seal leaks and that the cylinder will work properly means greater profit, satisfied customers and long-term customer loyalty. The high volume, high-pressure hydraulic system and precise controls and gauges of the Hydraulic Cylinder Tester provide a high speed testing capability.

HYDRAULIC CYLINDER SERVICER - DISASSEMBLY AND ASSEMBLY BENCHES



UNIQUE FEATURES

Versatility
Hundreds of different sizes and types of cylinders can be serviced on each of the Hydraulic Cylinder Servicer.

One Man Operation
The unique designs and built-in hydraulic power allow one man to service cylinders easily and without assistance. Set up is quick and easy with the provided mounting cones.

Centerline Mounting
Centerline mounting makes it possible to manually or hydraulically rotate the cylinder barrel either clockwise or counterclockwise around the stationary rod thus providing high torque to remove threaded caps, cap bolts and piston retaining nuts.

Built-In Universal Spanner Wrench
The Universal Spanner Wrench connects to retaining cap slots or holes thus allowing barrel rotation to quickly remove the retainer. Chain wrenches and conventional spanner wrenches are not required.

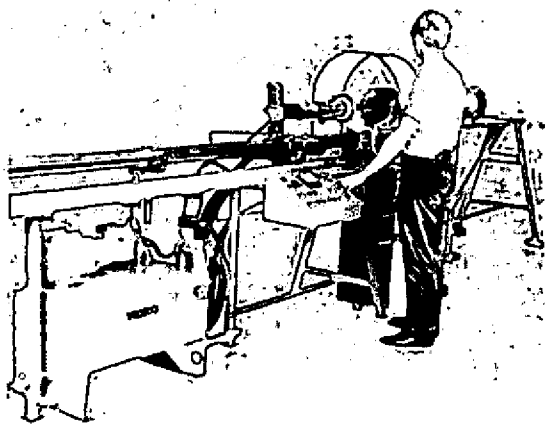
T-Slot Securing System
T-slot design provides a safe and secure way of quickly mounting both ends of a hydraulic cylinder to the servicer. The T-slots hold a wide range of mounting adapters, tools and accessories to make the toughest job easy.

Universal High Torque Wrench
This tool attaches quickly to all conventional hex and square piston retaining nuts from 2-1/2" to 4-1/2" (63.5 to 114 mm.) across the flats. It is built to withstand up to 30,000 lbs./ft. (4149 kg-m) of torque and eliminates the need for buying expensive high torque sockets. A wrench with a 4" to 6-1/2" capacity is also available.

Adjustable Support Stands
Both barrel and piston rod support stands provide micrometer-like vertical, horizontal and diagonal adjustment that helps eliminate seal damage on reassembly and assures repair integrity.

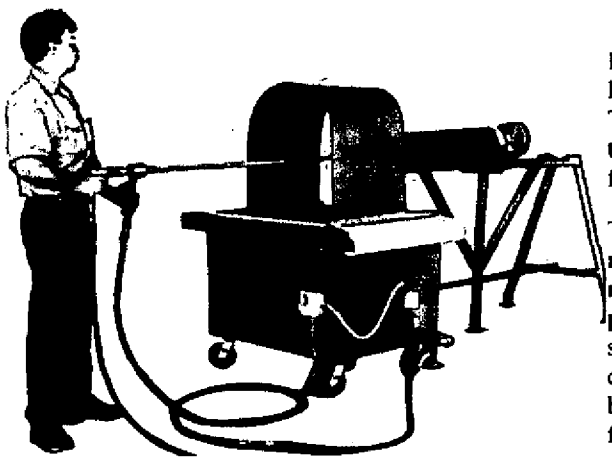
Easy To Read Torque Gauges
Large, liquid-filled gauge directly reads torque. It monitors and records disassembly torque, assuring that cylinders are reassembled to factory torque specifications.

Automatic Hydraulic Cylinder Hone



The fully automatic hone is a field proven design that allows the operator to quickly program stone surface speed, stroke length and stroke speed. Even stone expansion to compensate for wear is automatic. A timer controls the length of the honing process.

HYDRAULIC CYLINDER WASHER

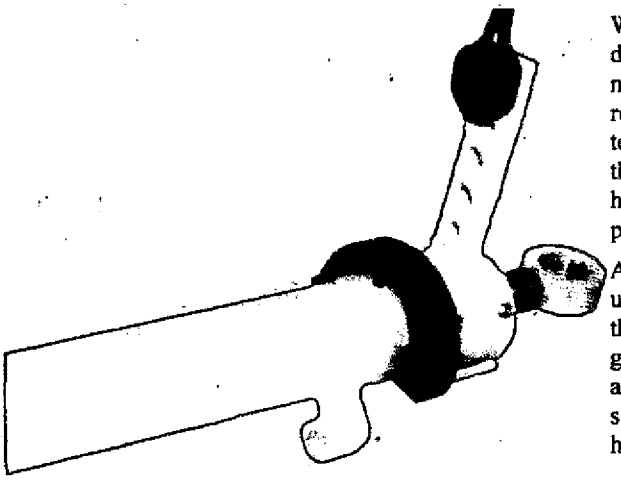


Dirt and honing debris are every hydraulic system's worst enemies. The Cylinder Washer guarantees that cylinders will be contaminant free when they are reassembled.

The uses rotating pressure spray nozzles and rotating brushes to make repaired cylinders clean. A powerful 15 GPM cleaning solution pump flushes out all the debris quickly. Two sets of brushes handle cylinders with from 4 to 13 1/2" bores.

CAD/CAM/CNC PRECISION COMPONENT MACHINING

PISTON ROD GUIDED SPANNER WRENCH



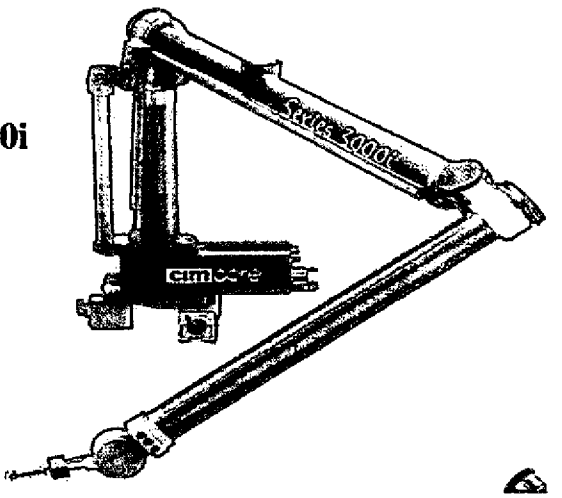
When corrosion, cylinder distortion or thread compounds make threaded cylinder head removal a time consuming job, technicians resort to cutting away the barrel, cutting the gland, torch heating or using a hammer and punch.

At HCT there is a spanner wrench useable in the shopfloor or field that makes high torque threaded gland head removal quick, easy and much safer because it won't slip and it won't damage the rod, head or its spanner slots or holes.

The attaches to piston rods from 1.00" (25.4 mm) to 3.10" (78.7 mm) in diameter. Built-in nylon pads protect the piston rod. A simple adjustment centers the wrench on the head. The appropriate slot or pin dies engage the head and follow it out, as it is unscrewed.

Coordinate Measuring Machine "CMM"

Series 3000i
20 micron



Annex 7 Start up costs

STANDARDIZED COMPANY

Legal Form: Limited Company

Capital: US$3,370 (C24 million) Minimum capital requirement C25,000

City: Accra

Registration requirements:

Proc 1 Apply to the Registrar-General's Department to obtain a incorporation certificate

Time to complete: 5 days

Cost to complete: C780,111=C500,000 for registration of a limited company +C100,000 filing fee +C20,000 per copy of Registration Certificate *Comments:* After incorporating the company the promoters must within 28 days complete forms 3 & 4 stating the names and addresses of the Directors and Secretary of the company, the Auditors, place of business etc. On payment of 0.5% of the stated capital as commencement tax, the Registrar shall issue a certificate to commence business.

Proc 2 Deposit paid in capital in an account

Time to complete: 1 day

Cost to complete: free

Comments: Present copies of regulations of the company; certificate of incorporation and certificate to commence business; signatories of authorized representatives of the company.

Proc 3 Obtain company common seal (OPTIONAL)

Time to complete: 14 days (2 weeks)Maximum

Cost to complete: C550,000.00

Comment: small size ¢400,000.00 - ¢550,000.00
large size ¢750,000.00 - ¢1,000,000.00
The step does not stop the following formalities.

Proc 4 Register with the Internal Revenue Service

Time to complete: 7 days (depending on the category of the business)The Registrar of Companies now automatically registers new Companies with the I.R.S.

Cost to complete: C 100,000

Comments: With companies engaged in general commercial/industrial activities the minimum registration fee is ¢10,000.00 and the maximum registration is ¢100,000.00 as calculated on projected turnover. Obtaining a tax clearance certificate if the company is otherwise entitled to a certificate on a satisfactory tax position will cost ¢2,000.00 and VAT is charged at 12.5%.

Proc 5 Pay for business licenses at the Metropolitan Authority

Time to complete: 7 days

Cost to complete: C900,000 (varies, depending on the nature of the business)

Comments: The cost to complete depends on the type of business and the category in which it falls. An officer of the Metropolitan Authority visits the business premises and assesses the type of business set up. The officer then determines at his discretion the category in which the business should be placed for purposes of assessing the license fee to be paid.

Category A	Turnover	5 billion	¢ 4,000,000
Category B	Turnover	2.1 billion - 5 billion	¢ 2,450,000.00
Category C	Turnover	1 billion - 2 billion	¢ 1,600,000.00
Category D	Turnover	30 million - 1 billion	¢ 915,000.00
Category E	Turnover	0 - 3 million	¢495,000.00

Proc 6 Register employment vacancies with the Employment center.(This procedure only relevant with minimum wage employees)

Time to complete: 1 day

Cost to complete: free at government labor department. With private employment agencies between ¢30,000 - ¢100,000.

Comment: The employer must go to the Employment Centre to register vacancies available on Vacancy Registration Card PEC 6.

Proc 7 File employment contracts with the Employment Center after hiring

Time to complete: 1 day

Cost to complete: free

Comment: This and the previous procedure are in the same building, however, there is an intervening procedure in-between - the hiring of the employee. Therefore they are considered 2 procedures.
Chief Labor Officer is required by the Labor Decree to attest each employment contract and confirm its validity and compliance with Ghanaian Labor Laws and International Labor Organization Laws. In practice, this seldom done.

Proc 8 Apply for Social Security

Time to complete: 3 days

Cost to complete: free

Comments: Must attach the list of employees, salaries, their Social Security Numbers and the company's Certificate of Incorporation and Certificate to Commence Business.

Proc 9 Inspection of work premises by the Employment Center(applicable only to enterprises such as restaurants, bars,etc,but not to the professions and executive emploment.)

Time to complete: 1 day

Cost to complete: free

Comment: A Labor Inspector inspects the business premises before the company begins its business operations. Subsequently the Labor Inspector inspects the business premises two (2) times in a month and a Labor

Officer inspects the business premises four (4) times in a month. This is to ensure that the business promises are fit for the purpose of the business and are fitted out in accordance with the labor laws of Ghana and the International Labor Organization at all material times.

Proc 10. Obtain Environment certificate

Time to complete: 60 days

Cost to complete: C,100,000 (Varies)

Comments: No fixed fees as the cost depends on which consultant is commissioned to assess the environmental impact of the work involved. The purchase of Environmental Assessment Preliminary Registration Form costs ¢5,000.00. The Environmental Assessment Registration Form costs ¢20,000.00. All other costs incurred will depend on the type of company to be set up, the environmental impact of the company or organization to be set up and the fees of the consultant commissioned to do the assessment.

The company submits an application describing the location, current zoning classification, nature of processes to be utilized, and the likely environmental impact. Environmental authorities or officials visit within 1 day of application. The cost of the visit is paid for by the company. The Environmental Officer classifies the project into (1) no impact; (2) minimal impact; (3) impact. In case two (2) the company must file a detailed report. In the case of three (3), a full environmental impact assessment is done. It takes 90 for the ideal situation.

Annex 8 CEPS database

1.1 Relevant market for TICCG

From all capital goods importers the TICCG is initially going to focus on:
Argiculture
Food processing
Machine tooling
Relevant products for the TICCG are:

HS Code	Product Description	Year 2004 CIF Import Value ($)
8455	Metal rolling mills and rolls thereof; parts	3059656
8456	Machine tools for material removal by laser etc	962903
8457	Machining centers, unit const mach etc work metal	540979
8458	Lathes for removing metal	812532
8459	Machine tools for drilling, boring, milling etc	5046350
8460	Machine tools for honing or finishing metal etc	936902
8461	Machine tools for shaping, slotting, gear cut etc	1,184,830
8462	Machine tools for forging, bending, stamping etc	4285224
8463	Machine tools for working metal, nesoi	2065351
8464	Machine tools for working stone, etc & glass	819961
8465	Machine tools for working wood, cork, bone etc	12276534
8466	Parts etc for machine tools of heading 8456 to 8465 (lathe, machine tools, etc)	13846957
8432	Agricult etc mach for soil etc; lawn rollers; pts	3369140
8433	Harvest etc machines, cleaning eggs etc nesoi, pts	1916917
8434	Milking machines & dairy machinery & parts	887307
8435	Presses etc for wine, cider, fruit juice etc, pts	298858
8436	Agri etc & poultry etc equip, inc incubators, pts	3440223
8437	Mach for cleaning seed etc & work cereal etc, pts	10883521
8438	Mach nesoi, ind prep of food or drink etc, parts	18215097
Total		83.664.412

Total market US$83,6 million

CEPS Data-Base Imports of Goods into Ghana

HS Code	Product Description	Year 2000 CIF Import Value ($)	Year 2001 CIF Import Value ($)	Year 2002 CIF Import Value ($)	Year 2003 CIF Import Value ($)	Year 2004 CIF Import Value ($)	Total Avg % Growth (2001 - 04)
4001	Natural rubber, balata, chicle etc, prim form etc	0	7,921	67,300	17,152,029	43,167	76%
4002	Synth rubber 7 fabric, inc nat-syn mk, pr fm	0	33,674	140,828	415,137	102,646	45%

	etc						
4003	Reclaimed rubber in primary forms or in plates, sheets or strip	0	10,307	9,468	68,229	6,489	-14%
4004	Waste of rub,exc had rub, & powder obtain thereof	0	20,563	23,004	24,397	5,131	-37%
4005	Compounded rubber, unvulcanized, primary forms etc	0	800,987	431,488	1,230,211	218,084	-35%
4006	Unvulc rubber forms nesoi & unvulc rubber articles	0	96,152	170,613	634,973	236,270	35%
4007	Vulcanized rubber thread and cord	0	17,838	13,165	98,827	34,673	25%
4008	Plates, sheets, profile shapes etc, soft vulc rubber	0	302,694	408,442	2,445,415	638,017	28%
4009	tubes, pipes & hoses of unhard vulcanized rubber	0	2,596,080	1,931,333	8,964,200	2,809,707	3%
4010	Conveyor or transmiss belts of vulcanized rubber	11,422,744	1,675,291	2,698,060	10,994,985	3,701,935	30%
4011	New pneumatic tires of rubber	0	29,413,940	32,138,299	216,526,588	43,903,327	14%
4012	Retread or used pneu tires, solid tires etc, rubber	0	8,057,953	6,523,719	38,499,438	8,443,361	2%
4013	Inner tubes for tires, of rubber	0	946,356	874,239	6,168,838	1,256,082	10%
4014	Hygienic or pharma articles of unhard vulcan rubber	0	1,473,689	2,267,866	4,237,159	1,075,313	-10%
4015	Art of apparel & access of unhard vulcanized rubber	0	556,466	663,164	3,023,806	617,685	4%
4016	Articles nesoi of un harded vulcanized rubber	0	3,067,066	2,467,150	13,980,985	4,070,473	10%
4017	Hard rubber in all forms: articles of hard rubber	0	101,701	59,238	326,265	113,897	4%
4201	Saddlery, harness, traces, leads etc, any material	0	14,829	21,157	209,996	166,343	124%
4202	Travel goods, handbags, wallets,	0	9,898,638	9,689,465	49,352,684	42,586,952	63%

	jewelry cases etc						
4203	Articles of apparel & access, leather & comp leather	0	209,534	225,744	2,745,603	2,573,141	131%
4204	Articles of leather used in machinery/mechanical appliances	34,065	108,817	16,870	142,154	128,187	6%
4205	Articles of leather, nesoi	0	42,547	43,241	213,897	201,109	68%
4206	Articles of gut nesoi, of gold beater's skin etc	0	4,224	1,821	6,384	6,153	13%
5901	Textile Book covered fabric; tracing cloth; paint canvas	0	2,929	32,915	486,424	441,517	432%
5902	Tire cord fabric of high tenacity yarn, nylon etc	0	378,039	2,883	739,651	704,966	23%
5903	Textile fabrics (not tire cord) coat etc, plastics	0	167,957	82,189	1,808,606	1,698,462	116%
5904	Linoluem; floor cover with coat etc on a text base	0	18,269	1,407	177,600	171,156	111%
5905	Textile wall coverings	0	0	1,350	61,805	59,562	#DIV/0!
5906	Rubberized textile fabrics, other than tire cord	0	22,250	20,327	294,062	280,427	133%
5907	Textile fabric, coated, etc, theatrical scenery, back-cloth	0	206,010	33,841	859,844	779,711	56%
5908	Textile wicks for lamps etc and gas mantles etc	0	0	5,297	12,898	10,747	#DIV/0!
5909	Textile hosepiping and similar textile tubing	0	3,937	21,156	707,252	655,942	450%
5910	Transmission/conveyor belts, tex matrl, whthr/no reinfrcd	0	132,563	91,691	2,379,816	2,293,466	159%
5911	Textile Products etc for specific tech uses nesoi	289,347	350,864	566,163	1,937,268	1,795,842	72%
7301	Sheet pilling, welded angles etc of iron or steel	0	540,095	562,181	5,464,222	5,174,037	112%

7302	Railway etc track construction material, iron & steel	0	437,714	207,475	2,402,002	1,179,564	39%
7303	Tubes, pipes and hollow profiles of cast iron	0	517,680	127,805	2,401,438	2,289,784	64%
7304	Tubes, pipes etc, seamless, iron nesoi, iron & steel	0	2,603,089	1,723,752	12,316,308	9,076,408	52%
7305	Tubes & pipes nesoi, ext dia ov406-4mm, iron & steel	0	119,599	1,309,272	4,794,070	986,636	102%
7306	Tubes, pipes & hollow profiles nesoi & steel	0	6,081,902	2,475,591	25,641,249	21,242,415	52%
7307	Tube or pipe fittings, of iron or steel	1,494,371	2,004,295	2,087,517	17,198,211	15,052,606	96%
7308	Structures nesoi & parts thereof, of iron or steel	0	16,980,345	8,865,131	53,321,057	46,598,267	40%
7309	Tanks etc, over 300 liter capacity, iron or steel	0	906,817	1,913,913	4,786,288	4,108,046	65%
7310	Tanks etc, n/ov 300 liter capacity, iron or steel	8,482,409	2,275,051	49,826,215	17,160,575	15,005,142	88%
7311	Containers for compressed or liquified gas	0	404,778	213,925	3,308,130	2,835,621	91%
7312	Stranded wire, ropes etc, no elec ins, iron or steel	0	1,500,275	1,476,771	5,666,094	5,015,799	50%
7313	Barbed wire and twisted wire for fencing, iron/steel	0	372,077	2,654,177	2,248,054	1,944,331	74%
7314	Cloth, grill etc iron or steel; expanded metal, iron or steel	0	1,021,417	858,687	6,711,649	6,321,234	84%
7315	Chain & parts, of iron or steel	0	610,785	1,029,605	3,569,633	3,076,224	71%
7316	Anchors, grapnels and parts thereof, of iron /steel	0	52,775	38,117	2,207,977	2,127,853	243%
7317	Nails, tacks, drawing pins etc of iron or steel	0	1,206,446	1,154,897	5,298,258	4,522,763	55%
7318	Screws, bolts, nuts, washers etc, iron or steel	0	4,630,094	4,505,720	30,082,420	21,601,358	67%

7319	Needles, sew & knits, bodkins etc, pins etc iron & steel	0	141,244	93,995	325,930	300,350	29%
7320	Springs & leaves for springs, iron or steel	0	412,190	474,834	5,796,838	5,267,501	134%
7321	Stoves, ranges etc, nonel domestic & parts, iron & steel	0	2,705,262	2,877,748	14,015,269	12,012,652	64%
7322	Radiators, air heaters etc, nonel & parts, iron & steel	0	46,828	130,622	526,666	499,152	120%
7323	Household articles & parts, iron & st; ir or steel	0	5,158,773	5,096,812	33,874,506	29,243,913	78%
7324	Sanitary ware & parts, iron or steel	0	1,133,452	741,509	8,621,734	8,048,972	92%
7325	Cast articles nesoi, of iron or steel	0	2,706,589	312,370	5,771,462	4,966,528	22%
7326	Articles of iron or steel, nesoi	0	10,331,381	8,813,361	35,487,887	27,815,060	39%
7610	Aluminium structures nesoi (no prefab) & parts of	2,569,843	1,293,478	1,567,751	0	0	-100%
8201	Handtools & Tools used in agricult etc, b met pts	790,573	801,713	972,649	2,977,205	4,256,018	74%
8202	Handsaws & metal pts: saw blades; base mtl saw parts	1,239,137	1,127,899	565,482	2,678,296	3,571,904	47%
8203	Files, rasps, pliers, metalcut shears etc, b mt pt	203,279	210,113	178,803	809,592	1,026,248	70%
8204	Hand operated spanners & wrenches etc, b met parts	462,956	391,350	460,741	1,709,642	2,042,654	73%
8205	Handtools nesoi; blow torches etc; anvils etc	1,450,571	2,297,814	1,373,778	5,450,417	7,586,629	49%
8206	Tools of 2 or more of hdg 8202 - 8205, sets for retail sale	196,161	214,971	346,088	747,787	999,733	67%
8207	Interchange tools for hand - or machine - tools bmpt	4,627,527	5,882,836	4,768,211	17,256,401	19,358,134	49%
8208	Knives & blades for machines & appliances, b mt pt	0	1,129,613	1,133,787	2,140,965	4,066,953	53%
8209	Plates, sticks, tips etc f tools unmntd sntrd	0	8,025	20,700	276,813	315,410	240%

	crbds/crmts						
8210	Hand-op mech appl 10kg or less, food/drk prp/con/srv pt	0	40,965	101,974	58,171	73,108	21%
8211	Knives with blades & blades for knives nesoi, bmpt	0	235,592	230,953	944,255	1,204,322	72%
8212	Razors & razor blades (incl blade blanks), b· mt pt	0	970,629	1,176,382	2,917,073	3,630,768	55%
8213	Scissors, tailors & smir shears, blds a oth bs mtl pas	0	46,517	30,289	128,839	406,468	106%
8214	Articles of cutlery nesoi; manicure sets etc, bmpt	0	57,544	57,788	271,583	352,131	83%
8215	Tableware etc of base metal, base metal parts	0	414,075	352,434	1,195,912	1,473,688	53%
8401	Nuclear Reactors; fuel elem (n-l): mach isotoe sep	228,912	13,415	60,608	77,121	713,177	276%
8402	Steam etc Generating Boilers nesoi; sup w boilers	2,024,400	3,491,008	444,608	1,299,584	4,110,738	6%
8403	Central Heat boilers nesoi, and parts	170,741	369,892	245,517	938,972	1,708,425	67%
8404	Auxilliary Plant used with boilers; condeners; pts	1,702,917	379,882	158,284	571,932	1,107,848	43%
8405	Producer gas, acetylene gas etc generators & parts	254,792	89,779	1,715,103	307,863	697,686	98%
8406	Steam turbines & other vapour turbines, parts	362,954	2,311,216	328,346	578,526	2,289,821	0%
8407	Spark ignition recip or rotary int comb piston engine	6,377,025	6,799,956	10,264,760	8,650,491	37,153,202	76%
8408	Compression-ignition internal comb piston engines	5,544,672	6,077,998	5,440,929	5,329,470	19,966,653	49%
8409	Parts for engines of heading 8407 or 8408 (spark & compr ignition, etc)	7,832,303	6,187,861	5,374,003	10,026,744	34,072,137	77%
8410	Hydraulic turbines,	1,632,767	5,981	566,087	204,782	475,220	330%

	water wheels & regulars, pts						
8411	Turbojets, turbopropellers & other gas turbines, pts	3,097,988	2,107,293	3,693,416	2,266,680	5,620,752	39%
8412	Engines and motors nesoi, and parts thereof	1,338,829	1,608,266	1,715,082	2,530,823	11,413,568	92%
8413	Pumps for liquids; liquid elevators; parts thereof	14,860,211	12,286,847	11,636,364	14,748,896	60,539,372	70%
8414	Air or vacuum pumps, compr & fans; hoods & fans; pts	11,448,790	9,384,963	9,341,042	12,619,292	47,273,236	71%
8415	Air conditioning machines (temp & hum change), pts	9,502,007	9,156,553	9,028,657	12,490,351	50,694,421	77%
8416	Furnace burners; mechanical stokers etc, parts	335,444	210,759	436,866	540,209	1,274,823	82%
8417	Industrial or lab furnaces & ovens, nonelect pts	457,999	2,938,529	593,212	1,895,321	3,987,384	11%
8418	Refrigerators, freezers etc; heat mat; w heat, pt	29,694,262	11,655,761	10,420,668	16,407,156	55,342,805	68%
8419	Machinery etc for temp change treat	3,534,360	6,007,688	6,630,940	4,070,465	18,677,922	46%
8420	Calendering machines etc nesoi & cylinders, parts	43,779	148,321	65,761	99,661	399,045	39%
8421	Centrifuges; filter etc mach for liquid or gases; pts	5,401,889	6,945,570	6,249,836	11,535,972	31,083,507	65%
8422	Machines, dishwash, clean etc cont & fill, pak etc	4,417,308	4,667,452	5,646,794	7,044,781	23,488,373	71%
8423	Weighing machines & weighing machine weights; pts	1,940,471	1,149,788	915,300	2,125,486	6,796,762	81%
8424	Mech appl to disperse liq etc; sand etc blast mach	1,247,275	4,133,959	5,056,678	11,635,063	17,673,886	62%
8425	Pulley tackle & hoists (exc skip); winch etc; jaks	1,021,803	2,000,656	1,102,085	933,666	4,653,329	32%
8426	Derricks; cranes; mobile lifting frames	1,502,953	3,537,423	1,507,348	5,410,778	13,723,910	57%

	etc						
8427	Fork-lift trucks; other works trucks with lifts etc	5,202,848	4,230,433	8,135,541	6,234,800	19,999,206	68%
8428	Lifting, handling loading & unload machines nesoi	3,673,829	4,110,288	4,076,339	18,868,688	13,671,832	49%
8429	Self-propelled bulldozers, graders, scrapers etc	27,574,857	15,696,511	21,438,009	13,002,538	72,108,490	66%
8430	Mach nesoi, moving grad etc, pile-dr; snowplow etc	2,894,198	1,836,383	7,483,076	4,552,893	11,745,060	86%
8431	Parts for machinery of headings 8425 to 8430 (trans, radar, electric signal etc)	50,183,152	24,273,458	24,898,702	25,642,220	86,614,111	53%
8432	Agricult etc mach for soil etc; lawn rollers; pts	1,300,866	1,886,750	628,207	1,761,345	3,369,140	21%
8433	Harvest etc machines, cleaning eggs etc nesoi, pts	529,611	805,155	427,525	2,782,171	1,916,917	34%
8434	Milking machines & dairy machinery & parts	70,810	231,877	92,542	209,087	887,307	56%
8435	Presses etc for wine, cider, fruit juice etc, pts	31,062	100,406	203,320	242,971	298,858	44%
8436	Agri etc & poultry etc equip, inc incubators, pts	259,585	308,481	506,961	4,062,533	3,440,223	123%
8437	Mach for cleaning seed etc & work cereal etc, pts	1,586,294	2,959,755	3,527,121	4,332,728	10,883,521	54%
8438	Mach nesoi, ind prep of food or drink etc, parts	4,710,369	9,374,455	11,481,868	8,487,301	18,215,097	25%
8439	Mach for making pulp & making / finishing paper, pts	54,975	120,053	708,582	1,916,336	1,107,248	110%
8440	Bookbinding machinery, incl book-sewing, parts	71,595	98,362	192,813	237,288	1,161,040	128%
8441	Mach for making up pulp & paper, inc cutters, pts	2,747,126	3,055,558	2,692,610	6,974,270	4,256,946	12%
8442	Mach etc nesoi for	1,006,464	704,678	625,723	966,794	3,081,567	64%

	typeset, making pr plates etc						
8443	Printing machinery; machines ancil to printing, pt	5,075,782	5,507,542	5,218,064	7,273,266	11,263,923	27%
8444	Machines extruding, drawing etc man-made textile	326,371	1,703	310,504	21,418	427,417	531%
8445	Machines for preparing textiles fibres & yarns	971,819	736,003	66,125	747,807	1,202,374	18%
8446	Weaving machines (looms)	243,445	414,085	475,638	218,757	1,705,847	60%
8447	Machines, knitting, stitch-bond, lace, net etc	39,432	220,488	695,822	232,314	980,795	64%
8448	Auxiliary machinery for use with textile machines	2,925,933	2,630,374	1,858,399	6,378,229	9,257,013	52%
8449	Mach for manuf or finish nonwovens; hat blocks; parts	8,178	13,500	17,710	101,669	179,954	137%
8450	Washing machines, household or laundry-type, pts	434,133	478,625	433,159	1,444,344	2,824,714	81%
8451	machinery (not laundry) for cleaning, drying etc	1,788,155	908,459	744,765	1,377,802	3,721,017	60%
8452	Sewing machines (not book-sew), cover etc; needles	2,169,311	2,522,868	2,872,286	2,526,719	10,277,306	60%
8453	Machinery for work leather etc & foorwear etc, pts	34,214	4,010,884	27,435	683,859	161,140	-66%
8454	Converters, ladles, ingot molds & casting mach, pt	437,176	1,902,226	2,529,143	999,486	1,457,408	-8%
8455	Metal rolling mills and rolls thereof; parts	677,228	1,046,945	1,081,881	1,874,516	3,059,656	43%
8456	Machine tools for material removal by laser etc	50,103	27,371	158,307	954,149	962,903	228%
8457	Machining centers, unit const mach etc work metal	9,564	11,251	54,049	362,934	540,979	264%
8458	Lathes for removing metal	135,081	180,919	305,848	753,282	812,532	65%
8459	Machine tools for	943,786	2,043,144	688,234	1,655,475	5,046,350	35%

	drilling, boring, milling etc						
8460	Machine tools for honing or finishing metal etc	104,825	403,587	204,930	716,316	936,902	32%
8461	Machine tools for shaping, slotting, gear cut etc	681,982	571,387	1,069,308	418,985	1,184,830	28%
8462	Machine tools for forging, bending, stamping etc	1,432,411	3,498,291	2,211,899	4,495,367	4,285,224	7%
8463	Machine tools for working metal, nesoi	1,474,158	797,204	679,787	521,150	2,065,351	37%
8464	Machine tools for working stone, etc & glass	378,521	258,165	916,808	121,098	819,961	47%
8465	Machine tools for working wood, cork, bone etc	4,810,228	7,542,985	4,038,096	2,680,751	12,276,534	18%
8466	Parts etc for machine tools of heading 8456 to 8465 (lathe, machine tools, etc)	5,283,787	4,336,164	3,525,046	4,142,326	13,846,957	47%
8467	Tools for working in the hand, pneumatic etc, pt	2,514,958	2,543,452	2,323,394	4,918,992	15,484,362	83%
8468	Machines, solder etc; gas surf temper machines, pt	157,662	182,590	337,841	1,369,319	1,866,798	117%
8469	Typewriters & word processing machines	352,226	149,930	195,199	8,076,357	632,331	62%
8470	Calculating & account machines, cash registers etc	480,913	471,612	411,373	1,244,725	2,381,180	72%
8471	Automatic data process machines; magn reader etc, computer hardware	19,506,124	20,604,036	20,379,322	32,131,617	97,810,433	68%
8472	Office machines nesoi (hectograph, addressing etc)	1,127,635	1,967,413	822,363	1,365,811	4,247,836	29%
8473	Parts etc for typewriters & other office machines computer accessories	3,184,379	2,128,227	1,918,757	6,852,294	21,026,592	115%
8474	Machinery for sorting screening etc minerals, pts	19,659,475	17,357,705	17,532,173	16,785,860	58,912,509	50%

8475	Machines for assembling elec tubes etc & glass mfr, pt	239,899	37,120	520,092	2,499,675	110,112	44%
8476	Automatic goods-vending machines, parts	37,124	75	197,497	1,108,842	225,500	1343%
8477	Machinery for working rubber & plastics etc nesoi, pt	8,344,076	11,755,129	7,738,164	7,107,411	34,245,003	43%
8478	Machinery for tobacco preparation nesoi, parts	456,918	1,018,767	791,349	181,961	731,846	-10%
8479	Machines etc having individual functions nesoi, pt	4,518,583	7,669,864	4,590,231	3,172,471	19,652,490	37%
8480	Moulding boxes for metal foundry; mold bases etc	2,830,006	2,070,614	4,922,295	3,682,558	11,195,353	76%
8481	Taps, cocks, valves etc for pipes, tanks etc; parts	4,090,565	5,911,203	4,166,916	7,191,382	21,248,000	53%
8482	Ball or roller bearings and parts	3,780,870	3,894,746	4,222,699	3,717,904	14,691,623	56%
8483	Transmission shafts, bearings, gears etc; parts	5,260,377	6,064,141	6,298,228	7,649,989	27,916,642	66%
8484	Gaskets & similar joints of metal sheeting	1,563,644	1,681,834	1,301,309	13,983,050	8,053,848	69%
8485	Machinery pts. No elect connectors etc nesoi	9,699,075	6,980,836	6,841,187	2,578,698	6,508,425	-2%
8501	Electric motors and generators (no sets)	22,356,401	4,152,476	3,253,526	17,419,151	14,584,762	52%
8502	Electric generating sets and rotary converters	3,869,110	5,458,257	6,952,347	32,411,421	31,261,803	79%
8503	Parts of electric motors, generators & sets	9,788,045	435,769	792,137	3,569,995	3,443,644	99%
8504	Electric Transform, static converters & induct, pt	16,177,181	11,336,864	9,350,673	41,131,689	39,697,194	52%
8505	Electromagnets, permanent magnets etc & parts	55,714	86,303	103,324	663,192	639,128	95%
8506	Primary cells & batteries, parts	0	17,573,379	16,073,611	29,018,113	27,965,580	17%

8507	Electric storage batteries, incl separators, parts	0	8,734,903	7,842,859	29,812,707	28,759,140	49%
8508	Electromechanical tools, working inhand; parts	329,832	531,320	500,765	1,087,700	1,048,234	25%
8509	Electromech domestic appliances; parts	0	843,234	773,051	4,926,617	4,753,083	78%
8510	Electric shavers & hair clippers; parts	0	17,924	18,488	327,630	315,936	160%
8511	Electric ignition etc equip; generators; parts	0	1,493,824	2,651,916	10,073,570	9,713,444	87%
8512	Electric light etc equip; windshield wipers etc,parts	0	804,655	820,151	6,986,742	6,740,551	103%
8513	Portable elec lamps function by own energy source	0	2,368,130	1,650,524	7,026,305	6,786,172	42%
8514	Industrial or lab elec furnaces etc, parts	2,218,864	719,161	285,889	1,772,007	1,721,107	34%
8515	Electric, laser or other light or photon beam etc	796,408	426,495	460,208	6,243,976	6,017,782	142%
8516	Elec water, space & soil heaters; telephone sets, pts	9,143,655	8,356,185	3,683,066	17,475,403	16,897,588	26%
8517	Elec apparatus for line telephony, telephone sets, pts	25,303,947	15,676,574	18,433,476	44,716,684	43,113,865	40%
8518	Microphones; loudspeakers; sound amplifiers etc, pt	2,052,312	1,922,754	2,009,375	10,821,023	10,452,808	76%
8519	Turntables, record & cassette players etc	0	1,450,466	1,231,931	5,956,388	5,742,078	58%
8520	Magnetic tape & other sound recorders	656,102	644,427	492,152	3,823,298	3,684,944	79%
8521	Video recording or reproducing apparatus	1,881,344	2,136,259	3,140,207	20,281,560	19,563,475	109%
8522	Parts & access of record play, mag tape record etc	0	336,209	405,046	457,292	440,699	9%
8523	Prepared unrecorded media no film) for sound etc	0	1,679,946	1,592,926	9,713,032	9,360,990	77%
8524	Records, tapes & other recorded sound media etc computer	0	806,249	354,594	3,019,392	2,910,516	53%

	software						
8525	Trans apparatus for radiotelephony etc, tv cameras cordless telephones	0	13,590,947	4,154,415	31,522,223	30,378,890	31%
8526	Radar apparatus, radio navig aid & remote cont app	0	635,869	576,405	3,278,112	3,159,169	71%
8527	Reception apparatus for radiotelephony etc	0	5,111,445	4,553,168	29,047,671	28,019,018	76%
8528	Television receivers (incl monitor & proj receivers)	0	14,012,626	15,654,514	70,233,024	67,771,071	69%
8529	Parts for television, radio and radar apparatus	0	2,816,148	1,705,258	12,030,809	11,614,065	60%
8530	Electric signal, safety or traffic control equip	0	41,379	255,510	546,355	526,531	133%
8531	Electric sound or visual signaling apparatus, pts	0	472,631	656,053	2,286,150	2,203,238	67%
8532	Electric capacitors, fixed, variable or adjustable (preset)	80,462	237,433	630,193	815,539	785,948	49%
8533	Electrical Resistors *except heating* resistors, pts	0	64,341	161,167	464,188	447,345	91%
8534	Printed circuits	0	129,390	10,090	222,162	214,101	18%
8535	Electrical apparatus for switchig etc, ov 1000v	0	5,109,814	1,581,880	8,636,525	8,323,274	18%
8536	Electrical apparatus for switchig etc, n/ov 1000v	0	6,846,446	6,015,714	34,959,788	33,721,224	70%
8537	Boards, panels etc with elec switch appar etc	0	1,542,317	1,659,404	8,490,321	8,209,368	75%
8538	Parts for elec appar etc of hd 8535, 8536 & 8537 (elecl appar for swtching etc)	0	899,140	2,568,236	5,125,088	4,940,792	76%
8539	Electric Filament or discharge lamps, part	0	3,567,054	3,349,900	16,007,187	15,442,319	63%
8540	Thermionic, cold cathode or photocathode tubes pt	0	77,732	122,704	1,340,831	1,292,180	155%

8541	Semiconductor devices; light-emit diodes etc, pts	0	173,164	175,310	1,654,136	1,594,117	110%
8542	Electronic integrated circuits & microassembl, pts	0	4,233,780	4,518,734	10,107,937	9,741,545	32%
8543	Electric mach etc, with ind functions nesoi, pts	361,814	546,307	1,049,965	4,306,067	4,195,626	97%
8544	Insulated wire, cable etc; opt sheath fib cables	0	14,509,607	13,779,866	35,126,660	33,926,229	33%
8545	Carbon electrodes & bruches, lamp carbons etc	0	816,288	825,796	3,678,938	3,545,451	63%
8546	Electrical insulators of any material	0	612,776	751,081	2,174,904	2,095,989	51%
8547	Insulating fittings for assembly nesoi	0	573,796	1,340,444	2,384,309	2,304,779	59%
8548	Electrical parts of machinery nesoi	0	4,650,182	3,671,232	1,309,393	1,261,883	-35%
8601	Rail locomotives, elect (battery or extrn source)	0	66,225	2,644	884	1,267	-73%
8602	Rail locomotives, nonelect nesoi; locomot tenders	0	0	1,534	0	39,004	#DIV/0!
8603	Self propelled railway etc coaches, vans etc nesoi	0	126,140	0	0	1,050,519	103%
8605	Railway, tramway pass etc coaches not self-propelled	0	0	0	0	1,141	#DIV/0!
8606	Railway or tramway freight cars, not self-propelled	0	87,058	2,259,121	67	315,784	54%
8607	Parts of railway or tramway locomotives or r stock	0	900,112	627,695	313,113	3,425,299	56%
8608	Railway fixtures; mech signaling, safety, etc, eq	15,214	38,683	177,289	316	176,783	66%
8609	Containers for one or more modes of transport	0	401,846	626,058	164,414	3,218,634	100%
8701	Tractors (other than works trucks) of heading 8709 (self-	2,639,000	4,306,155	9,041,029	5,289,578	72,784,965	157%

	propelled, no lift, etc)						
8702	Public-transport type passenger motor vehicles	0	10,138,937	8,623,175	5,474,236	15,521,866	15%
8703	Motor cars & vehicles for transporting persons	0	205,839,788	257,546,260	139,287,216	1,173,312,824	79%
8704	Motor vehicles for transport of goods	0	117,880,161	143,205,337	83,694,561	699,748,967	81%
8705	Special purpose motor vehicles nesoi	0	5,177,556	3,862,118	373,727	17,182,019	49%
8706	Chassis w eng for trac, mtr veh f pass/gd & special pur	0	101,726	48,197	213,401	2,193,264	178%
8707	Bodies (including cabs), for specific motor vehicles	0	135,981	101,615	32,930	9,616,943	314%
8708	Parts & access for motor vehicles (head 8701 -8705) - (tractors, motor cars, transport vehs)	0	20,570,642	18,001,600	9,804,694	67,517,611	49%
8709	works trucks, self-prop, no lift; stat tractors; pt	108,439	632,427	94,422	162,676	5,311,189	103%
8710	Tank & other armored fight vehicle, motorized; and parts	0	28	10,417	36,119	806,888	2976%
8711	Motorcycles (incl mopeds) & cycles with aux motor	0	7,111,901	8,519,409	6,204,994	52,657,601	95%
8712	Bicycles & other cycles (inc del tricycle) no motor	0	6,396,568	6,650,436	5,978,784	36,300,547	78%
8713	Invalid carriages, mechanically propelled or not	0	333,104	345,167	179,727	846,583	36%
8714	Parts & access for cycles & invalid carriages	0	1,731,751	5,106,232	2,761,210	22,123,539	134%
8715	Baby carriages (inc strollers) and parts thereof	0	23,444	20,822	10,055	282,858	129%
8716	Trailers etc; othr vehicles, not mech propelled, pt	0	5,223,030	5,974,205	4,706,646	31,116,646	81%
8901	Vessels for the	0	104,002	387,897	2,969	1,445,227	140%

	transport of persons or goods						
8902	Fishing vessels; factory ships, vessels, nesoi	0	1,043,348	430,149	18,757	516,725	-21%
8903	Yachts & other vessels for pleas etc, row boat etc	0	83,522	21,093	86,778	280,423	50%
8904	Tugs and pusher craft	0	0	24,668	118,909	2,177	#DIV/0 !
8905	Light - vessels, fire-floats, etc; fl docks & platforms	37,772	1,882,912	288,670	1,513,423	351,552	-43%
8906	Vessels nesoi incl warship/lifeboat ex row boats	0	909	260	0	1,787	25%
8907	Floating structures nesoi, rafts, tanks, bouys etc	35,401	321,574	4,516,923	1,839	6,120,678	167%
8908	Vessels and floating structures for scrapping	0	0	2,953	0	2,470,876	#DIV/0 !
9007	Cinematographic cameras & projectors, parts etc	62,461	310,329	299,162	34,802	1,189,825	57%
9008	Image projectors, still; enlargers etc, still; pts	0	73,062	70,467	27,456	621,752	104%
9009	Photocopying apparatus & thermocopy apparatus; pts	0	3,923,247	3,499,258	856,315	13,343,282	50%
9010	Apparatus etc for photo labs etc nesoi; parts etc	0	101,720	225,049	50,426	1,352,425	137%
9011	Compound optical microscopes; parts & accessories	51,087	82,787	122,164	0	227,609	40%
9012	Microscopes except optical; diffract appar; parts	118,808	5,605	9,638	0	222,294	241%
9013	Liquid crystal devices nesoi; lasers; opt appl; pt	11,776	22,080	10,775	5,577	458,829	175%
9014	Direction finding compasses & navig inst etc, pts	214,602	10,641	22,190	0	524,387	267%
9015	Survey, hydrogr, meteoro etc inst;	1,108,611	491,898	308,673	149,455	3,772,442	97%

	rangef etc, pts						
9016	Balances, sensitivity > =5cg, w or w/o wgt, & pts	61,080	78,926	63,318	0	420,125	75%
9017	Drawing, math, measuring inst etc nesoi, parts	296,105	586,897	521,215	129,902	1,736,255	44%
9018	Medical, surgical, dental or vet inst, no elec, pt	3,513,243	4,192,285	3,563,815	1,025,917	30,820,898	94%
9019	Mech-ther, message, psych test, ozone app etc, pts	1,366,140	501,138	442,052	152,844	670,504	10%
9020	Breathing appliances & gas masks nesoi; parts etc	126,138	156,504	218,419	11,891	1,692,793	121%
9022	X-ray etc apparatus; tubes, panels, screen etc, pt	4,052,947	203,658	370,435	33,428	5,730,327	204%
9023	Inst, appts & models, for demonstrational use & parts	8,914,187	8,463,691	141,909	5	637,251	-58%
9024	Machines etc for testing mech prop of material, pt	191,216	61,275	334,990	35,419	1,781,706	208%
9025	Hydrometers, Thermometers, pyrometers etc; pts etc	0	243,075	243,843	39,343	963,521	58%
9026	Inst etc measure or check flow, level etc, pts etc	0	879,109	696,302	464,824	4,542,519	73%
9027	Inst etc for physical etc anal etc; microtome; pts	0	1,033,803	925,750	19,468	5,864,851	78%
9028	Gas, liquid or electric supply etc meters, parts	0	5,359,037	7,809,788	5,076,665	9,288,148	20%
9029	Revolution & production count, taximeters etc, pts	0	64,545	63,363	5,122	388,212	82%
9030	Oscilloscopes, spectrum analyzers etc, parts etc	0	1,228,912	1,245,081	17,598	5,034,860	60%
9031	Machines nesoi in chapter 90; profile project, pt	685,052	542,105	292,331	139,505	3,456,365	85%

9032	Automatic regulating or controlling instruments and apparatus	0	786,873	1,186,097	328,436	4,911,214	84%
9033	Parts, nesoi for machines, appln, inst/appts of optical, photo, cine etc	0	61,835	113,951	379,307	295,446	68%

Annex 9 Interest rates

1.1 Ghana interest rates

	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05
Weighted Average Disc. Rates								
91-day	16.38	16.39	16.48	16.53	16.54	16.58	15.53	14.97
182-day	16.39	16.39	16.43	16.48	16.50	16.50	15.50	15.24
1-Year	17.85	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Interest Equivalent								
91-Day	17.08	17.09	17.19	17.24	17.25	17.30	16.16	15.55
182-Day	17.85	17.85	17.90	17.96	17.98	17.98	16.80	16.50
1-Year	17.85	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Repo Rates	18.50	18.50	18.50	18.50	18.50	16.50	16.50	16.50
Inter-bank weighted avg.	**16.19**	**16.22**	**16.20**	**16.20**	**16.25**	**16.29**	**15.78**	**15.22**
Deposit Rates (DMBs)								
Demand Deposits	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.25
Savings Deposits	9.50	9.50	9.00	9.00	9.00	9.00	9.00	9.00
Time Deposits (3 Mth)	13.25	13.25	10.50	10.50	10.50	10.50	10.50	10.50
Cert. Of Deposits	12.25	12.75	12.75	11.75	11.75	11.75	11.75	10.75
Call Money	9.25	9.25	7.75	7.75	7.75	7.75	8.00	6.75
Others	7.50	7.50	7.50	7.50	7.50	7.50	7.50	8.00
Lending Rates (DMBs)	**28.75**	**28.75**	**28.75**	**28.75**	**28.75**	**28.75**	**28.75**	

Source: Bank of Ghana

1.2 African Development Bank interest rates

ADB APPLICABLE LENDING RATES FOR LOANS APPROVED AFTER 4 MAY 2005

	Floating Base Rates (%)				Lending Spread (%)				Applicable Floating Lending Rates (%)			
Dates	USD	EUR	YEN	ZAR	USD	EUR	YEN	ZAR	USD	EUR	YEN	ZAR
1-Feb-05	2.960	2.185	0.064	7.514	0.400	0.400	0.400	0.400	3.360	2.585	0.464	7.914
1-Aug-05	3.922	2.143	0.067	6.998	0.400	0.400	0.400	0.400	4.322	2.543	0.467	7.398

	Variable Base Rates			Lending Spread			Applicable Variable Lending Rates		
Dates	USD	EUR	YEN	USD	EUR	YEN	USD	EUR	YEN
1-Jan-05	6.980%	5.360%	4.560%	0.40%	0.40%	0.40%	7.380%	5.760%	4.960%
1-Jul-05	7.000%	5.490%	4.660%	0.40%	0.40%	0.40%	7.400%	5.890%	5.060%

Last Update 1-Aug-05

1.3 World Bank lending rates

IBRD SINGLE CURRENCY LOANS (SCLs) AND FIXED-SPREAD LOANS (FSLs)
LIBOR-EQUIVALENT OF LENDING RATES*

LIBOR-Based Variable-Spread Loans (VSLs, formerly called VSCLs)

Applicable to interest rate periods commencing between:			Spread over LIBOR of lending rate	
			Old Loans	New Loans
07/15/2005	to	01/14/2006	LIBOR + 17 b.p.	LIBOR + 42 b.p.
01/15/2005	to	07/14/2005	LIBOR + 15 b.p.	LIBOR + 40 b.p.
07/15/2004	to	01/14/2005	LIBOR + 17 b.p.	LIBOR + 42 b.p.
01/15/2004	to	07/14/2004	LIBOR + 19 b.p.	LIBOR + 44 b.p.
07/15/2003	to	01/14/2004	LIBOR + 19 b.p.	LIBOR + 44 b.p.
01/15/2003	to	07/14/2003	LIBOR + 21 b.p.	LIBOR + 45 b.p.
07/15/2002	to	01/14/2003	LIBOR + 21 b.p.	LIBOR + 46 b.p.
01/15/2002	to	07/14/2002	LIBOR + 19 b.p.	LIBOR + 44 b.p.
07/15/2001	to	01/14/2002	LIBOR + 19 b.p.	LIBOR + 44 b.p.
01/15/2001	to	07/14/2001	LIBOR + 18 b.p.	LIBOR + 43 b.p.
07/15/2000	to	01/14/2001	LIBOR + 17 b.p.	LIBOR + 42 b.p.
1/15/2000	to	7/14/2000	LIBOR + 17 b.p.	LIBOR + 41 b.p.
7/15/1999	to	1/14/2000	LIBOR + 15 b.p.	LIBOR + 40 b.p.
1/15/1999	to	7/14/1999	LIBOR + 12 b.p.	LIBOR + 37 b.p.
7/15/1998	to	1/14/1999	LIBOR + 15 b.p.	LIBOR + 40 b.p.
1/15/1998	to	7/14/1998	LIBOR + 17 b.p.	-
7/15/1997	to	1/14/1998	LIBOR + 15 b.p.	-
1/15/1997	to	7/14/1997	LIBOR + 22 b.p.	-
7/15/1996	to	1/14/1997	LIBOR + 25 b.p.	-
1/15/1996	to	7/14/1996	LIBOR + 26 b.p.	-
7/15/1995	to	1/14/1996	LIBOR + 22 b.p.	-
1/15/1995	to	7/14/1995	LIBOR + 23 b.p.	-
7/15/1994	to	1/14/1995	LIBOR + 27 b.p.	-
1/15/1994	to	7/14/1994	LIBOR + 29 b.p.	-
7/15/1993	to	1/14/1994	LIBOR + 27 b.p.	-

LIBOR-based Fixed-Spread Loans (FSLs)

As of:	Spread over LIBOR of lending rate*		
	USD	EUR	JPY
07/01/2005	LIBOR + 50	LIBOR + 52	LIBOR + 52
01/15/2005	LIBOR + 50	LIBOR + 50	LIBOR + 50
11/25/2002	LIBOR + 50	LIBOR + 50	LIBOR + 45
01/01/2001	LIBOR + 55	LIBOR + 55	LIBOR + 50
05/01/2000	LIBOR + 55	LIBOR + 55	LIBOR + 45
01/01/2000	LIBOR + 55	LIBOR + 55	LIBOR + 40
09/01/1999	LIBOR + 55	LIBOR + 55	LIBOR + 40

Note: once an FSL is signed, the spread over LIBOR remains fixed for the life of the loan. Changes in posted spreads only applies to new loan commitments.

Fixed-Rate SCLs

Applicable to rate fixings effected between:			USD		Euro	
			Old Loans	New Loans	Old Loans	New Loans
07/15/2005	to	01/14/2006	LIBOR + 22	LIBOR + 47	LIBOR + 22	LIBOR + 47
01/15/2005	to	07/14/2005	LIBOR + 24	LIBOR + 49	LIBOR + 24	LIBOR + 49
07/15/2004	to	01/14/2005	LIBOR + 24	LIBOR + 49	LIBOR + 24	LIBOR + 49
01/15/2004	to	07/14/2004	LIBOR + 24	LIBOR + 49	LIBOR + 24	LIBOR + 49
07/15/2003	to	01/14/2004	LIBOR + 24	LIBOR + 49	LIBOR + 24	LIBOR + 49
01/15/2003	to	07/14/2003	LIBOR + 24	LIBOR + 49	LIBOR + 24	LIBOR + 49
07/15/2002	to	01/14/2003	LIBOR + 25	LIBOR + 53	LIBOR + 27	LIBOR + 52
1/15/2002	to	7/14/2002	LIBOR + 28	LIBOR + 53	LIBOR + 26	LIBOR + 52
7/15/2001	to	1/14/2002	LIBOR + 29	LIBOR + 54	LIBOR + 27	LIBOR + 53
1/15/2001	to	7/14/2001	LIBOR + 29	LIBOR + 54	LIBOR + 27	LIBOR + 52
7/15/2000	to	1/14/2001	LIBOR + 29	LIBOR + 54	LIBOR + 31	LIBOR + 56
1/15/2000	to	7/14/2000	LIBOR + 30	LIBOR + 55	LIBOR + 32	LIBOR + 57
7/15/1999	to	1/14/2000	LIBOR + 35	LIBOR + 60	LIBOR + 37	LIBOR + 62
1/15/1999	to	7/14/1999	LIBOR + 35	LIBOR + 60	LIBOR + 37	LIBOR + 62

Applicable to rate fixings effected between:			LIBOR Equivalent of Fixed Lending Rate*		
			USD	DEM	FRF
7/15/1998	to	1/14/1999	LIBOR + 38	LIBOR + 41	LIBOR + 37
1/15/1998	to	7/14/1998	LIBOR + 40	LIBOR + 42	LIBOR + 53
7/15/1997	to	1/14/1998	LIBOR + 44	LIBOR + 54	LIBOR + 53
1/15/1997	to	7/14/1997	LIBOR + 44	LIBOR + 54	LIBOR + 50
7/15/1996	to	1/14/1997	LIBOR + 43		LIBOR + 50
1/15/1996	to	7/14/1996	LIBOR + 45		LIBOR + 60
7/15/1995	to	1/14/1996	LIBOR + 45		LIBOR + 60

Annex 10 Opportunity study

Technology Center for Capital Goods

Opportunity and Feasibility Study

Opportunity Study Final Report

Client: Government of Ghana
C/o UNIDO

ECORYS Nederland BV in association with GIBB Africa and Bruks Associates Ltd

Rotterdam, 29 September 2005

PdJ/TF13183

Table of contents

1 Introduction

1.1 The project

The Government of Ghana (GoG) has defined in 2003 a National Medium Term Strategy for Private Sector Development. This strategy was designed to take forward progress towards the GoG's aim of achieving the Golden Age of Business. One of the key objectives is to enhance the level of industrialization by increasing the competence and capacity at the firm level.

The Ghana Poverty Reduction Strategy and the Integrated Industrial Policy for Increased Competitiveness (prepared by Ministry of Trade and Industry) all focus on the need to support the small and medium scale industries to enhance growth and competitiveness.

Capital Goods are a vital asset for the firms active in the industry. However the majority (approximately 65%) of the demand for Capital Goods is imported. In view of the Government's industrialization policy it is expected that the demand for Capital Goods will grow significantly for the medium term and for the long term.

In order not to depend on import, the GoG wants to support the local production of Capital Goods. It has been noted however that the locally produced Capital Goods in most cases do not meet the quality requirements of the firms demanding the Capital Goods in contrast to the imported Capital Goods.

A recent Market Study (prepared by UNIDO) indicated that the main reason for this the use of inefficient and obsolete machinery not capable of producing the kind of finish associate with imported products.

Consequently the GoG and UNIDO decided to initiate the concept of a Technology Center for Capital Goods.

In order to decide on the implementation of a Technology Center for Capital Goods they awarded a contract to ECORYS Nederland b.v. in association with GIBB Africa and Bruks Associates (hereafter "Consultant) following a competitive tender to prepare an Opportunity and Feasibility Study for the Implementation of a Technology Center for capital Goods in Ghana.

1.2 This Opportunity Study Report

In accordance with the contract agreed upon between UNIDO and ECORYS Nederland b.v. with the GoG as beneficiary, the Consultant is to submit as part of the Opportunity and Feasibility Study a Provisional Report related to the Opportunity Study. The Report, required to contain around 20 pages of text[1], is to address the following issues.

- Place and role of the sector (capital goods industry and its sub-sectors) in the industrial framework of the country.
- Size, structure and growth rate of the sector.
- Present size and growth rates of demand for items that are not imported and for those which are wholly or partially imported.
- Rough projections of demand for each critical item.
- Identification of the items in short supply that have growth, expert or import substitution potential.
- A broad survey of raw materials and sub-components indigenously and regionally available.
- Major constraints and conditions in the growth of sector.
- Identification of opportunities for development based on above information and on other important factors, such as transport costs, available or potentially available sub-contractors, regional suppliers, human resources, investors, technology base, and infrastructure.
- Conceptual role and functions of a technology centre to address the constraints and improve the conditions for the sector growth.
- Projected and recommended sources of finance (estimated) for a self-sustainable implementation of the envisaged technology

The issues are addressed in the following report structure.

Chapter 2 presents a summary of the market research. It includes a description of the market structure, the estimated demand for capital goods and the industry demands for a TCCG.

Chapter 3 presents the strengths, weaknesses, opportunities and threats for the capital goods sector as a whole based on which the key challenges for a TCCG are defined. Following the various options in terms of service offering, market focus and institutional setting are presented and taken into account the input from the stakeholders a preferred strategy is formulated.

In Chapter 4 the next steps are proposed to finalize the feasibility study.

[1] Because of the complexity of the issue at hand, the consultant has taken the liberty to extend the report excluding appendices to approximately 40 pages in order to adequately describe the preliminary findings and supporting analysis.

2 Market Research

2.1 Introduction

This chapter presents the basic characteristics of the market for capital goods. It is based on extensive desk research of related documents (see bibliography), interviews with industry experts and a comprehensive survey of a representative sample of the industry players.

2.2 Defining Capital Goods

There are a number ways that Capital Goods may be defined in the literature. For the purposes of this report Capital Goods refer to real products that are used in the production of other products but are not incorporated into the new product (these are termed Consumer Goods). They are often called fixed human-made means of production. Capital goods include factories, machinery, tools, and other buildings. They are different from raw materials which are used up in the production of goods.

Major sectors of the domestic market can be grouped into five (5) categories. 1) Manufacturing; 2) Vehicle repair and maintenance, 3) Metal working, 4) Sale of engineering materials and accessories; 5) Sale of automobile spare-parts

Major Sectors and Products

Major Sectors	**Product Group and Services**
Manufacturing	Food processing machinery & equipment and farm implements, Improved cook stoves, commercial and domestic utensils, foundry products
Vehicle repair and Maintenance	Engine overhauling, auto electrical works, vehicle interior upholstery, auto body straightening & spraying
Metal working	Metal fabrication and plant construction using sheet metals, angle irons, channel irons, bars etc.
Sale of engineering materials & accessories	Sheet metals, bars, iron rods, steel sections. Hand tools, fasteners, electric motors, pumps etc.
Sale of automobile spare-parts	Used engines and parts, car decorating materials etc

HS CODES LIST

72 IRON & STEEL
73 ARTICLES OF IRON OR STEEL
74 COPPER & ARTICLES THEREOF
75 NICKEL & ARTICLES THEREOF
76 ALUMINUM & ARTICLES THEREOF
78 LEAD & ARTICLES THEREOF
79 ZINC & ARTICLES THEREOF
80 TIN & ARTICLES THEREOF
81 BASE METALS NESOI; CERMETS; ARTICLES ETC.
82 TOOLS, SPOONS & FORKS OF BASE METAL
83 MISCELLANEOUS ARTICLES OF BASE METAL
84 MACHINERY & MECHANICAL APPLIANCES
85 ELECTRICAL MACHINERY & EQUIPMENT. & PARTS; TELECOMMUNICATIONS EQUIP; SOUND RECORDERS, TELEVISION RECORDERS
86 RAILWAY OR TRAMWAY LOCOMOTIVES, ROLLING STOCK, TRACK FIXTURES & FITTINGS, SIGNALS
87 VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING STOCK
88 AIRCRAFT, SPACECRAFT, & PARTS THEREOF
89 SHIPS, BOATS, & FLOATING STRUCTURES
90 OPTICAL, PHOTOGRAPHIC, CINEMATOGRAPHIC, MEASURING, CHECKING, PRECISION, MEDICAL OR SURGICAL INSTRUMENTS & ACCESSORIES

2.3 Relevance of the Capital Goods Sector

The capital goods sector is a very important sector of any economy. It is the engine of growth on which Ghana can move from being a developing country to an industrialized country. Every sector of the economy relies immensely on the capital goods sector for development (Agriculture, Agro-processing, Construction, Health, etc).

The role of the capital goods sector is to design and manufacture the requisite machinery and tools that industries require to produce and manufacture their products. The sector is to ensure the provision of maintenance, repair and recondition services to industries. The sector is to ensure the promotion of industries and the dissemination of appropriate technologies geared towards economic growth (GDP), and high productivity.

It is worth noting that, data on the Capital Goods sector in Ghana is limited.

2.4 Demand for Capital Goods

The ITS report on the imports of Capital Goods into the ECOWAS sub region shows Nigeria as the highest importer of Machinery and equipment with Ghana ranked second.

Figure 1: ECOWAS Imports of Machinery and Transport Equipment

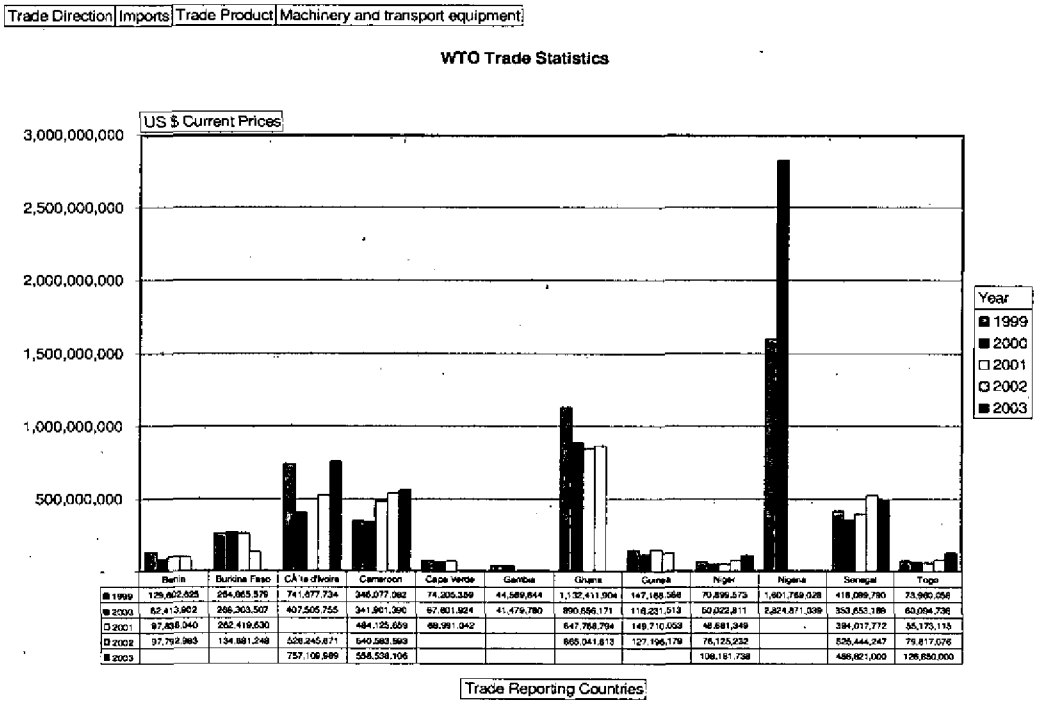
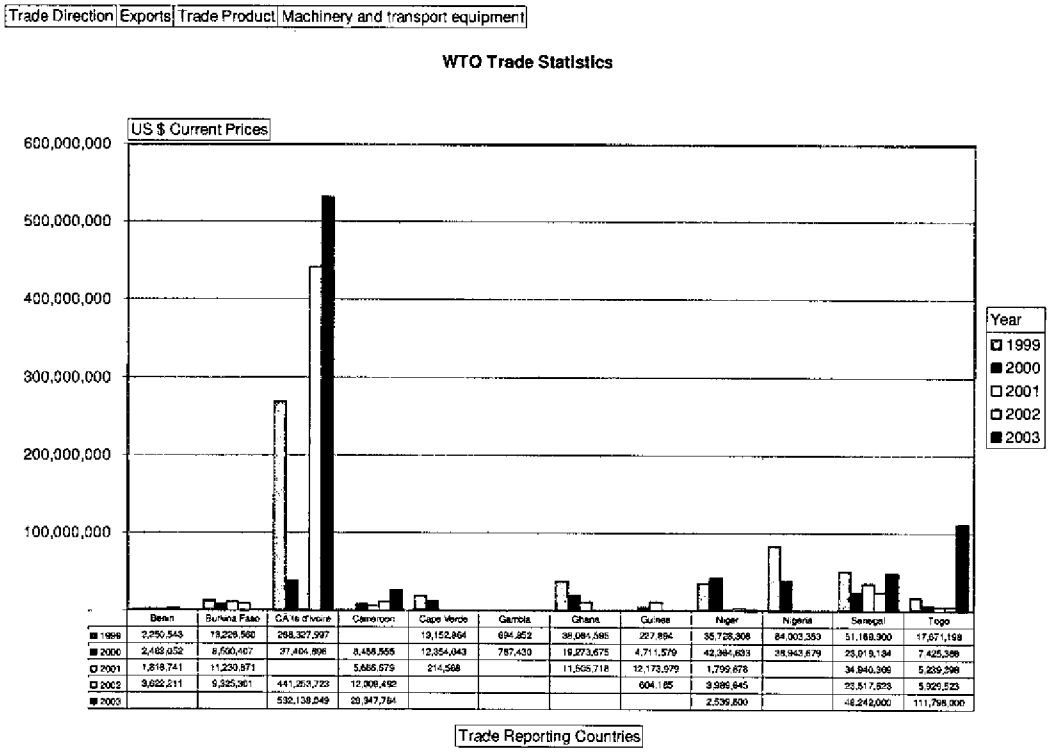


Table 1: Import of Machinery and Transport Equipment into West Africa

	% Value Change per annum			
Country	**1999-2000**	**2000-2001**	**2001-2002**	**2002-2003**
Benin	-36%	19%	0%	na
Burkina Faso	1%	-2%	-49%	na.
Cote d'Ivoire	-45%	na.	na.	44%
Cameroon	-1%	42%	12%	3%
Cape Verde	-9%	2%	na	na.
Gambia	-7%	-100%	na.	na.
Ghana	-21%	-5%	2%	na.
Guinea	-21%	29%	-15%	na.
Niger	-29%	-3%	56%	42%
Nigeria	76%	-100%	na.	na.
Senegal	-15%	11%	33%	-7%
Togo	-19%	-8%	45%	59%

Table 2 shows that, Ghana experienced significant negative growth between 1999 and 2000 and only started to record growth after 2001.

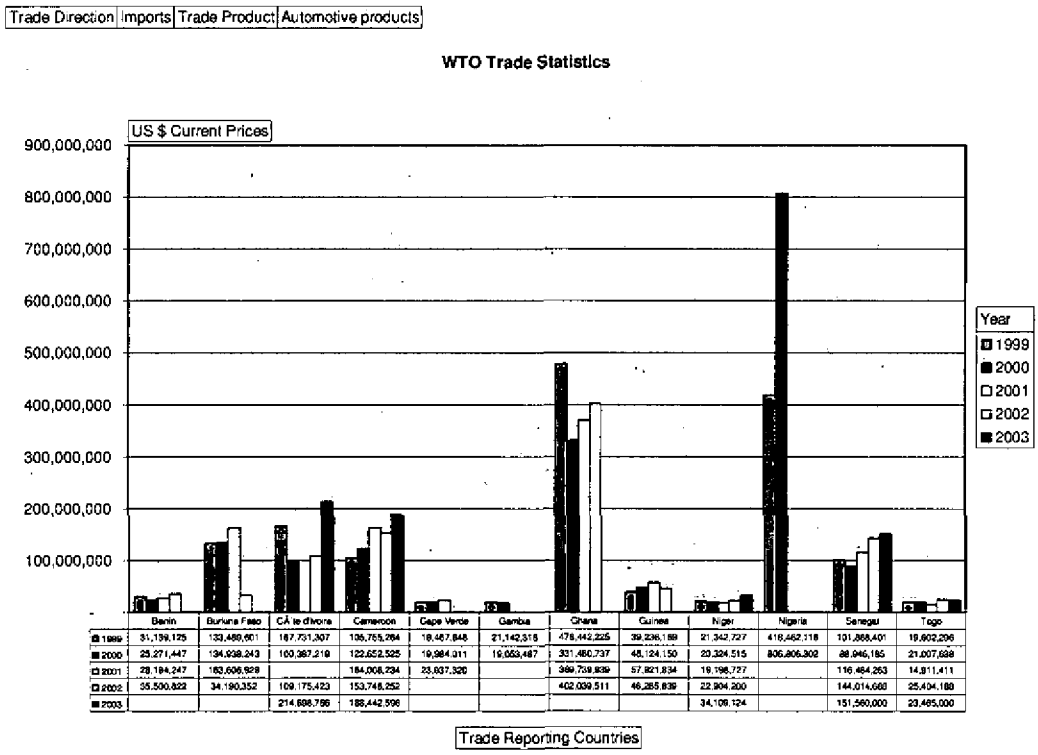
Figure 2: ECOWAS Exports of Machinery and Transport Equipment (1999 - 2003)



	Benin	Burkina Faso	CA te d'Ivoire	Cameroon	Cape Verde	Gambia	Ghana	Guinea	Niger	Nigeria	Senegal	Togo
1999	2,250,543	18,229,560	268,327,997		19,152,864	694,452	38,081,595	227,894	35,728,308	84,003,353	51,168,900	17,671,199
2000	2,469,052	8,590,407	37,404,806	8,458,555	12,354,043	787,430	19,273,675	4,711,579	42,364,833	38,943,679	23,019,184	7,425,388
2001	1,818,741	11,230,871		5,666,579	214,568		11,505,718	12,173,979	1,799,878		34,940,399	5,239,598
2002	3,622,211	9,325,361	441,253,723	12,008,492				604,185	3,986,645		22,517,523	5,926,523
2003			532,138,649	29,347,764					2,539,800		48,242,000	111,798,000

The data on exports of Machinery and Transport Equipment (figure 2) by this same group of countries presents a different picture. In this group, Cote d'Ivoire with an export figure of $532.1 million in 2003 emerges as the leading exporter of Machinery and Transport Equipment in the sub-region and exhibited a consistent growth over the period 1999-2003 which is only interrupted in year 2000. The beginning of the conflict in this country may have been responsible for this drop. Togo follows a distant second with a little over $100.1 million (also most probably the results of re-exports) with Ghana exhibiting a consistent drop in export values from a high value of $38.08 million in 1999 to a low value of $11.5 million in 2001. There was no data for 2002-03.

Figure 3: ECOWAS Imports of Automotive Products from year 1999 – 2003



The import trade statistics for automotive products follow the same trend as that for Machinery and Transport Equipment above. Over the period 1999 - 2000 that data is available, Nigeria is recorded as the leading importer of automotive registering a steady growth rate from 19% to 49%. Ghana follows second exhibiting modest and decreasing annual growth from 12% to 9% within the period 2000 - 2002.

Conclusions drawn from the WTO database

The above statistical gaps notwithstanding, Nigeria and Ghana are significant importers of Capital Goods with Cote d'Ivoire emerging as a dominant exporter. It is important to note however that Cote d'Ivoire's export performance may be due to significant re-exports from France and the other land-lock Franco-phone countries. For the 2 years (1999-2000) that complete data is available, there was over $5.0 billion per annum worth of Machinery and Transport Equipment imports into West Africa (ECOWAS).

Ghana imported approximately $0.86 - 1.0 billion worth of Machinery and Transport Equipment items per annum.

Estimated market growth

There have been high imports demands for Base and articles of base metals; Machinery and Mechanical Appliances; Electrical Equipment; Vehicles, Vessels and associated Transportation equipment and parts & accessories thereof. The 2004 total imports of capital goods into Ghana is about $2.1 billions. Automotives value for 2004 stand in excess of $1.9 billion.

The estimated overall market growth between the year 2001 to 2004 stands at 55%. Simple articles of base metals like tubes, springs, bolts and nuts etc. recorded an average growth rate of 56% per annum. Machinery and Transport Equipment also recorded an average growth rate of 55% per annum. Automobiles however recorded a significant rate 81% per annum. This high rate is due to the high imports of used vehicles and cars into the country.

Table 2: Summary of Capital Goods Imports into Ghana

Product Description	Year 2000 CIF Import Value ($)	Year 2001 CIF Import Value ($)	Year 2002 CIF Import Value ($)	Year 2003 CIF Import Value ($)	Year 2004 CIF Import Value ($)	Ave Annual % Change
HS Code 73-82 Base and articles of base metal	21,516,827	80,024,087	112,909,809	348,560,875	306,676,385	
% Annual Change			41%	209%	-12%	56%
HS Codes 83-90 Machinery and Transport Equipment excluding Automobiles	454,795,094	559,254,406	540,162,422	1,041,204,362	2,088,625,997	
% Annual Change			-3%	93%	101%	55%
HS Codes 73-90 Capital Goods (Base metals, Machinery and Transport Equipment excluding Automobiles)	476,311,921	639,278,493	653,072,231	1,389,765,237	2,395,302,382	
% Annual Change			2%	113%	72%	55%
HS Code 87 Automobile	0	326,006,478	404,621,980	224,155,312	1,937,803,376	
% Annual Change			24%	-45%	764%	81%
Total	476,311,921	965,284,971	1,057,694,211	1,613,920,549	4,333,105,757	
% Annual Change			10%	53%	168%	65%

Conclusions on Demand

- There is a significant and growing demand for imported capital goods into Ghana defined strictly by HS code 73-90 excluding automobiles. This value for 2004 is about $2.4 billion. The value of imported automobiles for 2004 stand in excess of $1.9 billion
- Two categories above with highest growth rates also present a significant opportunity for setting up a domestic capital goods industry in Ghana.
- Imports of Machinery, Mechanical, and Transport Equipment account for the highest percentage of 48% of this $2.4 billion imports.

2.5 Industry Structure

The capital goods industry is made up of producers of capital goods, users of capital goods and support institutions that render support services to both producers and users.

2.5.1 *Producers*

The producers of capital goods constitute basically private and Government agencies. 33% of these producing firms were established between 1970 and 1980 whilst 31% of them started operation after 1991. Many of these companies are limited liability firms. The key functionality of these companies is:

- Foundry and pattern making operations
- Welding and metal fabrication
- Machine tooling

Some of these producers do provide support services occasional to clients that come to them.

Figure 4: Year of Commencement

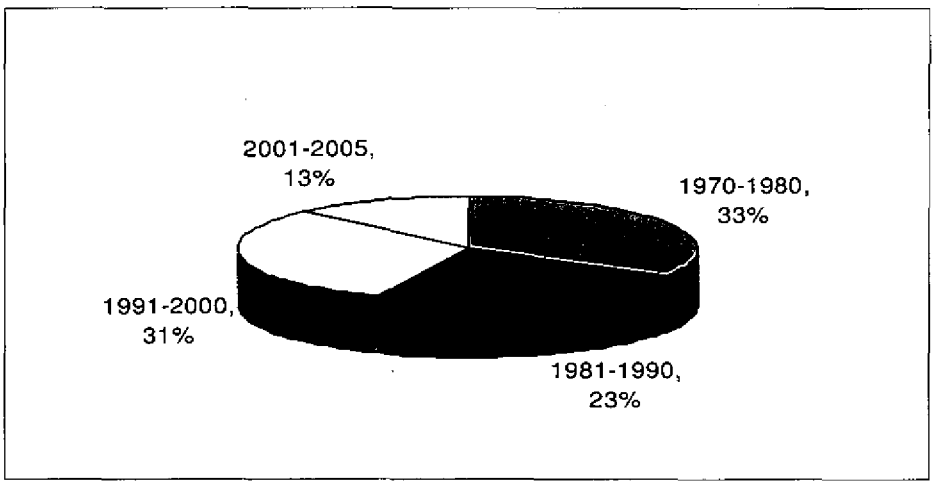
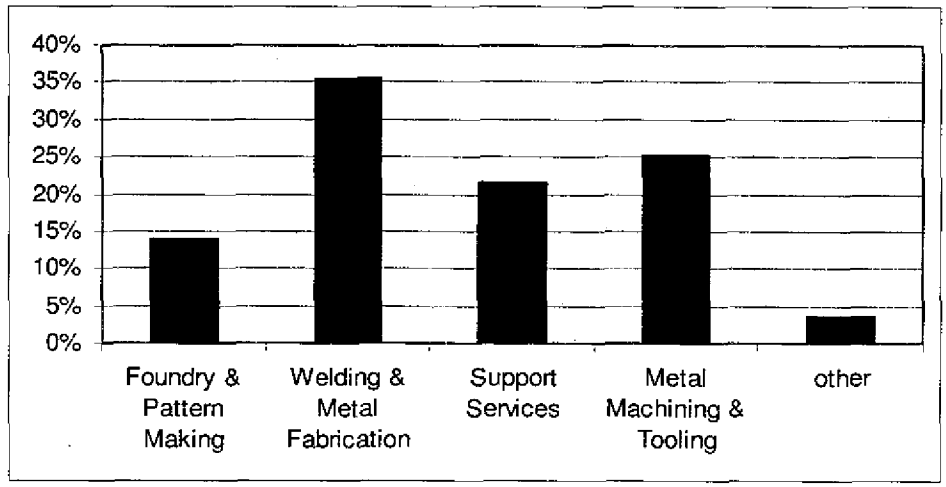


Figure 5: Key Functionality of Equipment Used by Producers



Welding & metal fabrications and metal machining & tooling are the key functionality and engineering capabilities of these producers. This is as shown in figure 25 by majority of respondents (35%) and (25%) respectively.

Among the key equipment currently used by producers, the Drilling machine, Guillotine machine, Grinding machine, Shaping machine, electric welding set and milling machine were found to be the most frequently used.

Table 1 below reveals that 22,025 (85%) of manufacturing establishments in the survey have up to 9 employees which categorizes them as a Small Scale Enterprise as per the Statistical Service definition.

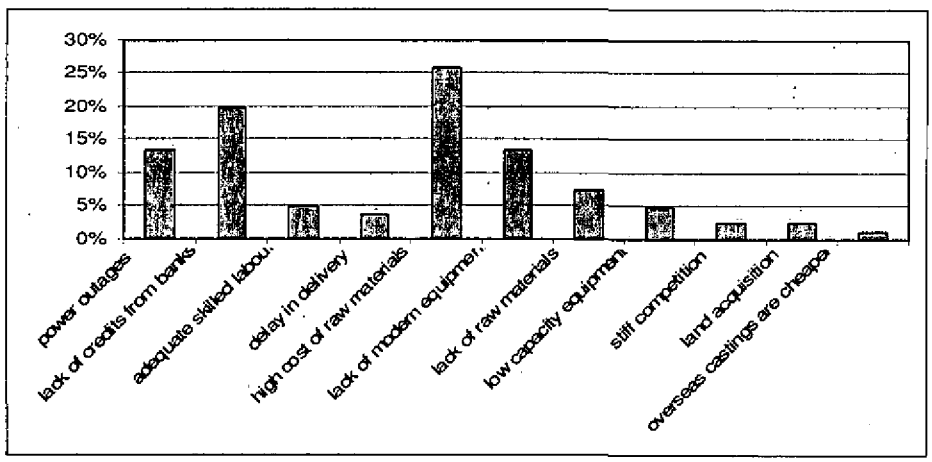
Table 3: Establishments in manufacturing by size and region

	Establishment size**									
Region	**1 – 4**	**5 - 9**	**10 - 19**	**20 - 29**	**30 – 49**	**50 – 99**	**100 – 199**	**200 - 499**	**500+**	**Total**
Western	973	678	180	30	16	18	9	8	8	1,920
Central	1,503	682	199	43	27	16	7	6	2	2,485
Greater Accra	4,029	1,635	531	140	100	75	49	37	14	6,610
Volta	599	435	161	38	33	26	10	3	3	1,308
Eastern	1,909	719	219	34	41	28	5	6	4	2,965
Ashanti	3,011	2,355	721	152	71	45	25	25	7	6,412
Brong Ahafo	1,078	429	161	27	29	14	10	1	3	1,752
Northern	487	433	132	50	71	53	5	1	-	1,232
Upper East	379	335	89	21	8	6	1	-	-	839
Upper West	229	127	33	6	5	5	3	-	-	408
Total	**14,197**	**7,828**	**2,426**	**541**	**401**	**286**	**124**	**87**	**41**	**25,931**
Percentage	55	30	9	2	2	1	0	0	0	**100**

Note : **'0'** in percentages means **less than 0.5%**, and ' - ' means **no** establishment
** Establishment size is defined on the basis of the number of persons engaged

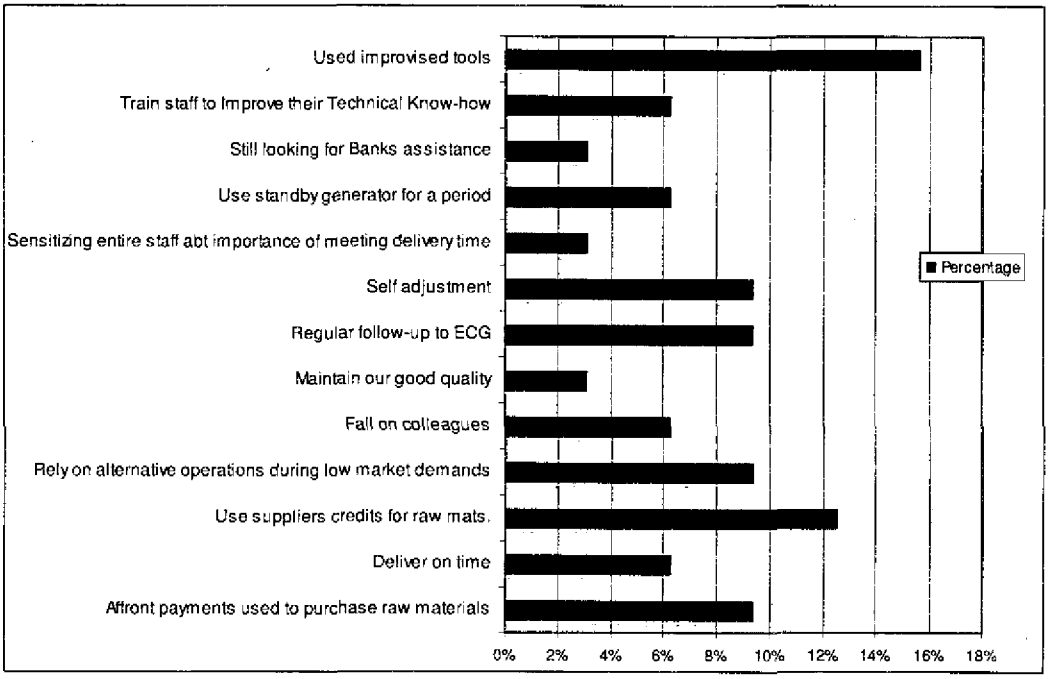
This information is to help put into perspective the nature of the manufacturing industry. **Note that only 41 manufacturing firms employ 500+ persons in their operations.** Industrial Statistics is therefore very limited. **Accra and Kumasi have the highest number of manufacturing concerns.**

Figure 6: Key Challenges Producers are confronted with



High cost of raw materials accounted for 26% of the major challenges facing producers in their operations. Lack of credits, followed with power outages and lack of modern equipment were also cited as major challenges.

Figure 7: Ways by which Challenges are addressed

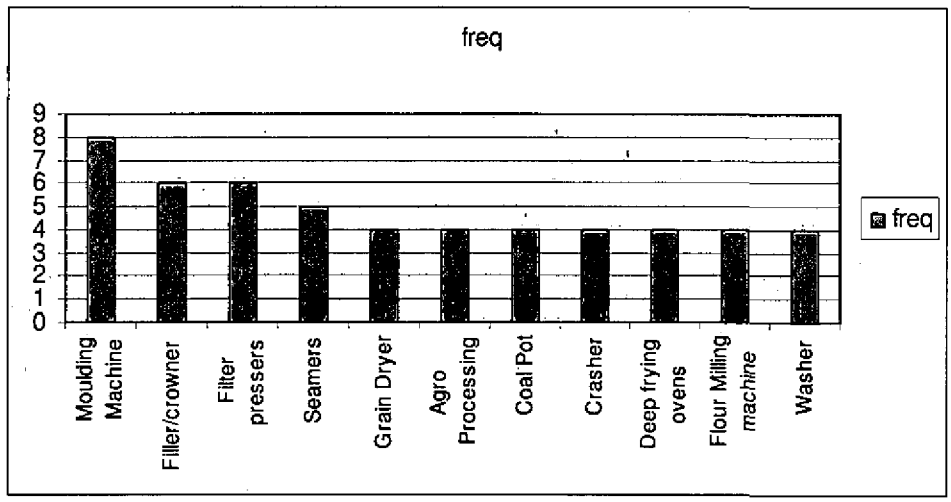


With regards to how they were addressing these challenges, the use of improvised tools and materials accounted for about 16% of the listed ways.

2.5.2 Users

The users of capital goods constitute firms engaged in food processing, agro-processing, construction, manufacturing, wood, and health. About 80% of these user firms are limited liability firms out of which 40% got incorporated less than five years ago.

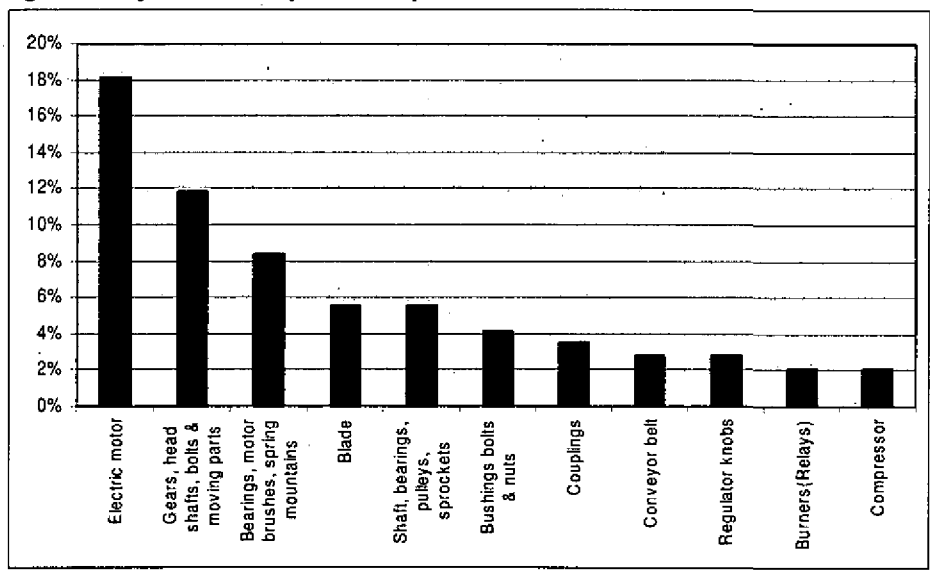
Figure 8: Few Types of Equipment used by Users of Capital Goods



Ninety five (95) different types of equipment were listed by users of capital goods. The most frequently listed equipment used by users are the moulding machine, filter pressers and filler/crowners.

The parts of the equipment that develop frequent faults are the electric motors, gears and shaft & bearings. Many of these are repaired or replaced with new ones occasionally.

Figure 9: Major defective parts /components



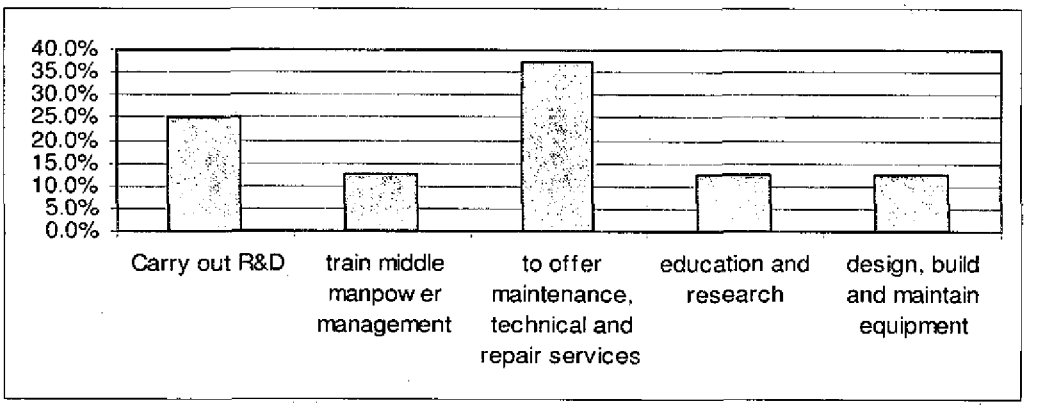
The market research shows that about 84% of the users interviewed are new investment in machinery to increase production.

2.5.3 Support Institutions

The support institutions are made of GRATIS foundation, the Centre for Scientific and Industrial Research (CSIR) which constitute Food Research Institute and Industrial Research Institute (IRI); the College of Engineering (Kwame Nkrumah University of Science and Technology - KNUST), Polytechnics, Accra Technical Training Centre, Ghana Standard Boards, Ghana Pumps Services Ltd, all government owned; and the private institutions (Agbemskod Engineering Ltd, Dunkwa Continental Goldfields Ltd, etc).

Apart from the private institutions, all the other support institutions were set up by Government. Most of these Government Institutions have been in existence as far back as 1970 and 1987.

Figure 10: Purpose of being in Business



These institutions provide:

- Training and support services for industries.
- Research, education and development services
- Technical supports
- Maintenance and repair services
- And also design and build engineering equipment

Figure 11: Type of Machinery & Equipment currently used by Institutions

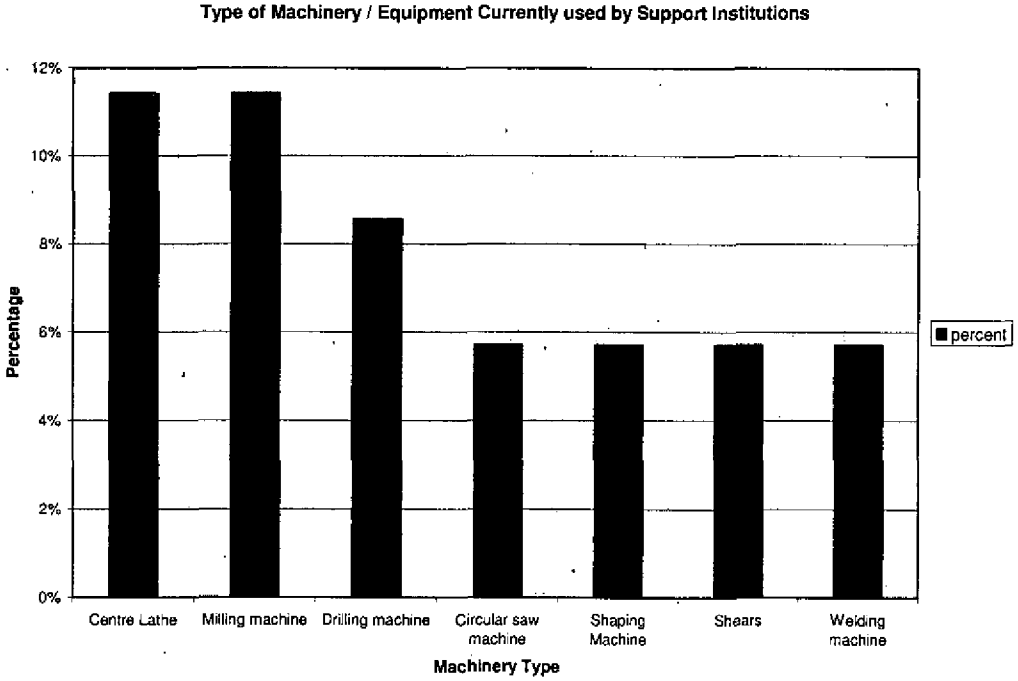
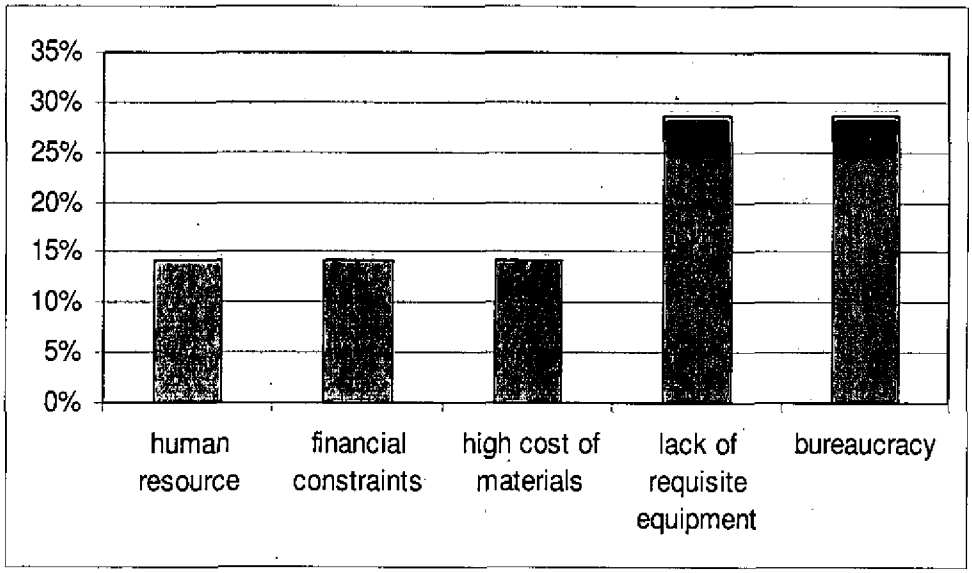
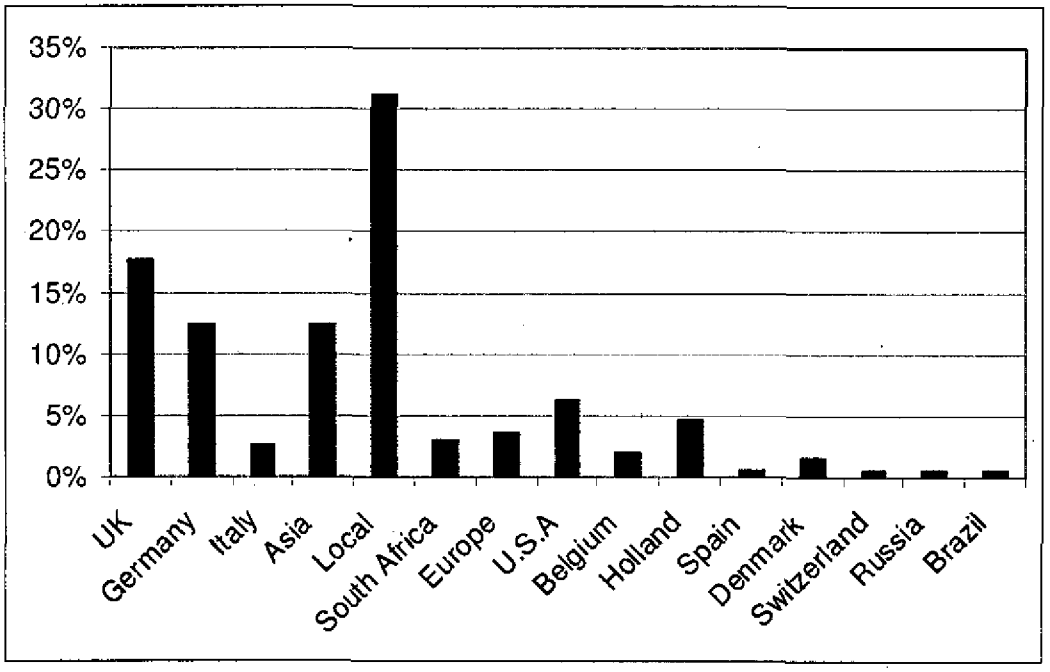


Figure 12: Factors Limiting Support Institutions' Ability to deliver Optimal Quality Services



The major bottlenecks preventing the institutions from achieving optimal services and delivery are the lack of requisite equipment and existence of bureaucracies.

2.5.4 Suppliers



Apart from the local market, the major sources of raw materials, equipment and machinery used by users are UK, Germany, Asia, USA, Holland, Europe, and South Africa. UK and Germany are the leading countries.

2.5.5 Competition

Ghana imports most of its capital goods from the European union, especially Germany and the United Kingdom.

It is expected that the Asian Capital Goods sector will expand and imports from countries as China and India will increase. Therefore, this study also looks at that competition.

This competitor analysis focuses on the following:
1. Identification of competitors
2. Critical success factors of competitors, strengths and weaknesses

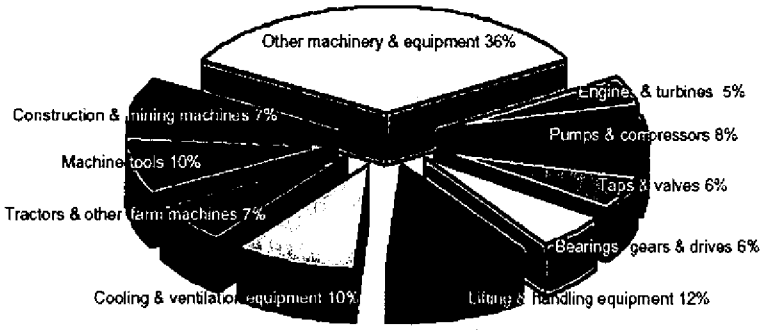
Ad 1. Identification of competitors

- *European Union*
  The European Union is the largest producer and exporter of mechanical equipment in the world. There are twenty-one thousand enterprises involved in mechanical engineering producing € 360 billion of machines and mechanical equipment (2003)

  Characteristics of the European Union Capital Goods Sector

Products

The figure below shows the products made in by the 15 EU countries:



Source: EU Engineering Database

Strengths

- Key know-how supply
- Technological edge
- The mechanical equipment made in the EU are quality products.
- Access to export markets

Weaknesses

- Economies of scale due to specialised production
- Price; difficulty in meeting Asian prices
- Investment in the Engineering Sector is too low
- Labour costs are relatively high

- *Asia*

The most important issue of competition with the more advanced Asian NICs lies in the area of the development of the Asian countries. This process has gained momentum, and the Tiger countries are benefiting from the opportunities; big projects have been launched, especially in the automotive industry and exports of capital goods from Korea and Taiwan to Southeast Asia are booming.

The countries known as the "little tigers" - South Korea, Taiwan, Hong Kong and Singapore - have established themselves as successful machine exporters in competition with the industrialised countries. In the course of their export oriented industrialisation, the consumption of mechanical engineering products by these countries has grown at immense rates in the past decades. In general, these growth rates have offered domestic manufacturers good potential for development.

2.6 Stakeholder Demands

2.6.1 Support Institutions

- The Support Institutions must be restructured
- Government and NGOs should provide financial assistance to these institutions
- Capacity building in their human resource through training of Staff in new technologies is required
- There is the need for the establishment of a technology centre of excellence for the sector
- The technology centre when realized, should be Commercialized
- There must be less bureaucracies in state owned institutions
- Raw materials and requisite equipment must be available and affordable to all

2.6.2 Users

- Producers should use quality raw materials in the manufacture of equipment and machinery
- Producers and support institutions should be trained and equipped with new skills
- Modern machinery and equipment must be made available
- Frequent workshops should be organized to upgrade the skills of stakeholders

2.6.3 Producers

- The technology centre being proposed should be commercialized
- The centre should be equipped with new technologies in order to meet industry needs.
- The centre must be free from too many bureaucracies.
- The centre should focus on the provision of training and technical assistance.
- Support institutions should be equipped with state of the art equipment
- Government and financial institutions must provide the sector with financial assistance
- The activities small scale industries must be promoted

3 Opportunity Assessment

3.1 Introduction

The objective of the Opportunity Assessment is to assess the opportunities for the envisaged TCCG. The assessment is based on the analysis of the strengths, weaknesses, threats and opportunities of the Capital Goods Industry in Ghana taken into account the findings of the Market Research as presented in the previous chapter. Based on this analysis the key challenges for a TCCG are identified and consequently the options for the TCGG in terms of:

- Which services to offer?
- Which markets to focus on?
- How to organize?

The defined options are evaluated by the following criteria:

1. *Alignment with government objectives.*
   As the envisaged TCCG is to be implemented as a public-private partnership and initiated by the Ministry of Trade & Industry for the purpose of enforcing the Capital Goods Industry it is relevant to assess to which extent the options align with the policy of the Government of Ghana. The government objectives in this respect are presented in the National Development Agency.

2. *Alignment with industry demand*
   In addition to alignment with government objectives it is also relevant to take into account the alignment with industry demand. The optimal public-private partnership is a project that meets both the objectives of the public authorities and the public sector. The industry demands are collected through an extensive survey of industry stakeholders as presented in the previous chapter.

3. *Stakeholder acceptance*
   In order to implement the defined concept of the envisaged TCCG it is of utmost importance that all the stakeholders accept the proposed concept and strategy. This acceptance is more than alignment with their respective objectives, though is also to take into account the stakeholders perception and acceptance of the impact of an option on their authority and level of control and power. The stakeholder acceptance is assessed in the Stakeholder Workshop on 2 August 2005 of which the Workshop Report is included in this report as Appendix I.

4. *Bankability*
   Although the bankability in terms of whether the possible revenues are sufficient

to recover the cost of operations and the costs of funding is to be assessed in detail in the next phase of the Opportunity and Feasibility Study, the initial perception by the stakeholders of the bankability of the various options is to be taken into consideration upon evaluation of the options. This initial perception is assessed in the already referred to Stakeholder Workshop on 2 August 2005.

5. *Ease of implementation*
   Also an implementation plan is to be defined in detail in the Feasibility Assessment, though the initial perception of the ease of implementation by the Stakeholders will be taken into consideration upon evaluation of the options. One could think of long period of implementation, possible legal barriers to be resolved, and so on. This initial perception is assessed in the already referred to Stakeholder Workshop on 2 August 2005.

6. *Sustainability*
   The sustainability of the various options is also a criteria to be taken into consideration as the TCCG is to enhance the industry in a sustainable manner. Sustainability will be assessed as the perceived expected sustainability by the Stakeholders in the already referred to Stakeholder Workshop on 2 August 2005.

Based on the evaluation of the options through the methodology of a multi-criteria analysis, a conclusion is presented in this chapter on the mission statement for the TCCG and related business domain.

3.2 SWOT Analysis

It should be noted that the SWOT analysis is focusing on the sector defined as the Capital Goods Industry as a whole, in order to define and justify the need for government intervention through the establishment of a TCCG and the related opportunities for the TCCG.

3.2.1 Strengths

From a competitive perspective the strengths of the Capital Goods Industry are the following:

1. *A matured industry.*
   The market research indicates that most (87%) of the producers of all capital goods exist already for more than 5 years and 56% even more than 15 years. This is evidence of a matured market with vested and experienced organizations.

2. *No capacity constraints*
   The market research also indicates that the industry does not experience any capacity constraints. Au contraire, the market research indicates that the producers are utilizing approximately 65% of their available capacity.

3. *Strong engineering knowledge base and technical skills*
   A previous market study[2] reveals that there is a wealth of engineering knowledge base and technical skills available within the country for development, innovation and manufacturing of capital goods. Over the years many institutions, both private and public operating in the formal technical and vocational education and training system in Ghana have been producing graduates who could be supported to enter the capital goods sector as entrepreneurs or even employees.

4. *Well established support institutes*
   As described in the previous chapter, there are a number of very well established quasi government institutions engaged in the production of capital goods in the formal sector. The market research indicates that the primary service offering is maintenance and repair services (35%) followed by research & development. The institutions, in particular GRATIS and its RTTCs have relative modern equipment -70% younger than 10 years- including lathe machines, pedestal shears, bending jigs, furnaces and milling machines and Computer Aided Design software for producing prototypes.

5. *Well developed educational facilities*
   Three out of the five universities provide tertiary education in a number of technical fields such as Agriculture, Engineering Science and Mining. The universities basically produce engineers, technical supervisors and future managers who can develop and manage industries and organizations. Apart from the Ministry of Education formal training institutions, there are also training institutions set up purposely to provide more practical oriented and formal apprenticeship training for graduates from the senior Technical Institutes.

3.2.2 Weaknesses

From a competitive perspective the weaknesses of the Capital Goods Industry are the following:

1. *Lack of economies of scale*
   The capital goods sector is quite diverse with operators ranging from rural blacksmiths, micro-urban metal firms, small and medium metal firms, scrap dealers to imported steel dealers and merchant capital good dealers. The operators are spread over all regions of the country. No single company has a market share of more than 5%. In comparison with the competing foreign companies who are mostly large conglomerates or medium sized though highly specialized global players, the industry is lacking economies of scale and consequently inefficiencies and high costs of production.

2. *Poor knowledge dispersion*
   Although the industry as a whole has a strong engineering knowledge base and technical skills, this knowledge and skills are poorly dispersed. The UNIDO market study reveals that 61% of the operators have no formal engineering

[2] Market Study on Capital Goods for Ghana (2004) prepared by UNIDO

background and that even 72% of the workers do not have formal engineering training, despite adequate educational facilities provided for by the universities and the Ministry of Education. Consequently the level of innovation and efficiency is hampered. It should be noted that access to skilled labor is not perceived as high priority by the operators, though that there is a need for additional training facilities.

3. *Limited availability and high costs of funding*
   The market research reveals the one of the key weaknesses in the sector is related to finance. Lack of credits from banks is ranked second by the respondent as major challenge in production. The high interest rates and the delay in releasing funds were also ranked second as the main limitation to the service delivery of support institutions. Consequently investments in new equipment and or research and developed is hindered by the lack of funding and if available its costs and release time.

4. *Inability to recover high cost of raw materials*
   The market research reveals that the high costs of raw materials are perceived as the most significant challenge in production. Apparently the operators have not been able to charge the high costs of raw materials to the clients.

5. *Lack of requisite equipment*
   The market research reveals that the lack of requisite equipment at the support institutions is regarded by both the users as the support institutions themselves as the key limitation in the service delivery of the support institutions. The reason for this could be either because the support institutions do not have the financial means to invest in requisite equipment or because the support institutions do not know what is requisite because of lack of communication between the support institutions and the operators.

It can be concluded that the combination of underutilization, lack of economies of scale, high costs of funding is driving the cost of production in general to an uncompetitive level, in comparison with the imported goods.

And that the combination of lack of skilled work force and lack of requisite equipment is limiting the quality of the produced goods in comparison with the imported goods.

Consequently the price quality ratio of locally produced goods does not match that of the imported goods, leading to lack of demand, consequently lack of income, consequently lack of investment possibilities aimed at cost reduction and quality enhancement.

3.2.3 Threats

The Capital Goods Industry is facing the following threats:

1. *Increasing competition of low-cost producers*
   It is noted that capital good producers in low-cost economies such as China and India are growing. This imposes a severe threat to the Capital Goods Industry in

Ghana as this competition is able to produce at low cost because of economies of scale, low cost of financing, and low cost of human resources and still able to produce adequate quality because of availability of skilled labor due to excellent government funded educational and training facilities. The only competitive advantage local production has in this respect is the cost of transport and import duties to protect the local industries. It should be noted that this threat is not likely to be eminent in the short term, as the short term competition is primarily to come from Europe, though in the medium term this threat is to be taken very serious.

2. *Increasing competition of high quality producers*
   Next to the low cost competition, there is also the competition from the high quality producers mostly from Western Europe, e.g. United Kingdom and Germany. These producers, most of them medium sized global players and highly specialized and consequently enabling economies of scale upon production, invest significantly in research and development and are able to constantly innovate products and production processes as being their strategy to remain competitive.

3.2.4 Opportunities

The Capital Goods Industry has the following major opportunities:

1. *Growing demand in Ghana for capital goods*
   Naturally the main opportunity for the sector is the expected growing demand for capital goods in Ghana itself. Drivers for this demand growth are the political stability of the country, the expected economic growth and the government policy to enhance the industrialization of the country's industries. As can be derived from the market research the main sub sectors expected to grow further are:
   a. Food crops
   b. Timber
   c. Cotton
   d. Food processing
   e. Textile
   f. Construction

2. *Government policy aimed at enforcing the sector*
   Political and government support to enforcement of the industry can also be regarded as a major opportunity for the sector. It implies among others the possibility to reduce the level of bureaucracy generally regarded as a major bottleneck for the sector as well as the possibility to enable more attractive funding opportunities through government support.

3. *Growing demand in the ECOWAS region for capital goods*
   It can also be concluded form the market research that there are opportunities in the ECOWAS region in particular Nigeria, as Nigeria is also depending severely

on import of capital goods.

4. *Availability of scrap material*
   It has been indicated by various of the institutes interviewed that scrap material is available throughout the country which could be used with some handling as raw material in order to offset the current high costs of raw materials in particular steel.

3.2.5 Conclusions

The SWOT analysis can be summarized as follows:

Strengths	Weaknesses
1. Matured industry 2. No capacity constraints 3. Strong engineering knowledge base and technical skills 4. Well established support institutes 5. Well developed educational facilities	1. Lack of economies of scale 2. Poor knowledge dispersion 3. Limited availability and high costs of funding 4. Inability to recover high costs of raw materials 5. Lack of requisite equipment
Opportunities	**Threats**
1. Growing demand in Ghana for capital goods 2. Government policy aimed at enforcing the sector 3. Growing demand in the ECOWAS region for capital goods 4. Availability of scrap material	1. Increasing competition of low-cost producers 2. Increasing competition of high quality producers

The analysis indicates that the sector requires a strategic breakthrough in order to seize the opportunities and match the competition. The strategic breakthrough is to be aimed at:

1. **Enabling economies of scale through specialization**

   In order to enhance cost effectiveness economies of scale is required. In general the Capital Goods Industry throughout the world is characterized by medium sized enterprises. The products offered by these firms are highly specialized and customized because of the high investments in requisite equipment and specific knowledge on the products and production process. The high level of specialization is required to enable economies of scale on the equipment and work force.

   It is recommended for the Capital Goods Industry in Ghana to choose explicitly for one or more specializations and focus all resources on these products.

2. **Enhancing knowledge dispersion**

   In order to enhance the efficiency and quality of production to match the competition a skilled work force is an absolute requisite. Although the industry as a whole has a strong engineering knowledge base and technical skills as well as good educational and training facilities, it has not led yet to well trained work force on the ground.

   Consequently it recommended to develop an infrastructure that enables a more efficient and effective knowledge dispersion.

3. **Enabling investments in requisite equipment**

   In order to enhance the efficiency and quality of production to match the competition more investments in equipment is an absolute requisite. Investments currently not possible because of limited availability of funds and associated high costs of funding and long period of release of funds. Cost of funding is related by the creditworthiness of the fund applicant and the risks of his investment proposal. Enhancement of the creditworthiness and risk mitigation on the investments are to reduce the cost of funding.

   Consequently it is recommended to enhance the creditworthiness of the fund applicants and mitigate the investment risks in order to enable more cost efficient funding of investment.

These challenges justify the establishment of a Technology Centre for Capital Goods and provide guidance to defining its service offerings, its markets to focus on and its institutional embedding.

3.3 Opportunities for Service Offerings

3.3.1 The options

The various forms and styles of (S) Service and (T) Technology capacity-building initiatives that have emerged over the past 20 to 30 years have given rise to a rather motley conceptual and terminological vocabulary. Similar concepts may have different names, and the same term may refer to initiatives with sometimes substantial differences in format and objectives. However, it is fair to say that many of the new institutional forms designed to support technology capacity-building are characterized by a specific physical location and co-operation between public- and private-sector institutions in the form of actions aimed essentially at building bridges between academia and industry, promoting innovation in small and medium enterprises (SMEs) and encouraging investment in technology-based start-up firms.

Brief definitions of some of the most common institutional forms of S and T initiatives and selected components are given in the following pages.

Technopoles

Technopoles are relatively new entities that extend over a well-defined geographical area where scientific and industrial activities are co-located, and where exchanges of expertise are greatly facilitated, owing to the proximity of the various institutions and their willingness to collaborate. For existing firms in new and evolving areas of applied science, technopoles offer an attractive environment, including ready access to research facilities. Technopoles usually involve urban development and may extend over a region that includes several cities. They comprise research laboratories for large firms, universities, research institutes and high-technology enterprises, as well as services for technology transfer.

Technology parks

Technology parks are similar to technopoles, but with more emphasis on the transfer of technological know-how and industrialization. Technology parks tend to have somewhat casual selection criteria, with a target clientele that is not always sharply defined. They may include technological and entrepreneurial tenants as well as service firms, financing institutions and governmental agencies.

Science/research parks and science cities

A park in which scientific R and D activities are predominant, whether in co-operation with research laboratories at universities or research institutes in the same location or somewhere nearby, is known as a "Science Park" or a "Research Park". When the park extends over a wide geographical area, it may be called a "Science City".

Innovation centers

Innovation centers, on the other hand, are capacity-building initiatives based on incubation schemes. Their principal aim is to help new high-technology firms survive their pre-launch, launch and early operational phases. They may also provide existing small firms with suggestions on improving their production processes. Members of an innovation centre are provided with access to R and D facilities and equipment from research centers or university laboratories, and are also offered guidance and assistance in becoming members of local or regional innovation networks. Naturally, firms that are selected as members of innovation centers tend to have a high-technology focus. Furthermore, owing to the demanding nature of the work involved, younger entrants often enjoy priority in tenant selection schemes.

Centers of excellence

Centers of excellence in science and technology are institutions that aim at demonstrating excellence in selected fields, whether in education or R and D, including a strong relationship with industry. They may specialize in some specific discipline or cover several areas of S and T. They always represent areas of emphasis that will bring the institutions behind them special distinctiveness owing to their uniqueness, special nature or high quality. They also provide leadership at the national or even international level through research, high-level education programmes or resources in their fields of expertise. Multidisciplinary teams are quite often involved in these excellence centers, where knowledge, applied research and technical assistance are used to strengthen and promote growth-oriented and technology-driven businesses. These centers generally emphasize distinctive aspects of their output that set them apart from other institutions in the same field. Almost invariably, they operate at the forefront of S and T with the idea of producing an impact that will result in ground-breaking applications of new technologies.

Technology incubators

Technology incubators are a special form of business incubators. They focus on new enterprises whose operations are based on novel technological ideas that are likely to lead to a marketable new product. They provide common services as well as financial, legal and business support to these newly formed enterprises. The incubation process ends after a limited period of time, either with "graduation" of successful start-ups that move outside the incubator, or with the termination of incubation arrangements for one reason or another.

High-technology industrial clusters

This term signifies groups of entities from various sectors that use relatively large amounts of each other's products and are characteristically based on innovative efforts and/or production linkages. Their activities relate to firms or sectors that co-operate in the process of diffusing innovations. Linkages relating to firms or sectors that form value-added production chains constitute another area of cluster activities.

Innovation networks

Innovation networks include managers, bankers, venture capitalists, professors, graduates, scientists, artists and government employees working on, or toward, innovation-related targets in a variety of application areas. Of the several types of institutional forms discussed above, innovation networks are best suited to the adoption of virtual status.

Based on these aforementioned concepts the following options for services can be defined relevant in the context of the envisaged TCCG:

1. **Production of specialized capital goods or components**

   The TCCG could produce capital goods or components of capital goods that are inefficient for current manufacturers to produce. This would concern capital goods or components of which the production would either require specific equipment that is too costly for current manufacturers to purchase on their own, or of which the production would require specific knowledge of the work force too costly for current manufacturers to acquire in terms of training costs.

2. **Training and knowledge transfer**

   The TCCG could provide training and knowledge transfer services to the workforce on the ground. It would facilitate knowledge dispersion though training courses, workshops, and so on.

3. **Research and Development**

   The TCCG could be active in the area of research and development. Research on and development of new products and business process reengineering, computer software development, prototyping, and so on.

4. **Facilities**

   The TCCG could provide facilities for various purposes; e.g. manufacturing

facilities, design facilities, testing facilities and measuring facilities. Facilities that would be inefficient for manufacturers to invest in on their own. It would imply that TCCG would provide only facilities but that the operators are responsible for their own work force.

5. **Consulting and human resources**

   As an alternative to training the TCCG could also offer engineering consulting on a commercial basis. It could also post or second skilled work force employed by the TCCG at the manufacturer in order for him to access to temporary skilled labor. The TCCG would be a Center of Excellence in the area of the requisite knowledge

6. **Financing**

   The TCCG could be supporting and facilitating in fund raising for investments in requisite equipment or even have the means to provide funds by itself in the form of grants or loans or to reduce the costs of funding by means of guarantees or insurances.

7. **Marketing and logistics**

   The TCCG could be providing marketing or logistics services to respectively stimulate demand by promoting the industry and reduce costs of logistics by means of central warehousing and coordinated transport.

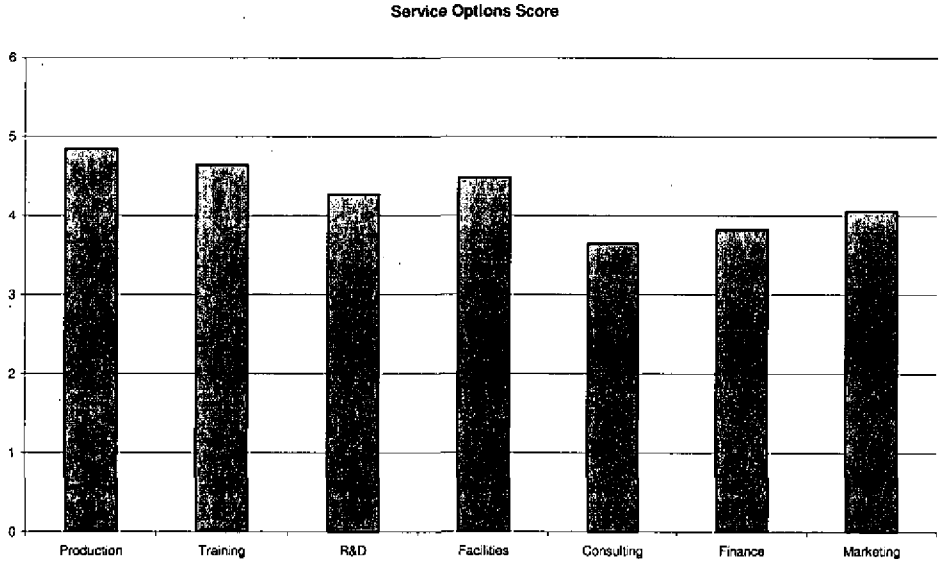
3.3.2 Evaluation of options

The options for service offerings have been presented to the industry stakeholders at the Stakeholder Workshop on 2 August 2005 for evaluation in accordance with the defined criteria as presented in the introduction of this chapter.

The criteria have been weighted by the stakeholders by allocating 100% to the different criteria. Following the service options have been ranked per criteria on a scale from 1 to 7 in terms of level of agreement. For example, a stakeholder has given the service option #6 Finance the highest score on the criteria #2 Alignments with Industry demand. This means in his opinion that financing services is most aligned with industry demand. For the criteria #5 Ease of implementation he has given service option # 6 the lowest score. In other words, he believes that financing services is most difficult to implement.

The weight and the rankings have resulted in the weighted average per service option.

The outcome of the individual questionnaires indicated that no services were significantly less preferred than others, as following presented.



At the Stakeholder Workshop a group was formed to further elaborate the required service offerings. The results of their discussion are following presented:

Criteria	1. Alignment with government objectives	2. Alignment with industry demands	3. Stakeholder acceptance	4. Bankability	5. Ease of Implementation	6. Sustainability	Weighted average
Weight	**20%**	**35%**	**10%**	**10%**	**5%**	**20%**	**100%**
Service Options Score							
1. Production	1,4	2,45	0,4	0,3	0,3	0,6	5,45
2. Training	1,2	1,75	0,4	0,2	0,2	1	4,75
3. R&D	0,4	2,45	0,3	0,1	0,1	0,8	4,15
4. Facilities	0,4	2,45	0,3	0,2	0,15	1,4	4,9
5. Consulting	0,2	0,35	0,1	0,1	0,05	0,2	1
6. Finance	0,4	1,75	0,2	0,4	0,2	1,4	4,35
7. Marketing	0,2	2,45	0,5	0,1	0,1	1,4	4,75

3.3.3 Conclusions

It can be concluded that the stakeholders are in need for a broad range of services to be provided by the TCCG with the exception of consulting services. The Feasibility of

providing such a diversified service offering is to be assessed in the next phase of the study.

3.4 Opportunities for Market Focus

3.4.1 The options

The second decision to be made is which markets the TCCG should focus on. As concluded from the SWOT analysis it is of the utmost importance that economies of scale or to be achieved through specialization. Consequently the TCCG has to limit its focus to one or two at the most sub sectors to which it offers it services.

Following the demand analysis of the market research the following sub sectors have been defined that currently are already significant users of capital goods and which demand is expected to grow further in the coming years:

1. **Food crops**

   Cocoa is the main crop accounting for 30-40% of total exports. Other crops include cassava, cotton, coffee, palm oil and sugar. Ghana produces an average of 12,826,000 tonnes of food crops a year in the 1996-2001 period.

2. **Timber**

   Timber one of the main export products of Ghana, exporting 472,427 cubic meters of timber in 2002, for the amount of EUR 183.4 million

3. **Cotton**

   Ghana produces 70,000 bales of cotton on a yearly basis, this makes Ghana worlds 37th cotton producer out of 121 cotton producing countries

4. **Food processing**

   The food processing industry accounts for 13,7% of total manufacturing sector for food processing and 8,1% for the beverage industry. Together being the largest manufacturing sector of Ghana

5. **Petroleum refinery**

   The second largest manufacturing sector in Ghana is the petroleum refinery sector, representing 19% of the manufacturing sector. Production started in the early 1990's, led by 3 large international companies

6. **Textile**

   The textile industry represents 15% of the manufacturing sector, by producing

textile, wearing apparel, and leather goods.

7. **Construction**

   Construction is rapidly growing in Ghana. Growth is driven by increasing infrastructure development

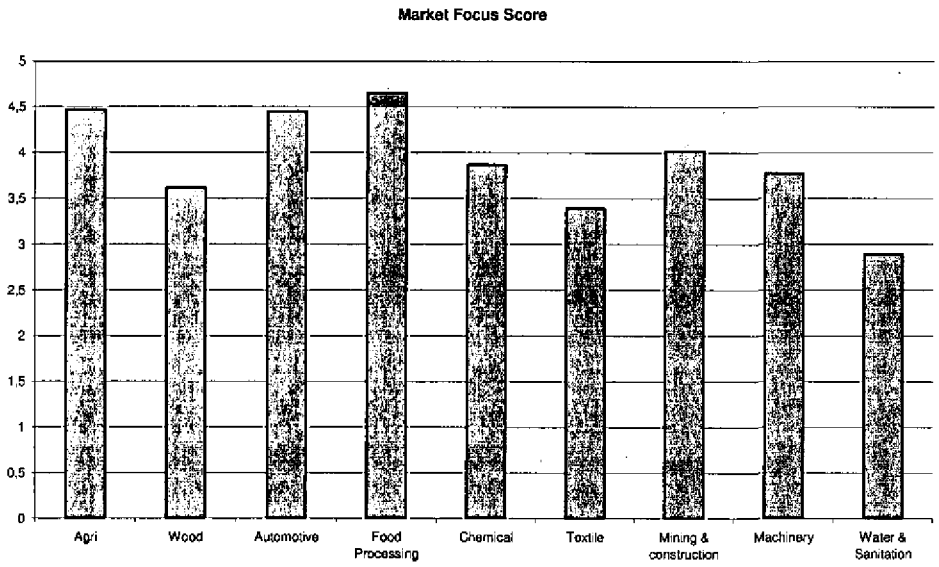
3.4.2 Evaluation of options

The options for market focus have been presented to the industry stakeholders at the Stakeholder Workshop on 2 August 2005 for evaluation in accordance with the defined criteria as presented in the introduction of this chapter.

Upon request by the stakeholders the options were redefined to the following options for market focus:

1. Agricultural Production
2. Wood Processing
3. Automotive Industry
4. Food Processing
5. Chemical Industry
6. Textile Industry
7. Mining and Construction
8. Machine Tooling
9. Water and Sanitation

The outcome of the individual questionnaires indicated that no markets were significantly less preferred than others, as following presented.



At the Stakeholder Workshop a group was formed to further elaborate the required service offerings. The results of their discussion are following presented:

		Ranking
1.	Food Processing This is to cut down on post harvest losses	9
2.	Agricultural Production The emphasis is on producing appropriate tools in order to increase productivity	8
3.	Machine Tooling We need the machine capability to be able to produce the machines required for the industries listed. Accessibility to machines should be critical for our rural folks to move from subsistence farming to mechanized farming	7
4.	Waste and Sanitation To enable us as a country collect and process our waste products	6
5.	Automotive Industry	5
6.	Mining &Construction	4
7.	Wood Processing	3
8.	Chemical Industry	2
9.	Textile Industry	1

3.4.3 Conclusions

It can be concluded that the stakeholders prefer the TCCG to have a diversified market focus. However taken into account that some prioritization is necessary the demand the TCCG to focus initially on:

1. Food Processing Industry
2. Agricultural Production Industry
3. Machine Tooling

3.5 Opportunities for Institutional setting

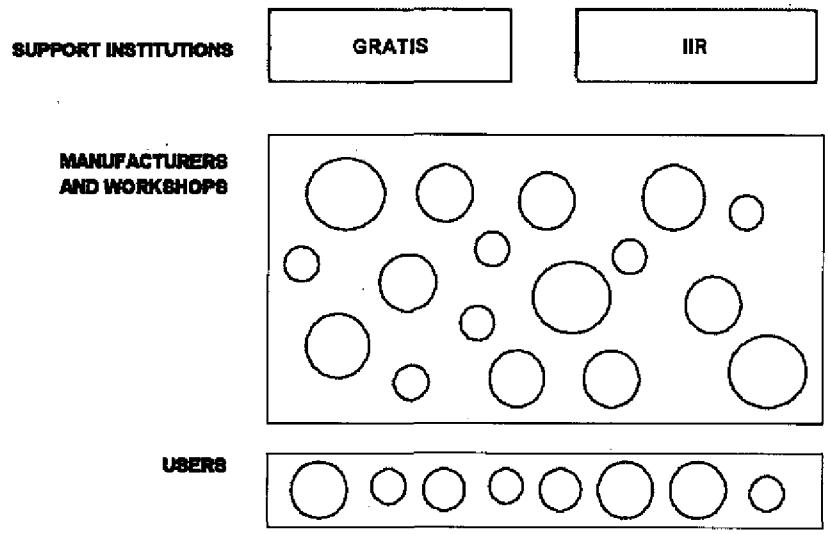
3.5.1 The options

Next to defining the service offering and the market focus, the third key decision to be made is how to organize the TCCG. It should be noted that this is not just a start-up factory, but an institute to facilitate a strategic breakthrough in an already matured industry with established institutions and vested interests. The existing infrastructure cannot be neglected and is to be taken into account upon defining the institutional setting for the TCCG.

Following the sector analysis of the market research, the following options for embedding the TCCG in the institutional infrastructure haven been defined:

1. **Upgrading of existing institutions**

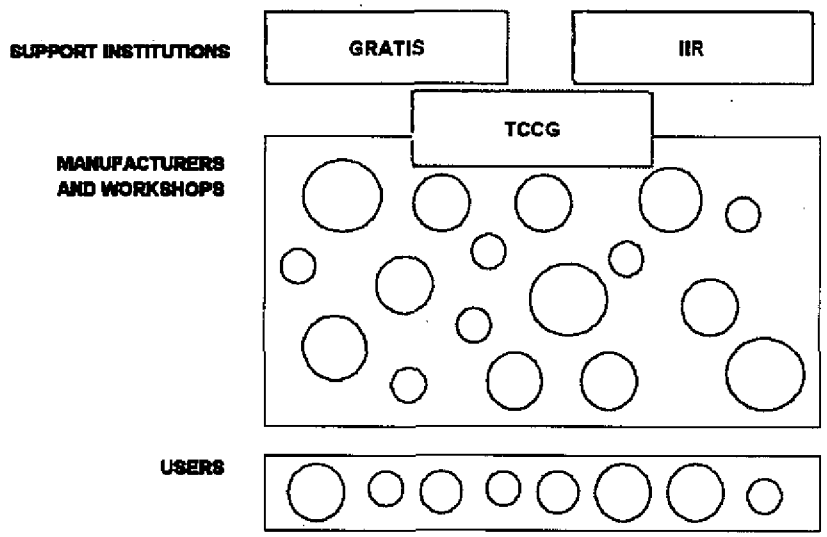
   The first option is not to establish a TCCG but to upgrade already existing institutions enabling them to offer the requisite services for the defined market focus. This would concern primarily GRATIS and IIR. This would imply the following industry structure.



The Support Institutions would be provided with the necessary means to upgrade the necessary resources in terms of human resources and equipment to provide the defined service offering to the heterogeneous group manufacturers and workshops active in the defined market focus. Public Private Partnerships would be possible through selling of part of the ownership to private investors.

2. **Adding a new institution**

It is also possible to position the TCCG in addition to the existing institutions. Pending on the defined service offering, it is likely that the TCCG is to compete to a certain extent with the existing institutions. The resulting industry structure is following presented.

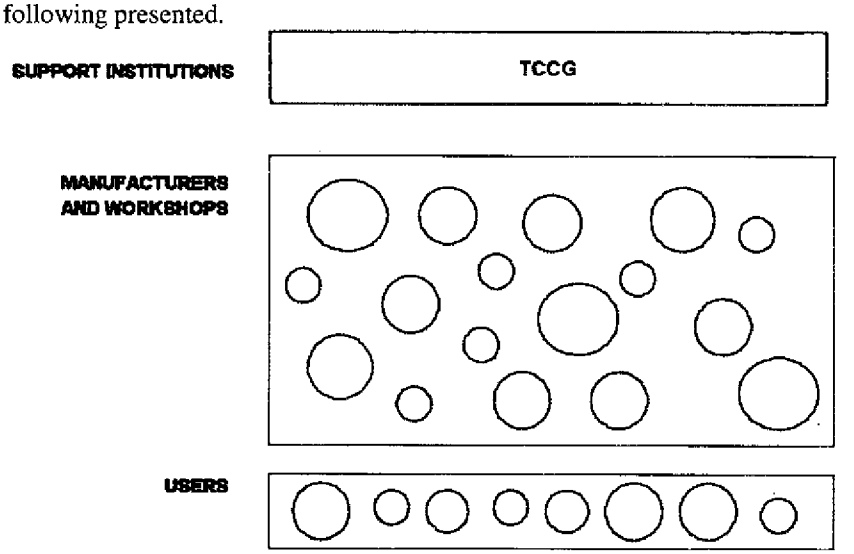


Public Private Partnership is possible by either tendering the right to establish a TCCG through a Design Build Finance and Operate concession, or through

establishment of a legal entity with public and private shareholders.

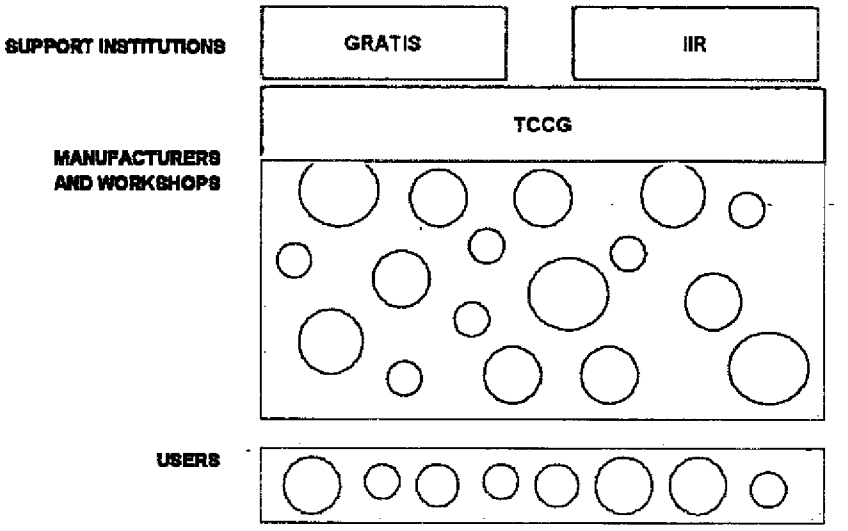
3. **Merger existing institutions**

The third option is to merge the existing institutions and to upgrade and rebranding the joint institutions as TCCG. A Public Private Partnership would be possible by allowing a private equity investor. The resulting industry structure is following presented.



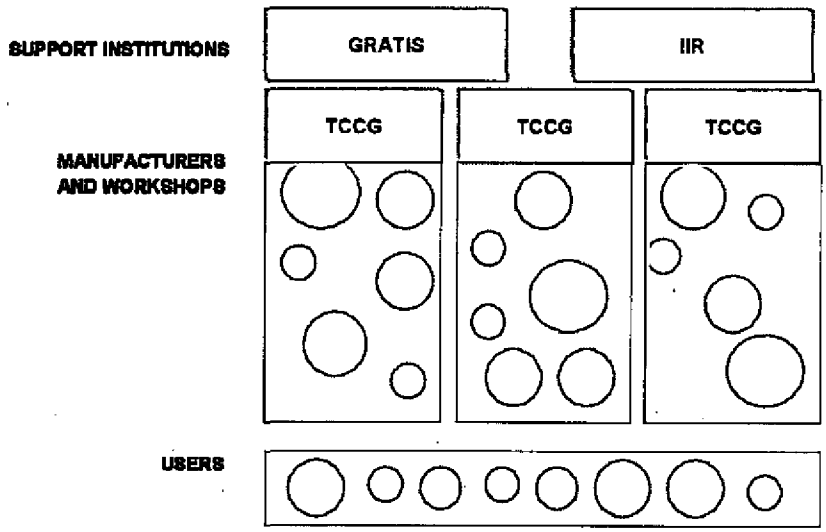
4. **Coordinating body**

The fourth option is to position the TCCG as a coordinating body to coordinate the activities of the support institutions and the support them wit the necessary means for upgrading their resources. Public Private Partnership would be possible through private sector participation in the coordinating body. The resulting industry structure is following presented.



5. **Restructuring the industry**

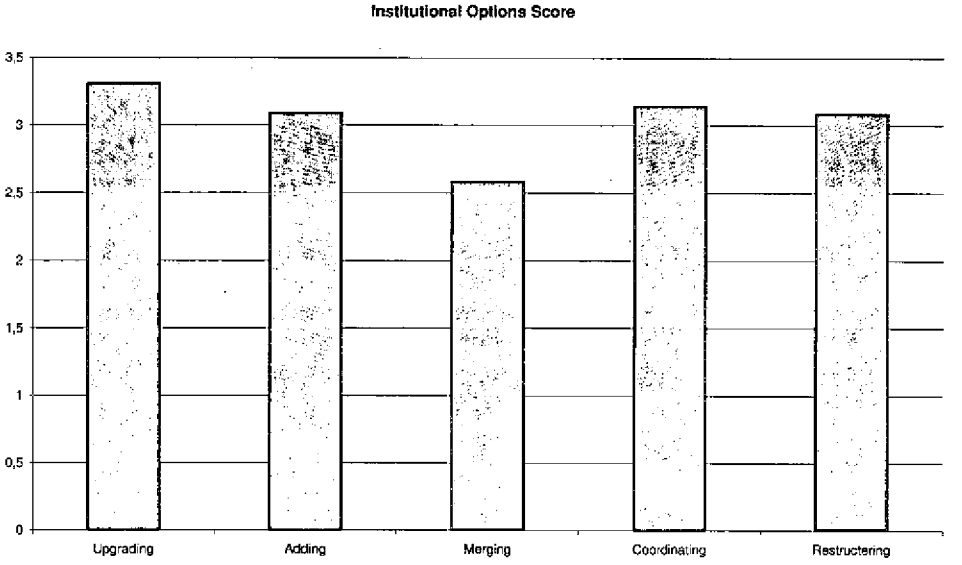
The most advanced option is a restructuring of the industry through sectored and geographical clustering. This implies that each region has a cluster of related industry supported by a sectored and regional TCCG. This options also enables Public Private Partnership through private sector participation in the TCCG. The resulting industry structure is following presented.



3.5.2 Evaluation of options

The options for institutional setting have been presented to the industry stakeholders at the Stakeholder Workshop on 2 August 2005 for evaluation in accordance with the defined criteria as presented in the introduction of this chapter.

The outcome of the individual questionnaires indicated that no options for institutional setting were significantly less preferred than others, as following presented.



At the Stakeholder Workshop a group was formed to further elaborate the possible options for institutional settings. The results of their discussion are following presented:

Group III -- Institutional focus Options	Ranking
1. Adding a new institution	5
2. Industry Restructuring	4
3. Upgrading of existing institutions	3
4. Merging existing institutions	2
5. Coordinating	1

The reasons supporting their options are:

- There is the need to develop a green field technology centre that will develop programmes to facilitate Ghana's vision. This is because all the existing centres and facilities cannot fulfil dreams of this vision
- We need a programme committee serving as a Board to give vent to the central planning which would establish the central board to be made up of:
  - GRATIS
  - CSIR
  - Private Sector
  - Technical Institutions
  - Government Representatives
  - Donor Representatives
  - Others

  They would establish the user requirements e.g. Funding, Electroplating, tooling, Machining etc
- Stakeholders
  - Government – initiator which may off load shares to the private sector later.
  - Industry Financing – Banks like NIB
  - International Financial Services – IFC
  - Private Sector – Producers & Traders

3.5.3 Conclusions

Although the stakeholders as a whole has a more diverse opinion, it can be concluded that the most preferred option for institutional setting is to add a new institution in addition to the existing institutions. The existing institutions as well as other stakeholders are to be involved in defining and implementing the concept of the TCCG. Upon actual establishment the TCCG is to be operated as an independent entity owned by:

- Government – initiator which may off load shares to the private sector later.
- Industry Financing – Banks like NIB
- International Financial Services – IFC
- Private Sector – Producers & Traders

The feasibility of this institutional setting is to be assessed in the next phase of the study.

4 Conclusions & Next Steps

4.1 Conclusions

4.1.1 Mission Statement for the Technology Centre

The Technology Centre for Capital Goods in Ghana is an independent public private partnership to support the Capital Goods Industry by offering production facilities and services, research and development, training services and support in financing, marketing and logistics on a commercial basis.

4.1.2 Business Strategy

The Technology Centre is to focus initially on the Agriculture and Food Processing industry as well as the Machine Tooling industry. Its long terms strategy is to serve all vital industries of the Ghana Manufacturing Sector.

4.2 Next Steps

4.2.1 Feasibility Assessment

The next step will be to assess the feasibility of the aforementioned mission and strategy of the TCCG. In particular the following issues will be addressed:

- Assess equipment requirement
- Assess property requirements; location, site and environment
- Assess human resource requirement
- Assess raw materials and supplies requirements

⇨ **Estimate investment costs and cost of operations**

- Assess price setting potential
- Assess revenue potential
- Assess funding options and cost of capital

⇨ **Estimate net present value**

4.2.2 Implementation Plan

Assuming feasibility of the defined mission and strategy an implementation plan will be prepared including:

- Description of the implementation phases
- Proposal for allocation of responsibilities for implementation
- Proposal for procedure to involve the private sector in a transparent and effective manner

Annex 11 Stakeholder workshop report

PROCEEDINGS OF THE STAKEHOLDERS WORKSHOP ON TECHNOLOGY & INNOVATION CENTRE FOR CAPITAL GOODS (TICCG) - MOTI/UNIDO

VENUE: Council for Scientific and Industrial Research Science and Technology Policy Research Institute (CSIR/STEPRI)

DATE: August 2, 2005

The workshop started at about 9:40am. In attendance were the Minister of Trade and Industries Hon. Mr. Alan Kyerematen; his deputy Hon. Mr. Kofi Osei Ameyaw and the UNIDO representative to Ghana Mr. A. D. Akba. Mr. P. V. Obeng, Chairman of the Board of the Technology & Innovation Centre for Capital Goods chaired the workshop. Sixty two (62) participants from public and private sector attended the workshop. This includes CSIR – IIR, TCC-KNUST, GRATIS Foundation, Fateco, Denco Foundry, Ghana Standards Board, Ghana Railways Corporation Ltd, MOTI, MPSD/PSI and National Board for Small Scale Industries (NBSSI).

In his opening address, Mr. P.V. Obeng urged all participants to help Ghana realize this dream of a Technology & Innovation Centre for Capital Goods by contributing to the objectives of the workshop.

Address by the Deputy Minister of Trade and Industry (MOTI):Hon. Mr. Kofi Osei Ameyaw

The Deputy Minister of Trade and Industry Hon. Mr. Kofi Osei Ameyaw, in his welcome address informed the house that the Ministry of Trade and Industry is pursuing industrial growth for the national economy to create employment. The proposed centre is designed to manufacture machine plant, parts, components and equipment for selected manufacturing firms such as the agro processing centre.

In December 2004, UNIDO accepted to fund the opportunity and feasibility study for such a centre. An Advisory Committee was set up and after competitive bidding a consortium of three consulting firms Ecorys, Bruks and Gibbs emerged as winners and subsequently commenced work which are to discuss today. UNIDO also opted for a Steering Committee.

Address by UNIDO's Representative to Ghana: Mr. **A. D. Akba**

In his message to the house, Mr. A. D. Akba informed participants that UNIDO's objective is to support the objectives of Government. The objective is to help

- Contribute to the realization of poverty reduction
- Contribute towards the creation of a broad and industrial based centre

For this purpose, UNIDO has been working in close collaboration with the Ministry of Trade and Industry in formulating its programmes with the proposed Technology & Innovation Centre as an integral part of these programmes. The project has two phases. The first phase is to conduct a full feasibility study and the second, is to embark upon the resource mobilization for the implementation of findings of the study.

He continued that the technology centre being set up aims to manufacture the parts and components to service Capital Goods being imported into Ghana. The envisaged Technology Centre will among others:

- Support existing and emerging companies to allow them enhance products through the promotion and transfer of technology.
- Offer professional support services, product engineering, design, assist in usual technology software and equipment.
- Create and strengthen partnership
- Explore new markets for new products

He went on to say that at the regional dimension, the centre will be the focal point for Ghana and its neighbouring countries by tracking technologies. That is, new technologies involving the private sector for both developed and developing countries. The development objective is to increase and improve manufacturing companies for the production of capital Goods and build up industrial partnership in West Africa.

He went on to say that the implementation of phase one has been successful and that the full feasibility study will be ready for discussion at the end of September 2005. He observed that the deliberation and discussion at the workshop will be crucial to the implementation of the technology centre. In line with that, UNIDO has contracted international experts to assist in selling the project to private and public institutions. About 60 of such institutions have already been contacted and what is left is for UNIDO to provide a detailed study for their consideration.

He continued by informing participants that the workshop is supposed to be an interactive process. The research findings and options should be discussed to serve as inputs for the feasibility and opportunity study.

He concluded by pledging UNIDO's support to bring the technology centre to a successful realization and implementation.

Address by the Minister of Trade and Industry: Hon. Mr. Alan Kyerematen

The Minister of Trade and Industry Hon. Mr. Alan Kyerematen in his address stated that, the consultants have proposed a number of strategic options that stakeholders have to evaluate. He observed that even though a multivariant analytical tool was being used by the consultants to prepare these options, stakeholders should feel free to present their own opinions and options.

He however cautioned that, in choosing a development option, they should ensure that the choice made fits into the development paradigm of Government. This is because which ever strategic option that is chosen will depend on where Government wants to go as a developing country. The greatest development challenge for Ghana is how to move from stabilization to growth. The question then is why growth? The answer is that it is only growth that can lead to poverty reduction. Not real or nominal growth but rather accelerated growth.

He went on to say that with Ghana's economy growing at 5.8%, the economists believe that stabilization by itself can induce some growth. However, Ghana needs to move beyond stabilization which in itself is a necessary condition but not sufficient. The development experience of other countries points to only one direction which is industrialization. To achieve development, Ghana needs to develop a new industrial programme.

He added that, one of the things that underpin industrialization is technology; the embodied technology being hardware and the non-embodied technology which is software. The proposed technology centre is the core of embodied technology. He went on to observe that no country had been able to develop without embodied technology. Even if they do, such a country has to decide to either buy or make the machinery or equipment by itself. The two are however not mutually exclusive. They may go together.

He went on to say that if the final proposal comes to the argument that Ghana is not competitive in developing Capital Goods but rather to continue importing, we should remember not to look at competitive advantage always. As a poor country, if we concentrate on only competitive advantage then we will end up being poor again. We have no choice than to do both by developing our own machines. This helps to increase our employment capacity by making use of the Human Resource Capability. He said we should remember that Japan and others grew through reverse engineering. Even if we decide to continue importing the capital goods, Ghana has not got the required foreign exchange to buy the machines. We therefore need to agree on how to do it, who to do it and where to do it.

He continued by saying that, the consultants' criteria may lead to a certain result but they should put aside the arithmetic and concentrate on the strategic options. He urged all stakeholders to provide their technical advice to the development of the centre in order to fit this into Ghana's development paradigm. He was glad that Ghana is not starting from scratch because the institutions are already there but they are not enough.

He added that, Ghana needs some additional infrastructure to complement the existing infrastructure. A lot of what we have does not fit into any strategy. We therefore need a new centre that pulls along all the other institutions. We need a centre with that additional capability but not just upgrading of existing institutions.

Ghana he said is looking at the manufacturing of basic tools, machines and equipment. The question then is what is the capacity required for the Technology centre – medium, high or low? What level of engineering sophistication the centre should have? What should the raw material base be i.e. whether there is steel or iron in the system? What standards i.e. to what extent can the Technology centre establish the standards setting? To what extent can the centre be a stimulus for the Human Resource capability? What type of machine type we are proposing? Will it be Agriculture, Mining, Construction or what? Once these are done, we can then go ahead and propose a good Technology Centre.

He again cautioned stakeholders to concentrate on the basic guidelines and not to spend time on whether we need a technology centre or not.

Questions in Response to Address by Honorable Minister of Trade and Industries Alan Kyeremanten by Participants

When questions were invited from participants, Mr. Robert Woode, a member of the Steering Committee commented that there is no way Ghana can have a sustainable industry if we have no machine building capacity. He therefore pleaded with the minister to do all he can in his power to ensure that the technology centre is realized.

Mr. Acquaah Harrison, advisor in TUET wanted to know if the centre was going to be an innovation centre or will be producing its own machines. Mr. Lawson (formally of GRATIS) wanted to know if the centre will dismantle and copy machines that are in the country and then reproduce new ones.

Dr. George Afeti, the principal of Ho Polytechnic wanted to know the policies that have been set, to ensure that the market for the local producers of capital Goods is established and that users accept the local products, in order for Ghana to be competitive with regards to quality.

In response to the questions, the honorable minister Mr. Alan Kyerematen mentioned that design capability of the centre is very important. The proposed centre must have the capacity to have the platform to design. Without that, the centre will have problems with manufacturing capacity. The centre should be able to produce some machines and equipment through the entire value chain in foundry, etc on a commercial base. He reminded the house that it is not enough to stop at design. Ghana needs to go further by the same product infrastructure to produce high precision equipment. The level of existing capacity cannot do high precision. This is not because Ghana lacks the requisite skills but because the engineering tools are not available. If Ghana is able to do these, then we can also receive engineering designs from other countries to produce for export. We can also provide support to existing capital goods centres integrating the existing institutions through subcontracts.

Mr. Robert Woode added that, with regards to quality, there is no way Ghana cannot achieve that if we use the required machines needed to produce the precision products.
The minister ended by informing the house that what we need is the need assessment for the capital goods centre to take off.

Tea Break

An address by Mr. Robert Tandor of the MOTI On MOTI's Overview on the Technology and Innovation Centre of capital Goods

Mr. Robert Tandor said The Technology Innovation Centre for Capital Goods is the first phase of the programmes the MOTI is implementing under the Industrial Reform and Accelerated Growth Programme. The rural enterprise development programme envisages one common viable industry which is local base to provide employment.

He added that Ghana is supposed to get a technology training centre that will help industries with the needed machinery and program. The industry is also expected to:

- Support the establishment of a foundry and machine tool centre to promote capital Goods.
- Provide infrastructural support and services to local machine tool enterprises.
- Introduce standards and quality management in the machine tool industry in the country.
- Provide academic training for first and second cycle educational institutes.

He went on to say that the basic things the technology centre has to deliver will depend on Government and donor funding. The project will be a private – public partnership with support from other agencies. For the project location, land of about 200,000 sq metres is required. The centre would be located at an area where there is an already existing foundry; where students can receive training; where there is market distribution and where there is available manpower. For this, cities being considered are Accra, Tema, Takoradi and Kumasi.

He continued by saying that with regard to technology transfer, there would be selection, implementation, adaptation and training. For the source of machinery acquisition a lot of countries are being considered. Funding will be from Government, bilateral donors and local banks. The project will be a joint venture programme. The supply units will include raw materials, foundry, training, utilities, metal works, heat treatment, finishing, and engineering design centre for precision standards. The ministry will therefore seek the support of industry and research institutions to give inputs into this concept.

He added that the foundry unit will include melting shop, moulding plants, sound testing and pattern shop. The tool room will include Computer Numeric Control (CNC) milling machines, lathe machines, metallurgical laboratory including spectrometer and other physical testing equipment (either hand or gear test). The purpose of this is to ensure precision, roughing and straightening. There will also be electromechanical thermal heat facility (temperature or furnace) to reduce stress in the final product. For the design unit, the centre will use mobility aid design ideas. He concluded by saying that it is the concept of the ministry to use either IS standards at the initial stage to produce for specification.

Presentation by Consultants

Before the presentation on the Market Research, the leader of the Consulting Team representing Ecorys, Mr. Marcel van den Broek informed the stakeholders that views and opinions on the technology centre were very important since they will be the beneficiaries of the centre. They were therefore to assess the strengths and weaknesses of the options provided, how the technology centre should be structured, what focus it should take and how the market should be structured and implemented. He concluded by saying that in doing so, they need to focus on the things that Ghana as a country can do best and concentrate on that.

Mr. Matthew Armah of Bruks Associates then presented findings of desk research and market survey conducted. Mr. Marcel van den Broek then presented various strategies and options for the setting up of the centre. He also further took the participants through a multicriteria analytical tool to enable them prioritize the various options.

In reaction to that the MCA tool, Mr. Woode said, he thinks not all the criteria identified in the tool had been looked at yet. It was the responsibility of Government to take the initiative as a catalyst to drive the industrialization of a capital tool centre.

The Chairman then asked Mr. Marcel van den Broek to put forward the due processes and allow stakeholders to give their own service offering opinions using groups. After a long discussion on the various listed options provided, all stakeholders agreed that the current list on the service and market options be revised because it does not capture the important issues. Thus the listed options were changed from:

1. Service Options
    - Production of non Standardized capital goods
    - Training
    - Research and Development Activities
    - Keeping available process Facilities
    - Consulting
    - Financing
    - Marketing

2. Market Focus Options
    - Food Crops
    - Timber
    - Cotton
    - Food Processing
    - Petroleum
    - Textiles
    - Construction

To:

1. **Service Options**
    - Production of Specialized Capital Goods
    - Training and Knowledge Transfer
    - Research and Development Activities
    - Service and Facilities
    - Consulting and Human Resource
    - Managing Funds
    - Marketing and Logistics

2. **Market Focus Options**
   - Agricultural Production
   - Wood Processing
   - Automotive Industry
   - Food Processing
   - Chemical Industry
   - Textile Industry
   - Mining and Construction
   - Machine Tooling
   - Water and Sanitation

Participants were then asked to make the necessary corrections on the multicriteria analysis questionnaires that had been distributed earlier before answering the questions which participants did.

Lunch Break

Whilst data on individual opinions were being entered for analysis, participants were divided into three groups based on the three (3) options (service, market and institutional) identified by the consultants to deliberate in relationship to other key issues such as the expectations of public and private sectors.

After participants returned from their group discussions, the results of the multicriteria analysis administered to participants individually were discussed. It was found out that 48% of the participants were producers, 19% government and 33% support institutions and capital goods users. The findings were as follows:

- The technology centre should be in Alignment with industry demands.
- All the service options provided was regarded by all as very important.
- All the market focus options were considered by all stakeholders as important and so the technology centre should concentrate on all the listed sectors of the economy.
- Again all structures within the institutional options were considered as necessary.

The implication of that as pointed out by Mr. Marcel van den Broek the team leader of the consulting group was that more investment would be required for this.

Team leaders of the three groupings were asked to present the conclusions of their discussions which findings are in the annexure of this report.

Closing of Workshop

The workshop came to an end with a concluding message from the chairman Mr. P. V. Obeng. He said that the Steering Committee participation will go beyond what had been done at the workshop. They will take into consideration all the sentiments and then the outcome will be shared with the stakeholders.

The workshop ended at about 5:25pm.

Compiled by Rita Adwoa Peprah
Bruks Associates (August 4, 2005)

LIST OF PARTICIPANTS FOR MOTI/UNIDO STAKEHOLDERS WORKSHOP ON TICCG ON AUGUST 2, 2005.

	Name	Organization	Address	Tel. No.	Fax	Product/Services
1	Isaac Appiah	Eastern Alloys Co. Ltd.	Box GP. 1844, Accra	022-306830	022-308043	Aluminium Louvre Frames (EACO)
2	A. K. Frimpong	MEMOT Co. Ltd.	Box 6233, Accra-North	021-223805	021-322773	Agric Machine etc
3	Edwin Gagba	MEMOT Co. Ltd.	Box 6233, Accra-North	021-223805	021-322773	Agric Machine etc
4	J. K. Boamah	MOFA - AESD	Box M 82, Accra	021-777789		
5	Elane Asafo Adjaye	UNIDO	Accra	021-785034	021-773898	
6	Dan Baffour-Awuah	UNIDO	Accra	021-782537	021-773898	
7	Ebenezer Acquaah-Harrison	Past President AGI	Box M 119, Accra	021-400567		*Advisor in TUET*
8	Emmanuel O. Lamptey	NBSSI	Box M 85, Accra	021-661396	021-661394	MSE Development
9	H. Adu-Mante (Mrs.)	NBSSI	Box M 85, Accra	021-668641-2	021-661394	Public Relations
10	L. D. Baeka	NBSSI	Box M 85, Accra	024-479-9019	021-661394	MSE Development
11	Elizabeth Nguah	NBSSI	Box M 85, Accra	021-661393	021-661394	MSE Development
12	Kwame Siame	NBSSI	Box M 85, Accra	021-669708	021-661394	MSE Development
13	Nick A. Sosu	GSB	Box MB 245, Accra	020-815-0701	021-500092	*Standardization &* Quality Assurance
14	Lawrence Carbong	Anfom Machine Shop	Box SC 470, Tema	024-403-6589		Bolts & Nuts Production
15	Mr. Isaac Anfom	Anfom Machine Shop	Box SC 470, Tema	020-818-2839		Bolts & Nuts Production
16	K. O. Konadu	Koppo Eng. Co. Ltd.	Box CS 8572, Tema	022-302343		Machine & Fabrication
17	Mike O. Konadu	Koppo Eng. Co. Ltd.	Box CS 8572 Tema	024-476-8645	mokonadu@yahoo.co.uk	Machine & Fabrication
18	Mr. J. A. Assuah	CEASSUAH ENT	Box 8250, Tema	022-306127		Fabrication & Spinning Moulds
19	Dr. Peggy Oti Boateng	TCC, KNUST, Kumasi	TCC, KNUST, Kumasi	051- 60296	051-60137	Technology Transfer
20	George Y. Obeng	TCC, KNUST, Kumasi	TCC, KNUST, Kumasi	051- 60296	051-60137	Technology Transfer
21	K. Ntim Donkoh	MOTI	Box M 47, Accra	021-686546	021-662428	Civil Servant
22	Daniel Keelson	MOTI	Box M 47, Accra	024-460-9533	021-662428	Civil Servant
23	Kwame Mante-Bediako	MOTI	Box M 47, Accra	024-414-4131	021-662428	Civil Servant

24	Samuel Amanor Godji	MOTI	Box M 47, Accra	024-414-4131	021-662428	Civil Servant
25	Andrew E. Quayson	MPSD/PSI	Box 46, Accra	021-662048	021-662086	Civil Servant
26	Kwasi Poku	MPSD/PSI	Box 46, Accra	021-685013	021-685013	Government Official
27	Sam A. Quaye	ENTESEL	Box CS 8071, Tema	022-306856	022-306856	Engineering manufacturing
28	A. D. Akba	UNIDO	Box M 23, Accra	021-782537	021-773898.	
29	F. O. Kusi	MOTI	Box M 47, Accra	021-663376	021-662428	Civil Servant
30	Kobin Kesse	Danmens Eng	Box AX 276, Takoradi	024-436-5646		Manufacturing
31	Seth Evans Addo	MOTI	Box M 47, Accra	021-679283	021-662428	Civil Servant
32	S. Y. Bortsi	MOTI	Box M 47, Accra	021-686524		Government
33	Ruby S. Tetteh	MOTI	Box M 47, Accra	021-686555		Government
34	Daniel Kwame Numo	DENCO Foundry	Tema	022-305221		Private
35	Ama Sakyibea Kwakye	MOTI	Box M 47, Accra	021-686539		Government
36	P. V. Obeng	O. B. Associates	Tema	022-300509	022-300508	Private
37	G. M. Afeti	Ho Polytechnic	Ho	091-28398		Education & Training
38	Charles Dawson	Agbemskod	Accra	024-4791966		Fabricators
39	Eric Amoah	Benod Machine Shop	Accra	021-225405		Manufacturing Industry
40	Daniel Akomio-Siaw	Benod Machine Shop	Accra	021-225405		Manufacturing Industry
41	R. B. Tandor	MOTI	Accra	021-686560	021-662428	Government
42	Yaw Amponsah Amoah	Bruks Associates	No. 6,6 Ringway Estate Accra	021-769289	021-7011857	Consultancy services
43	Kwesi Korboe	Bruks Associates	No. 6,6 Ringway Estate Accra	021-769289	021-7011857	Consultancy services
44	Rita Adwoa Peprah	Bruks Associates	No. 6,6 Ringway Estate Accra	021-769289	021-7011857	Consultancy services
45	Kris Kapoor	Dunkwa Continental Goldfields Ltd.	39 Aviation road, Accra	021-775631/020-2018801	021-778637	Copian Goods Manufactures & Engineers
46	Dr. Essel Ben Hagan	CSIR-IIR	Box LG 576, Accra	021-500193	021-500193	Industrial Research & Development
47	Manfred Lawson	CEASSUAH ENT	Box C8250, Tema	027-7707568		Machining & Fabrication of dies, moulds, etc

48	Frank W. Agbley	MOTI/UNIDO	Box 1423	024-414-8422	
49	E. K. Tay	Accra Machine Shop Ltd.	Box 1881	020-811-0625/021-689857-8	Fabrication Services
50	Robert Woode	FATECO	Accra		
51	E. K. Anka	Ghana Metal Fabrication Co. Ltd.			
52	Sheini-M. Abu Bakar	GRATIS Foundation	Tema		
53	Ameyaw Baafi	Accra Technical Training Centre	Accra		
54	Emmanuel Abekah Kwansah	Abek-Sandfeld Gh. Ltd.			
55	Asibu Yartey F. A.	Continental Plastics			
56	Solomon Baffu	Great Kosa Ltd.			
57	Kwame Amofa	Ghana Railways Co. Ltd.	Takoradi		
58	Nicholas Mensah Nai	Hiram Engineering Ltd.			
59	A. R. Krishnan	Tema Steel Co. Ltd.	Tema		
60	Joseph A. Hanson	De-Hans Foundry Ltd.			
61	K. Owusu-Adjei	Ghana Railways Co. Ltd.	Takoradi		
62	Fred Dokosi	Ghana Metal Fabrication Co. Ltd.			

ANNEX - Group Reports

1. **Group I – Service Options**
   - Alignment with Government Objectives 20%

   This is due to the fact that the government is seen as a facilitator and therefore has limited control.
   - Alignment with Industry Demands 35%

   This is because the industry is where the fieldwork is executed and this should be slightly higher than the government
   - Stakeholders Acceptance 10%
   - Bankability 10%

   The banker will assess the economic viability of the project and will assist only when the project has taken off in order not to lose his investment
   - Ease of Implementation 5%

   This is very necessary since what should be done must have no hindrances
   - Sustainability 20%

   A project which is not sustainable is not feasible

2. Group II – Market Focus Options Ranking
   - Food Processing 9

   This is to cut down on post harvest losses
   - Agricultural Production 8

   The emphasis is on producing appropriate tools in order to increase productivity
   - Machine Tooling 7

   We need the machine capability to be able to produce the machines required for the industries listed. Accessibility to machines should be critical for our rural folks to move from subsistence farming to mechanized farming
   - Waste and Sanitation 6

   To enable us as a country collect and process our waste products
   - Automotive Industry 5
   - Mining &Construction 4
   - Wood Processing 3
   - Chemical Industry 2
   - Textile Industry 1

3. Group III – Institutional focus Options Ranking
   - Adding a new institution 5
   - Industry Restructuring 4
   - Upgrading of existing institutions 3
   - Merging existing institutions 2
   - Coordinating 1

The reasons supporting their options are:

- There is the need to develop a green field technology centre that will develop programmes to facilitate Ghana's vision. This is because all the existing centres and facilities cannot fulfil dreams of this vision
- We need a programme committee serving as a Board to give vent to the central planning which would establish the central board to be made up of:
  - GRATIS
  - CSIR
  - Private Sector
  - Technical Institutions
  - Government Representatives
  - Donor Representatives
  - Others

  They would establish the user requirements e.g. Funding, Electroplating, tooling, Machining etc
- Stakeholders
  - Government – initiator which may off load shares to the private sector later.
  - Industry Financing – Banks like NIB
  - International Financial Services – IFC
  - Private Sector – Producers & Traders

ECORYS Research and Consulting

SOUND ANALYSIS • 75 YEARS • INSPIRING IDEAS

HANDOUT

STAKEHOLDER WORKSHOP

ON THE OPPORTUNITY ASSESSMENT FOR THE

TECHNOLOGY CENTRE FOR CAPITAL GOODS

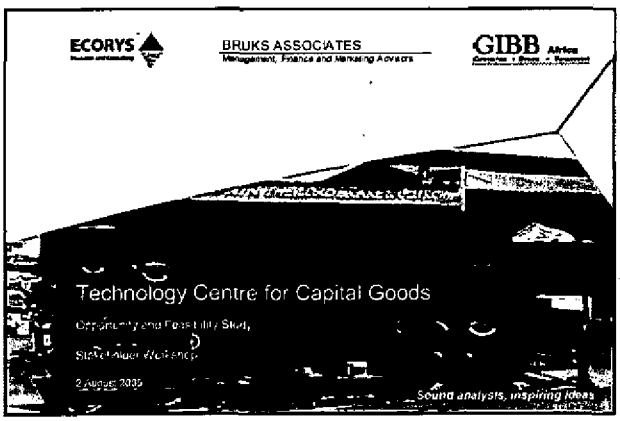
2 August 2005

CSIR/STERPRE Conference Room

ECORYS

BRUKS ASSOCIATES
Management, Finance and Marketing Advisors

GIBB Africa



Technology Centre for Capital Goods

Opportunity and Feasibility Study,
Stakeholder Workshop

2 August 2006

Sound analysis, inspiring ideas

Program of the Day

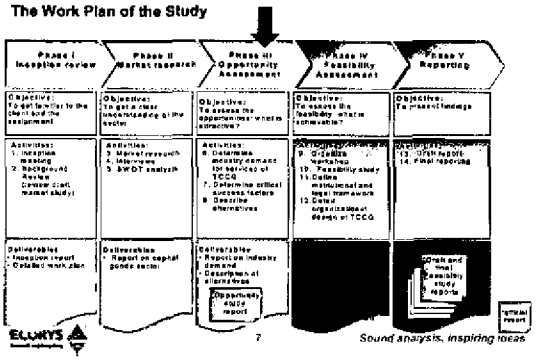
9.00	Opening	
10.00	Presentation of the Market Study	Matthew Arman
10.30	The Opportunity Study	Marcel van den Broek
11.00	Options Questionnaire	
12.00	Lunch	
13.00	The Questionnaire's Results	Marcel van den Broek
14.00	Discussion	
15.30	Conclusions of the Day	
16.30	End of Workshop	

Contents

Objective of the Study

- The opportunity and feasibility study is to constitute the basic information for the government's decision making and the preparation of the policy and strategy documents for the implementation of the Ghana Technology Center on Capital Goods (TCCG).
- In other words:
  - What should the TCCG do and why?
  - How should the TCCG do that and why?
  - When should the TCCG do that and why?
  - Is that all feasible?

The Work Plan of the Study



Objective of the Day

- To jointly select the
  - Service offerings for the TCCG
  - Market Focus for the TCCG
  - Institutional setting for the TCCG
- Though a multi-criteria analysis and discussion
- Taken into account the market research

I Opening of the Day

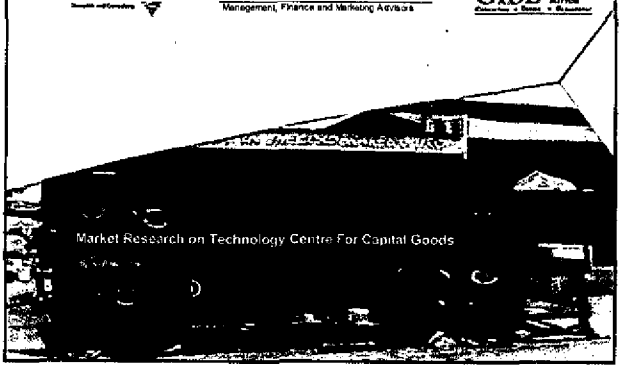
II The Opportunity and Feasibility Study

III **The Market Research**

IV The Opportunity Study

V Conclusion of the Day

ECORYS BRUKS ASSOCIATES Management, Finance and Marketing Advisors GIBB Africa



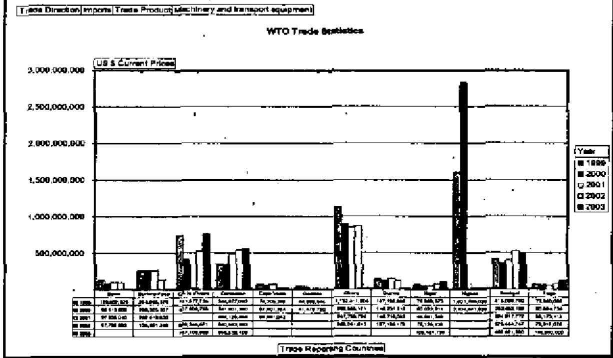
Market Research on Technology Centre For Capital Goods

- For the purposes of this report Capital Goods refer to real products that are used in the production of other products but are not incorporated into the new product.

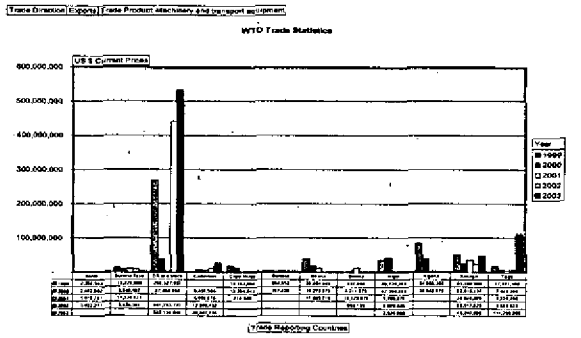
Limitations Of Trade Statistics

- While Trade statistics provide a useful channel for market research and assessing trade performance, they present some limitations:
- Trade statistics do not fully capture all the transactions taking place between countries, owing to compilation errors and omissions, smuggling and the non-reporting of transactions.
- Trade statistics occasionally include re-exports, which can artificially inflate the extent of trade.
- Trade statistics refer to the total value of transactions, which may be very different from local value added.
- Even at the lowest level of dis-aggregation, differentiated products exist within product groups.

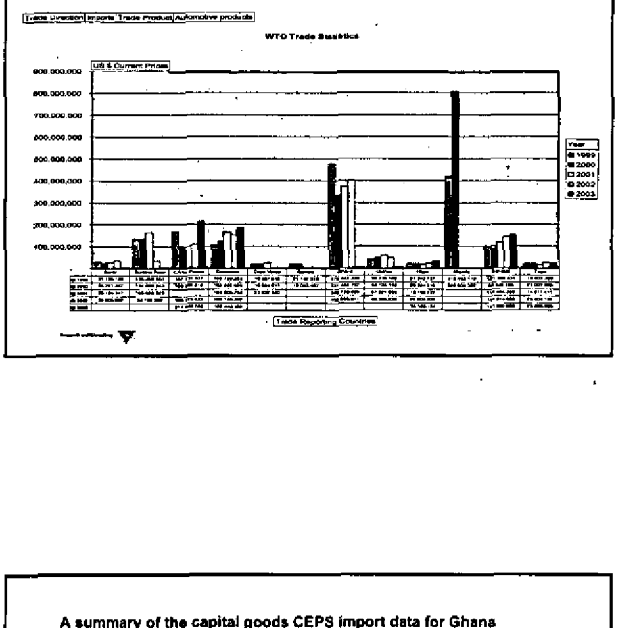
ECOWAS Imports of Machinery and Transport Equipment



ECOWAS Exports of Machinery and Transport Equipment



ECOWAS Imports of Automotive Products



Conclusions

- Nigeria and Ghana are significant importers of Capital Goods
- Cote d'Ivoire is a dominant exporter.
  - It is important to note however that Cote d'Ivoire's export performance may be due to significant re-exports France and the other land-lock Franco-phone countries.
- (1999-2000) that complete data is available, there was over $5.0 billion per annum worth of Machinery and Transport Equipment imports into West Africa (ECOWAS).
- (1999-2000) Ghana imported $0.86 - 1.0 billion worth of Machinery and Transport Equipment items.

A summary of the capital goods CEPS import data for Ghana

Product Description	2000 CIF Import Value ($)	2001 CIF Import Value ($)	2002 CIF Import Value ($)	2003 CIF Import Val ($)	2004 CIF Import Val ($)	% Growth 2001-2004
HS Code 73-82 Base and articles of base metal	21,519,827	86,024,887	112,909,868	348,560,375	306,676,385	
% Annual Change			41%	209%	-12%	58%
HS Codes 83-90 Machinery and Transport Equipment excluding Automotives	697,730,309	708,429,491	757,214,147	1,733,675,799	[illegible]	
% Annual Change			7%	129%	55%	34%
HS Code 87 Vehicle, Automotive Products	[illegible]	347,018,304	422,010,960	235,479,862	1,976,351,560	
% Annual Change			22%	-44%	739%	79%
Total for Capital Goods	697,859,748	1,055,447,995	1,179,227,195	1,967,955,661	4,655,304,008	
% Annual Change			12%	67%	137%	64%

CEPS IMPORT STATISTICS GHANA

Hs Code Groupings	CIF Imports 2004 Value	% of CIF Total
HS Code 73-82 Base And Articles of Base Metal	306,676,385	7%
HS Codes 83-90 Machinery, Mechanical, Transport, Equipment, Etc Excluding Automobiles	2,372,276,063	51%
HS Code 87 Vehicle, Automotive Products	1,976,351,560	42%
Total	4,655,304,008	

Observations

- *Items under the HS Codes 73-82 that are basically simple articles of base metals like tubes,* springs, bolts and nuts etc. these recorded an average growth rate of 56% per annum.
- Machinery and Transport Equipment within the HS Code range 83-90 (excluding HS code 87) also recorded an average growth rate of 56% per annum.
- Automotives products (HS Codes 87) however recorded a significant rate 79% per annum. This high rate may be due to the high imports of used vehicles and cars into the country.
- The overall growth rate for the entire items in the Capital Goods categories shows a significant growth rate of 64% per annum within the period under discussion.
- Details of the various sub-group items are provided in the Annexes.

Conclusions

- *There is a significant and growing demand for imported capital goods in Ghana which is* currently in the region of $4.6 billion.
- Two categories above with highest growth rates also present a significant opportunity for setting up a domestic capital goods industry in Ghana.
- Imports of Machinery, Mechanical, and Transport Equipment account for the highest percentage of 51% of this $4.6 billion imports.

Profile of Domestic Market for Capital Goods in Ghana

Major Sectors	*Product Group and Services*
Manufacturing	Food processing machinery & equipment and farm implements, Improved cooking stoves, commercial and domestic utensils, foundry products
Vehicle repair and Maintenance	Engine overhauling, auto electrical works, vehicle interior upholstery, auto body straightening & spraying
Metal working	Metal fabrication and plant construction using sheet metals, angle irons, channel irons, bars etc.
Sale of engineering materials & accessories	Sheet metals, bars, iron rods, steel sections. Hand tools, fasteners, electric motors, pumps etc.
Sale of automobile spare-parts	Used engines and parts, car decorating materials etc

PRIMARY DATA SURVEY Objectives

- Assess the gap between the current level of technology available in Ghana for the production of capital goods and desired level as perceived from the view of
- Support institutions and
- Government.
- Producers of Capital Goods,
- Users of Capital Goods,

Survey therefore seeks to profile:

- Machinery and equipment, operating environment and related capacities.
- Constraints underlining current level of capacity utilisation.
- Strategies identified by respondents to address constraints.
- Current adequacy of support to the capital goods sector way forward.

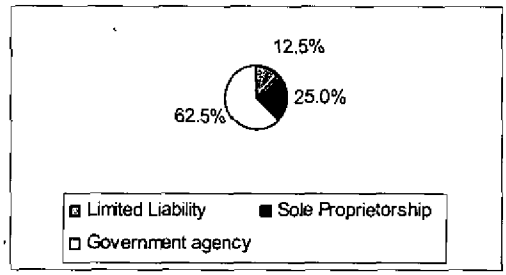
Methodology

- Firms interviewed under this study were selected based upon previous knowledge of their activities;
- Used the Association of Ghana Industries database and;
- Initial interviews of identified contacts including those from Steering Committee.
- The details specific to a firm are not revealed in this paper; data and figures are consolidated to provide an overview of the capital goods situation in Ghana today.

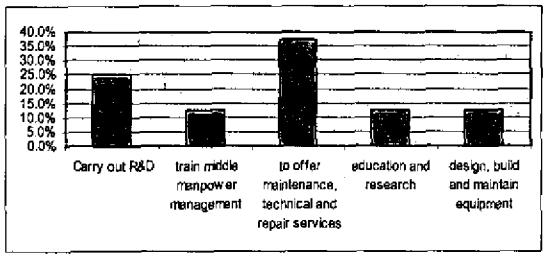
Sample Size and Location of Study

	Users of Capital Goods	Producers of capital goods	Support Institutions
Greater Accra Region	24	16	5
Western Region	11	10	
Ashanti Region	12	14	4
Central Region	2		
Brong Ahafo	2		
Total	51	40	9

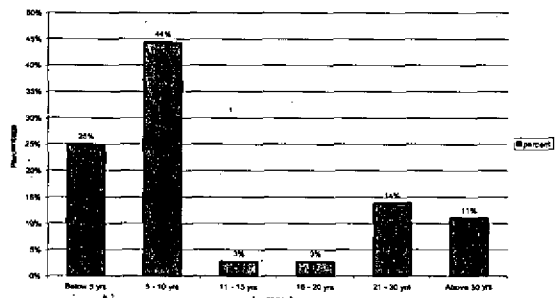
SURVEY FINDINGS OF SUPPORT INSTITUTIONS



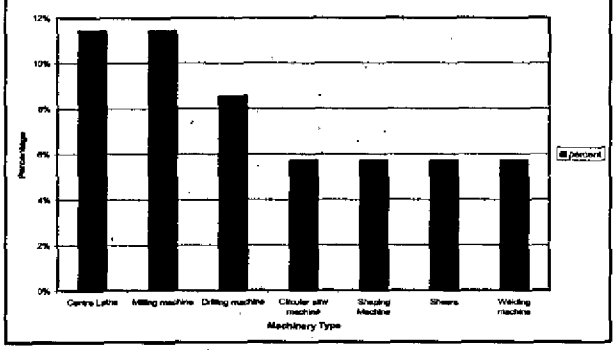
Purpose of being in Business-Support Inst.



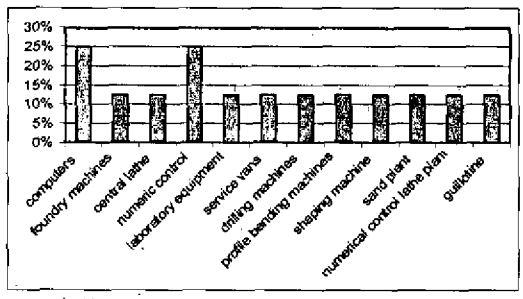
Average Age of Machinery /Equipment Used by Support Institutions



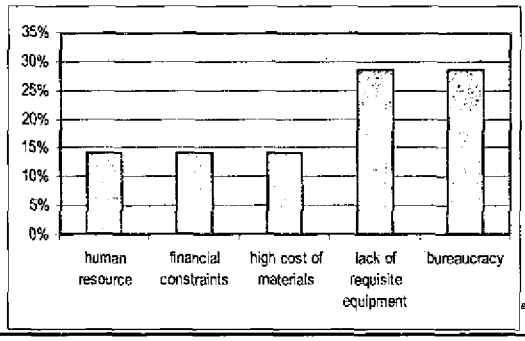
Type of Machinery / Equipment Currently used by Support Institutions



Support Inst. 5-10 Year Investment Vision



Support Inst. Major bottlenecks identified



ers

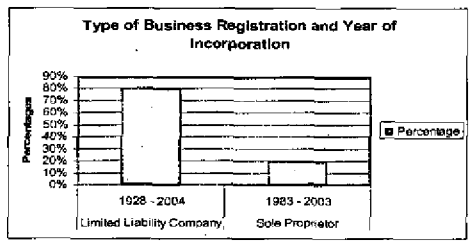
Conclusions

- Government had always played a key role in the provision of support to industries in the country which are in line with the countries industrialisation policy and drive. The role of government is very important but care should be taken to ensure that, that role does not impede the running of such centres.
- The private institutions have recently made machinery and equipment acquisition to provide support services to producers and users in the sector. Their objectives are similar to those owned by Government institutions. They are responding to a market demand.
- That, designing and prototyping was not the primary focus of most support institutions but rather repair and maintenance.
- There is a minimal use of computer assisted design and computer numeric control systems in the production process. Respondents identified these as major requirements for investment.

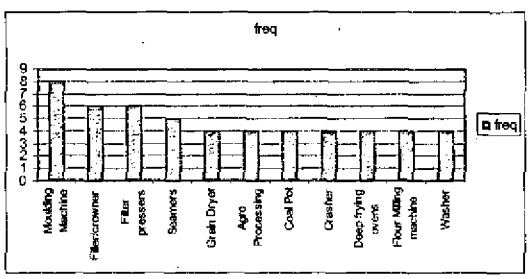
Conclusions

- That, bureaucracy and lack of requisite upgraded machinery and equipment are the key issues negatively affecting the delivery of good services. The reasons for this can be explained in various ways.
  - Most of the support institutions are government agencies. Thus, management have to contend with significant bureaucratic delays with respect to acquisition of equipment, budget support and policies.
  - This in turn may affect the quality of their output.
- That, in the establishment of such a centre of excellence, the management structure adopted needs to be carefully evaluated to ensure sustainability of operations.
- That, modern equipment with emphasis on ICT is procured to provide more enhanced support for any proposed centre of excellence and any financial support that is provided should be structured such that it is geared towards.
  - The acquisition of equipment to support new trends and developments
  - The maintenance and support of research and development functions of the centre

Users Of Capital Goods



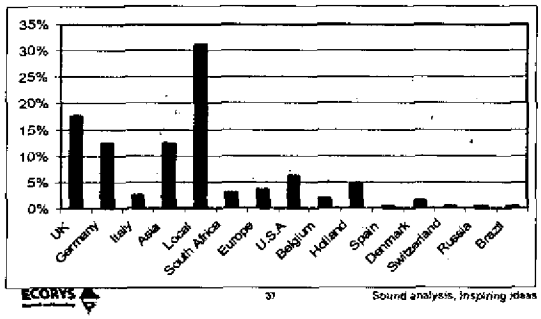
SURVEY FINDINGS OF CAPITAL GOODS USERS



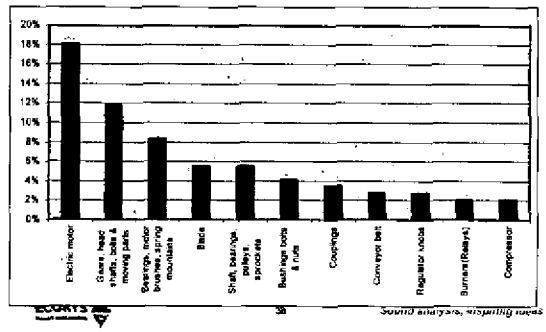
Age Distribution of Listed Machinery

Age Distribution of Machinery/ Equipment Currently Used by users	Frequency	Percentage
Below 5 yrs	76	33.78%
5 - 10 yrs	69	30.67%
11 - 15 yrs	23	10.22%
16 - 20 yrs	20	8.89%
21 - 30 yrs	23	10.22%
Above 30 yrs	14	6.22%
Total	225	100.00%

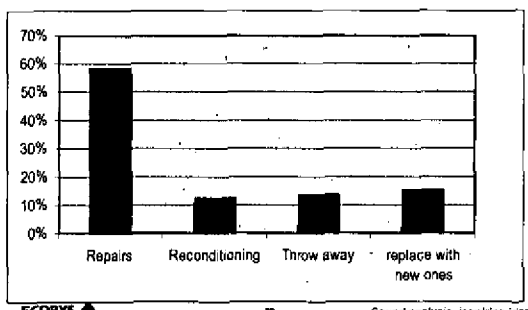
Capital Goods Users Sources of Equipment



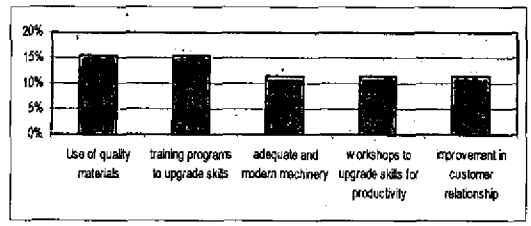
Major defective parts /components



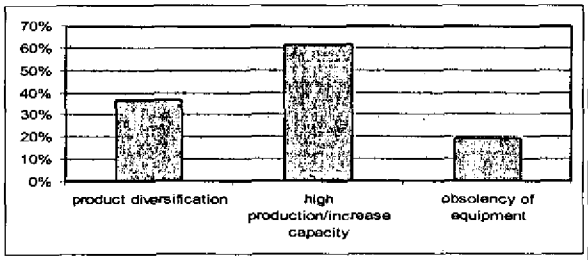
How defective components of Equipment are Treated



Users Views on How To improve the quality of services rendered by manufacturers of capital goods



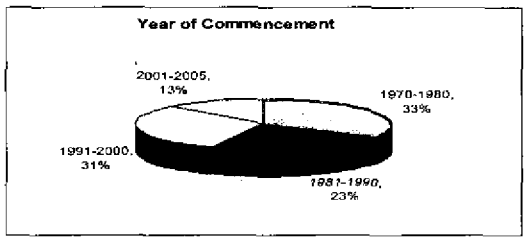
84% Plan Investments 5-10 years -Reasons



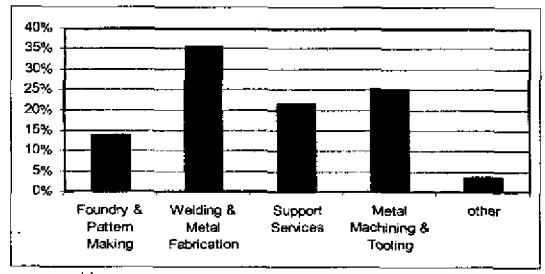
Conclusions

- That, most users of capital goods have, at least one piece of equipment sourced and fabricated in Ghana.
- That, the preferred option for users of capital goods is to repair the defective components and parts of their machinery or equipment rather than for them to purchase new ones.
- That the quality of raw materials used and level of skill training of capital goods manufacturers are of concern to users.
- That there is a desire amongst users of capital goods to increase their current capacities by making new investments to expand and diversify production.

SURVEY FINDINGS OF CAPITAL GOODS PRODUCERS



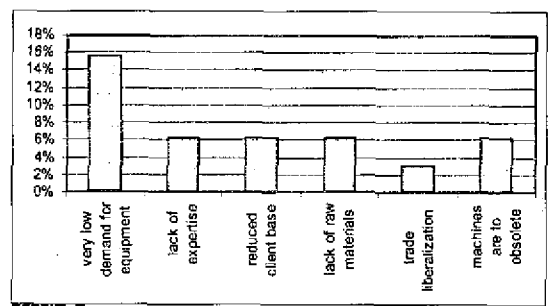
Key Areas of Functionality



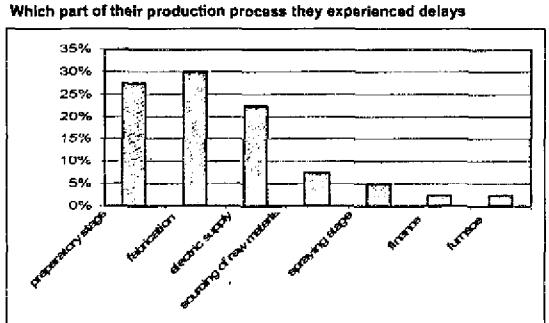
Most frequently listed Key equipment

Machine type- producers	freq	percent
Drilling Machine	36	18%
Guillotine/Cutting Machine/Hacksaw	22	11%
Grinding machine	16	8%
Shaping Machine	16	8%
Electric Welding Set	15	8%
Milling Machine	15	8%
Centre Lathe	10	5%
Small lathe machine	8	4%
Rolling Machine	7	4%
Band saw	6	3%

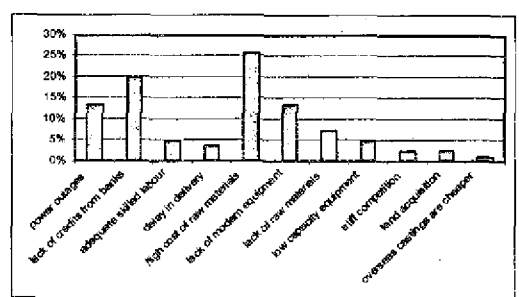
Reasons for current levels of capacity utilisation.



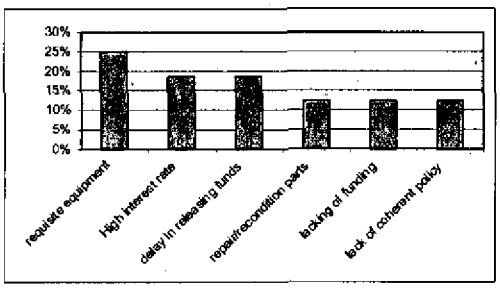
Which part of their production process they experienced delays



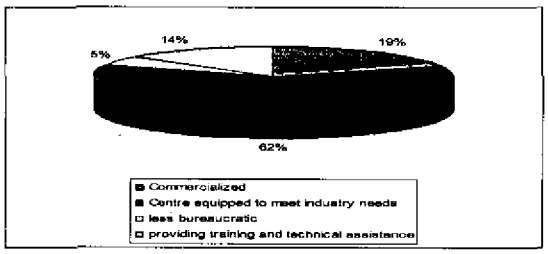
Identify major challenges in production



Main limitation of support institutions – Producers Perspectives



Type of Centre



Conclusions Producers

- That, most capital goods producers were of the opinion that there was the need to acquire equipment which precised and also reduced production time
- That, majority of producers were not happy with their current level of capacity utilisation and gave some reasons such as lack of quality equipment and machinery and which tends to be very expensive even if one decides to acquire it from abroad and finally the high cost of raw materials
- Producers were also not happy with the services of support institutions and blamed it on their lack of quality equipment and were of the opinion that they needed to acquire state of art equipment
- Producers of capital goods indicated the need to locate any proposed centre of excellence in Accra or near the major industrial areas. The tool centre should be structured commercially in order to ensure that government interferences are reduced if not minimal

Objective of the Opportunity study

- To define the strategic options for the envisaged Technology Centre for Capital Goods in terms of where and how to compete.
- Based on an analysis of the sector and the market for capital goods and the resulting strengths, weaknesses, opportunities and threats.

The Strengths of the Capital Goods Sector

1. Matured industry
2. No capacity constraints
3. Strong engineering knowledge base and technical skills
4. Well established support institutes
5. Well developed educational facilities

The Weaknesses of the Capital Goods Sector

1. Lack of economies of scale
2. Poor knowledge dispersion
3. Limited availability and high costs of funding
4. Inability to recover high costs of raw materials
5. Lack of requisite equipment

The Opportunities for the Capital Goods Sector

1. Growing demand in Ghana for capital goods
2. Government policy aimed at enforcing the sector
3. Growing demand in the ECOWAS region for capital goods
4. Availability of scrap material

The Threats for the Capital Goods Sector

1. Increasing competition of low-cost producers
2. Increasing competition of high quality producers

The SWOT Analysis in Summary

Strengths	Weaknesses
1. Matured industry 2. No capacity constraints 3. Strong engineering knowledge base and technical skills 4. Well established support institutes 5. Well developed educational facilities	1. Lack of economies of scale 2. Poor knowledge dispersion 3. Limited availability and high costs of funding 4. Inability to recover high costs of raw materials 5. Lack of requisite equipment
1. Growing demand in Ghana for capital goods 2. Government policy aimed at enforcing the sector 3. Growing demand in the ECOWAS region for capital goods 4. Availability of scrap material	1. Increasing competition of low cost producers 2. Increasing competition of high quality producers
Opportunities	Threats

The Key Challenges consequently for the TCCG

1. Enabling economies of scale through specialization
2. Enhancing knowledge dispersion
3. Enabling investments in requisite equipment

The Key Questions for the TCCG

- Service Offering options -> What should the TCCG do?
- Market Focus options -> Where should the TCCG compete?
- Institutional Setting options -> How should the TCCG be organised?

The Service Options

1. Production of specialized capital goods or components
2. Training and knowledge transfer
3. Research and Development
4. Facilities
5. Consulting and human resources
6. Financing
7. Marketing and logistics

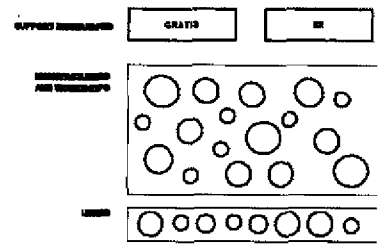
The Market Focus Options

1. Agricultural Production
2. Wood Processing
3. Automotive
4. Food processing
5. Petrochemical/pharmaceutical
6. Textile
7. Mining & Construction
8. Machine Tooling
9. Water & Sanitation

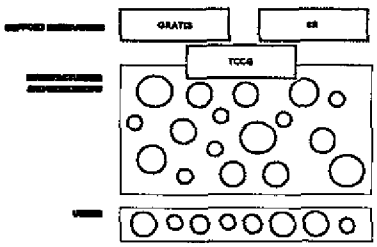
The Institutional Setting Options

1. Upgrading of existing institutions
2. Adding a new institution
3. Merger existing institutions
4. Coordinating Body on top of existing institutions
5. Industry restructuring

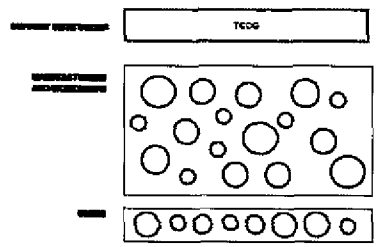
Upgrading of existing institutions



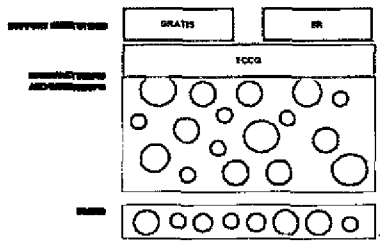
Adding a new institute



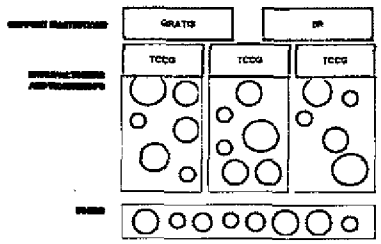
Merger existing institutions



Coordinating Body



Industry Restructuring



Evaluating the Options through Multi-Criteria Analysis

- Define Criteria
- Weight Criteria
- Rank options per criteria
- Weight X Rank = Score

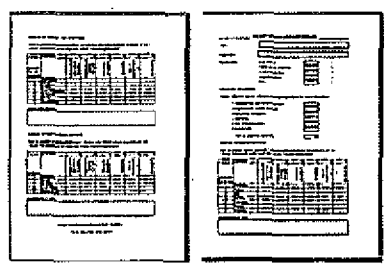
The Criteria

1. Alignment with government objectives.
2. Alignment with industry demand
3. *Stakeholder acceptance*
4. Bankability
5. Ease of implementation
6. Sustainability

The Ranking

- Service Offering options -> A scale from 1 to 7 (7 is most, 1 is least)
- Market Focus options -> A scale from 1 to 7 (7 is most, 1 is least)
- Institutional Setting options -> A scale from 1 to 5 (5 is most, 1 is least)

The MCA Form



An example

	WEIGHT	20%	20%	20%	10%	10%	20%
	CRITERIA	1	2	3	4	5	6
SERVICE OPTIONS		Alignment with government objectives	Alignment with industry demands	Stakeholder acceptance	Bankability	Ease of implementation	Sustainability
1	Production	3	1	5	3	6	7
2	Training	6	6	6	7	7	4
3	R&D	7	5	7	5	3	6
4	Facilities	4	2	4	4	4	2
5	Consulting	2	3	2	6	1	1
6	Finance	1	7	1	1	1	5
7	Marketing	3	4	3	2	2	3

Result of the example

	CRITERIA	1	2	3	4	5	6	
	WEIGHT	20%	20%	20%	10%	10%	20%	
SERVICE OPTIONS		Alignment with government objectives	Alignment with industry demands	Stakeholder acceptance	Bankability	Ease of implementation	Sustainability	TOTAL
1	Production	1	0,2	1	0,3	0,6	1,4	4,5
2	Training	1,2	1,2	1,2	0,7	0,7	0,8	5,8
3	R&D	1,4	1	1,4	0,5	0,3	1,2	5,8
4	Facilities	0,8	0,4	0,8	0,4	0,4	0,4	3,2
5	Consulting	0,4	0,6	0,4	0,6	0,5	0,2	2,7
6	Finance	0,2	1,4	0,2	0,1	0,1	1	2
7	Marketing	0,6	0,8	0,6	0,2	0,2	0,6	3

I Opening of the Day

II The Opportunity and Feasibility Study

III The Market Research

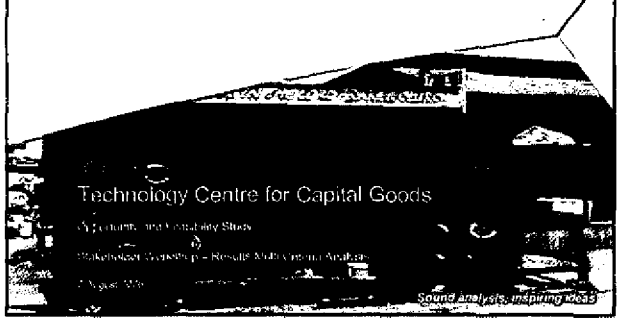
IV The Opportunity Study

V Conclusion of the Day

ECORYS

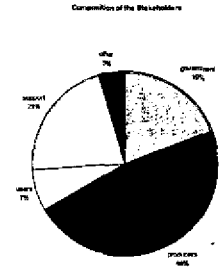
BRUKS ASSOCIATES
Management, Finance and Marketing Advisors

GIBB Africa

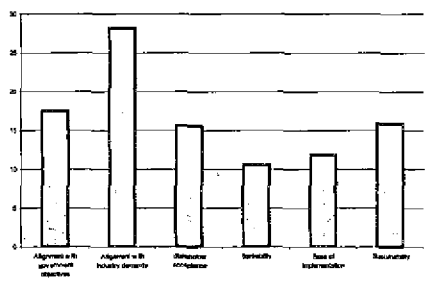


Technology Centre for Capital Goods

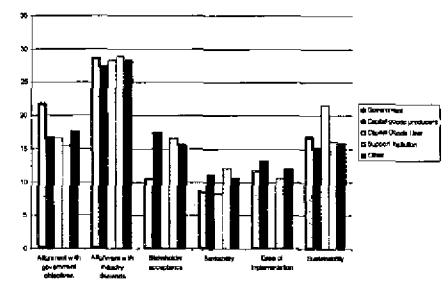
Sound analysis, inspiring ideas



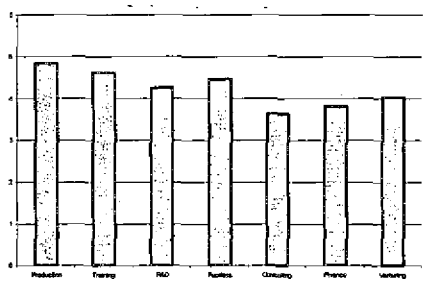
ECORYS 2 Sound analysis, inspiring ideas



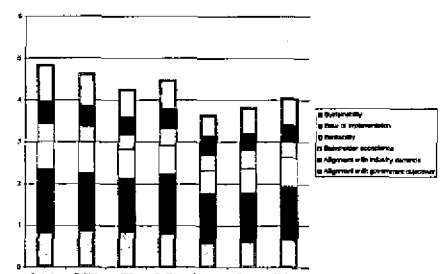
ECORYS 3 Sound analysis, inspiring ideas



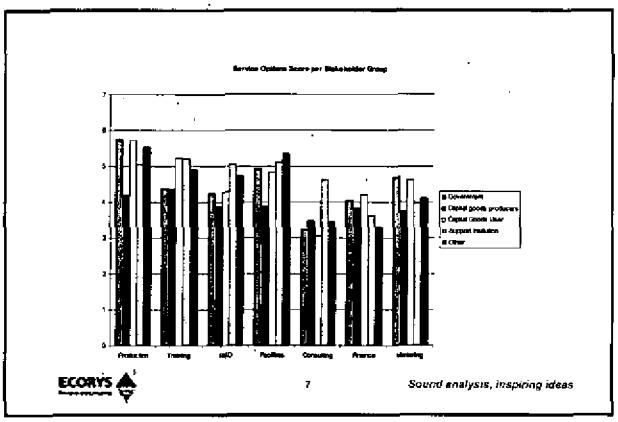
ECORYS 4 Sound analysis, inspiring ideas

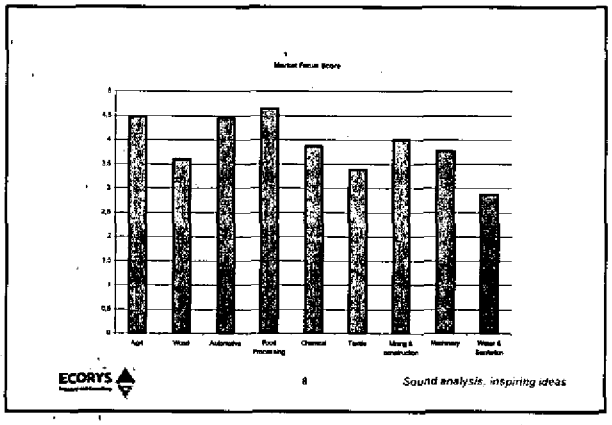


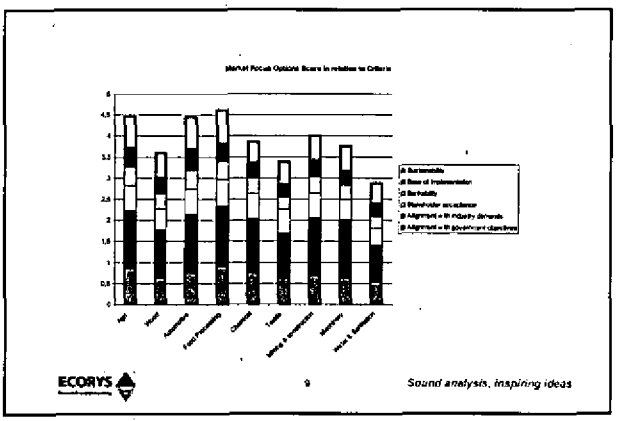
ECORYS 5 Sound analysis, inspiring ideas

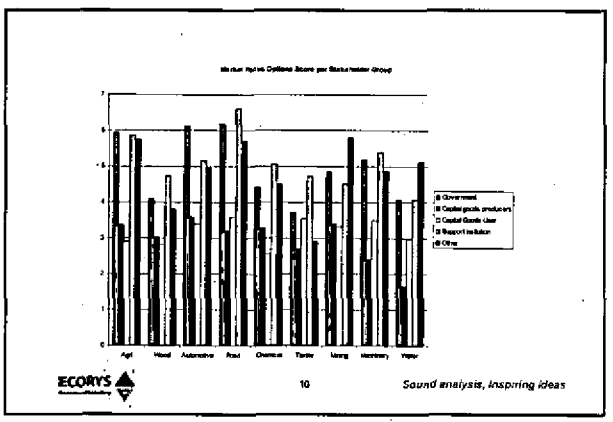


ECORYS 6 Sound analysis, inspiring ideas


Government
Capital goods producers
Capital goods user
Support institution
Other
Production
Training
R&D
Facilities
Consulting
Finance
Marketing


Agri
Wood
Automotive
Food Processing
Chemical
Textile
Mining & construction
Machinery
Water & Sanitation


Sustainability
Ease of implementation
Durability
Stakeholder acceptance
Alignment with industry demands
Alignment with government objectives


Government
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Chemical
Textile
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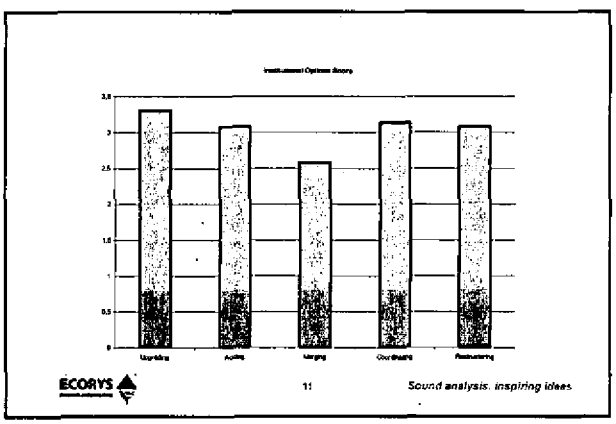
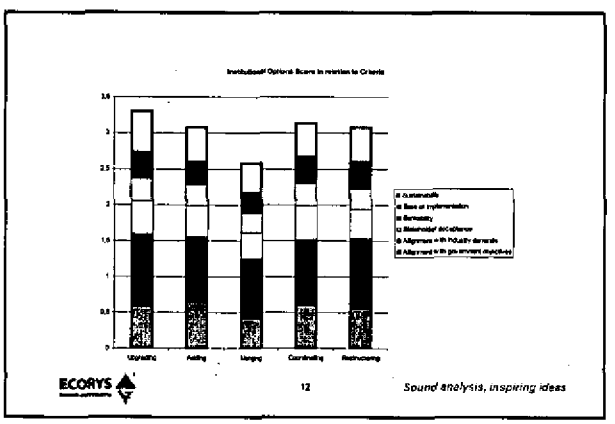
Machinery
Water


Upgrading
Auditing
Merging
Coordinating
Restructuring


Upgrading
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Merging
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