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FOLLOW - UP SYMPOSIUM  
ON

STUDY OF THE MANUFACTURE OF INDUSTRIAL CHEMICALS  
IN  
THE MEMBER STATES OF THE SOUTHERN AFRICAN DEVELOPMENT  
CO-ORDINATION CONFERENCE (SADCC)

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Dar Es Salaam  
UNITED REPUBLIC OF TANZANIA  
10<sup>th</sup> - 11<sup>th</sup> September, 1990

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R E P O R T

elaborated by the team of experts of TKP CONSULTANTS LTD  
WARSAW - POLAND

Note:

This Report has not been cleared with the United Nations Industrial Development Organization, which does not therefore necessarily share the views presented.

11

	<u>Page</u>
1. INTRODUCTION	3
2. ORGANIZATION OF THE SYMPOSIUM	5
2.1. Opening of the Symposium	
2.2. Introduction of SADCC Industrial Development Strategy	
2.3. Presentation of the UNIDO Study Report (findings, observations, conclusions) and Methodologies used for Evaluation	6
Issue A. Summary of the Report and Methodology of Forecasting Consumption of Industrial Chemicals	
Issue B. Fertilizer Industry	3
Issue C. Organic and Petrochemical Industry	15
Issue D. Inorganic Chemical Industry	20
Issue E. Methodology of Programming Development of the Chemical Industry	25
2.4. Presentation of TISCO Study on Industrial Sectoral Plan on Industrial Chemicals, comments and discussion	27
2.5. SADCC SITCD Recommendations and Approval of the Symposium Report. Closing of the Symposium.	29
3. UNIDO TEAM CONCLUSIONS, RECOMMENDATIONS and ACTION PLAN aiming at ACCELERATION of CHEMICAL INDUSTRY DEVELOPMENT in the SADCC Region	30
3.1. Fertilizer Industry	
3.2. Inorganic Industry	36
3.3. Organic/ Petrochemical Industry	39
3.4. Other Chemical Industries	40
3.5. General Conclusions and Recommendations	42
<u>Annexes</u>	
List of Participants	43
SITCD Report on Industrial Chemicals Workshop	-

## 1. INTRODUCTION

1.1. The follow-up Symposium on the REPORT ON THE STUDY ON THE MANUFACTURE OF INDUSTRIAL CHEMICALS IN THE MEMBER STATES OF THE SOUTHERN AFRICAN DEVELOPMENT CO-ORDINATION CONFERENCE (SADCC) was held in Dar Es Salaam, URT, from 11 to 12 September, 1990.

1.2. The Symposium called Workshop was organized by SADCC Industrial and Trade Coordination Division (SITCD), located in Dar Es Salaam.

1.3. Short introduction of the Report titled "INDUSTRIAL DEVELOPMENT POLICIES AND STRATEGY" prepared in 1990 by SITCD for SADCC Member States was presented at the Symposium, followed by presentations of:

- The REPORT ON THE STUDY ON THE MANUFACTURE OF INDUSTRIAL CHEMICALS IN THE MEMBER STATES OF SADCC, prepared by UNIDO in 1988,
- The REPORT ON DEVELOPMENT OF PRODUCTION OF THREE INDUSTRIAL CHEMICALS: caustic soda, sodium silicate and starch in SADCC Member States, made in 1989 by a Tanzanian consulting company - TISCO.

1.4. Low decision-level representatives only of three SADCC Member States participated in the Symposium namely of: Malawi, Tanzania and Zambia despite of efforts by SITCD to discuss the reports by all nine Members. Unsignificant representation of SADCC Members affected negatively the Symposium results and proper dissemination of the reports presented.

It must be noted that 2.5 year postponement of the Symposium organization resulted in low level of participants acquaintance with the Report on UNIDO Study contents and resulted in scope of discussion which was rather unimpressive and hardly contributed any new findings, approaches and significant remarks. Every effort should be made to avoid such a delay in the future.

Another Report discussed on the Symposium, made by TISCO was unfortunately not disseminated among participants prior to the Symposium, so limited discussion took place.

1.5. SITCD elaborated for its own purposes wide excerpts from the UNIDO Report concerning Fertilizers and Inorganic Branches.

1.6. The SADCC Report on the Symposium covering general recommendations of the three reports presented was drafted by SITCD and adopted by the Symposium.

1.7. The Team of TKP Consultants experts, contracted by UNIDO, authors of the Study participated at the Symposium, namely:

Mr. A.Inowolski, M.Sc.Eng., Team Leader.

Mr. K.Feliszewski, Dr.Eng.(Chem.), Organic and Petrochemical Industry,

Mr. E.Karp, M.Sc.Eng.(Chem.), Fertilizer and Inorganic Industry.

1.8. This Report was prepared by a Team according to UNIDO Project DP/RAF/86/013, Contract No. 87/187 signed on August 29, 1990. It covers presentation and discussion of the UNIDO Report on the Study on the Manufacture of Industrial Chemicals held during the Symposium and detailed recommendations resulting from the Study and the discussion.

The recommendations on production of industrial chemicals were updated whenever possible after 2.5 years that lapsed from submission of the Report presentation.

Notes on other subjects presented and discussed were also added for proper presentation of the Symposium agenda.

## 2. ORGANIZATION OF THE SYMPOSIUM

### 2.1. Opening of the Symposium

The Symposium was opened and chaired by the Director of SITCD, Mr.A.T.PALANGYO. The Chairman welcomed the participants and expressed opinion. that Workshop should help to utilize data, findings and recommendations of all reports presented despite only three Membe. States representatives being present at the Symposium.

It was commented also that delay in calling a follow up symposium on the UNIDO Report of 1988 was rather unfortunate.

Agenda of the Symposium was accepted by the participants.

### 2.2. Introduction of the SADC Industrial Development Policies and Strategy.

SADCC Industrial Development Policies and Strategy was reviewed by SITCD. Among the features stressed there were: development of intra- SADCC trade, intra- regional transport facilities and improving of investment and production climate.

Objectives and targets of the strategy were discussed, among them: creation of new jobs, increase of savings, free currency economy increase, raise level of utilization of production capacities and to rehabilitate existing production capacities.

It was explained that 15 industrial sectors had been identified as being of particular importance for regional co-operation. Among the chemical sectors identified, were some of those mentioned as priorities in the UNIDO Study. Observations were made that UNIDO Study was completed before the adoption of the Industrial Development Policies and Strategy and that contents of the Study is useful and generally compatible with policies adopted by SADCC.

2.3. Presentation of the UNIDO Study Report (findings, observations, conclusions) and Methodologies used for Evaluation.

Issue A: Summary of the Report and Methodology of Forecasting of Consumption of Industrial Chemicals.  
Terms of reference for the Study were presented and among them the aim of the project: to assist the SADC Member States to prepare development programme of the chemical industry for the forthcoming years and obtain:  
- reduction of external dependence.  
- creation of operational and equitable regional interrelation.

The scope of the Study consists of the following most essential points:

- to set up a list of the most important industrial chemicals used in the SADC Region,
- to calculate expected consumption of these chemicals in the target year 2000,
- to select priority projects for investments by the year 2000,
- proposing practical steps for reduction of external dependence,
- suggestions for creation of operational and equitable regional integration.

The regional approach was adopted for the Study, although country approach was recognized as extremely important whenever possible.

It was presented that the UNIDO Team of three experts carried out field work in all nine SADC Member States from October 1987 to March 1988. During that period the Team collected necessary data working in close co-operation with national counterparts: state offices (envt, statistical and custom offices), geological departments, enterprises etc.

Based on preliminary preparatory work and on data collected, the Team set up lists of:

- industrial chemicals,
- macrodata,
- raw materials available.

In spite of the Study being devoted to industrial chemicals, the Team decided to include in the Study selected additional chemicals, not necessarily of industrial nature but of great importance for the region.

The lists of chemicals were discussed with State Authorities in all nine SADC Members and with SITCO and obtained their general approval.

Being supported by the a/m work the Team calculated expected consumption of industrial chemicals in the year of 2000.

Among the assumption taken into account were:

- population growing from 71 to 111 mln. inhabitants,
- growing of national income by 3% (per capita constant) and by 4% per year,
- expected changes in consumption of industrial chemicals resulted from education, cultural etc. progress.

To calculate demands, the Team worked together with Prof. M. Lesz from Institute of Chemical Industry Economics in Warsaw. Methodology of Consumption Targets by Prof. M. Lesz was used for demands calculation.

Basic issues of the Methodology was discussed and among them stoichiometrical equations of chemical intermediates on which the Methodology is based.

Methodology of Consumption Targets was discussed with the participants on the individual basis as well.

Continuing presentation of the Summary of the Report methods of applying of the data as above were discussed to set up a list of findings and recommendations and among them to set up a list of industrial enterprises to be modernized rehabilitated and established.



Pattern network of the chemical industry and methodology applied to set up a list of enterprises were presented and discussed in the Issue E. below.

It was stressed during presentation that SADC Member States differ in level of economic development, GDP, location, political and other conditions. There are however constraints which could be treated as common for the Region and which heavily influence possibility of economic development. Among these constraints are:

- fast population increase which is a real economic potential both as a source of cheap labour and purchasing force. Provided that its active participation in production and market is secured, it could result in increasing of savings level which is necessary for securing the regional development.
- relatively high operating costs in the industry and transport creates various problems: social, managerial, financial and results in relatively low competitiveness of local production in comparison with costs of imported goods,
- transport constraints, external and internal, due to lack of properly developed infrastructure,
- unorganized regional market and unimpeded development of export of industrial chemicals beyond the SADC and possibly PTA Regions.

#### Issue B, Fertilizer Industry.

Basing on several diaspore transparencies, prepared for the Symposium, Mr. E.Karp broadly illustrated the most principal assumptions, data, models and scenarios adopted in the Fertilizer part of the Study, in order to design the short-term and the long-term programme of the fertilizer industry development in the SADC countries. The materials were copied and distributed among the participants. They illustrated following issues:

- Interlinkage of chemical process industries with basic needs of population.
- Backward linkages of industrial chemicals to fertilizer related raw materials and forward linkages to fertilizer products together with their impact for agricultural production increase, food self-sufficiency and agricultural export promotion.
- Composition of fertilizer consumption per hectare of arable land and per capita both for the nine Countries and SADC Region versus those for the RSA, African Countries and the World.
- The gap between total fertilizer consumption and production for sub-Saharan Africa and for SADC Region for the time-base of 1970- 1989.
- Different fertilizer consumption scenarios by 2000 in the SADC Region, derived both from EAC and UNIDO sources in order to analyze short-term and long-term fertilizer demand gap for the Region.
- Assumptions and variables adopted in the fertilizer industrial system analysed with the regional economy, in order to design a long-term scenario of the fertilizer industry development toward 2000, both on the regional and national basis.
- Balances of N,P,K,S nutrients to be produced by 2000 in the newly created facilities, for the scenario in which the SADC Region is to be self sufficient in supply of fertilizers.
- New capacities needed in ammonia, phosphoric acid, sulphuric acid and muriate of potash in the Region self-sufficiency scenario build on the basis of import substitution.
- Endowment of fertilizer related raw materials (natural gas, phosphate, sulphur bearing raw materials and potash) and suggestions for their utilization in the development of the fertilizer industry in the Region.
- Logistic model representing simplified pricing circumstances in the SADC Region for the scenario of import substitution.

- Explanation of the meaning and method of the assessment of the Investment Location Factor (ILF) in estimating optimal investment for the programme of fertilizer industry development in the Region. Examples illustrating the importance of ILF for the evaluation of economic efficiency and competitiveness of the regional fertilizer industry toward the world producers utilizing the economy of scale in plants built in locations with existing industrial infrastructure.
- Explanation of fertilizer production costs for different locations, investment costs and energy prices in order to illustrate feasibility of fertilizer production located in the remote area of the Region. To compare an export of fertilized intermediates and final products on international markets.
- Impact of the capacity utilization in a fertilizer plant on the possibility of generating return of investment from the plant operating in locations with weak general and industrial infrastructure.
- Three different scenarios of the long-term fertilizer industry development in the Region adopted and designed in the Study through the computer aided optimization and project priority selection methodology MDA (Multiobjective Interactive Decision Aid), a Decision Support System for Programming Development of the Chemical Industry.
- Final scenario of the fertilizer industry development by 2000 in the Region and its aggregated programme with the list of fertilizer plant, their capacities and capital investment involved.
- Global economic parameters of the long-term development programme of the fertilizer industry in the Region, based of final scenario designed in the Study.
- Recommended locations for fertilizer plants and complexes in the long-term development programme, both on the national and regional basis, with indications of capital investment involved related to programme maximum - regional self-sufficiency in fertilizer supply by 2000.

- A block diagram of the Fertilizer Industry System in Africa, illustrating through its components and interlinkages - the necessity of adopting integrated approach to assure balanced development of the fertilizer industry within the national and regional economy and the process to make EAFU programme in this industry a success.

The introduction as above was followed by presentation of the important findings and observations:

Agriculture is mainstay of the economy in the most of the SADC Member States and therefore industrial growth will depend heavily on the success of raising agricultural output both for domestic uses and for exports.

SADC Region with population growth of per annum and projected population of 111 mln inhabitants in the year 2000 - will have to face a different task to nourish its people unless special and thoroughly co-ordinated measures are undertaken.

In some Member States of SADC, agriculture exports would be main source of foreign exchange earnings. Therefore the ability of agriculture to cover domestic demand, to cut off food imports and to produce a surplus for exports is of great importance for the sustained growth of their economies.

Agriculture-driven industrial development of the SADC Member States is recognized to be the most justified strategy for the Region.

Agricultural exports will still be needed to pay for industry's growing import requirements while industry itself gradually generates more foreign exchange.

Increased fertilizer use is one of the key elements in the intensification of the crop production and agricultural exports increase.

However, the strategy of developing the fertilizer industry poses special problems, virtually no single country in the SADC Region has domestic market large enough to justify fertilizer industry development at the reported level; the

economy of scale. Investments of this kind should be based on market principles and will benefit through regional integration that respects market forces.

The possibilities of creating export-oriented fertilizer sector in the SADC Region seem to be remote. On the other hand, without creation of the national and regional fertilizer industry, SADC Member States would be totally dependent on grants of fertilizers and international market.

Therefore, the only reasonable solution for the SADC Member States is to maintain existing fertilizer facilities in operation, avoid deterioration of the fertilizer plants and complexes, through implementing short-term programmes of effective rehabilitation modernization, remaining projects and to create, in the long-term, regional sector of the fertilizer industry based on: import-substitution scenario, regional integration and market forces.

Relatively depressed international fertilizer market does not favour investments in this sector, however, without increased use of fertilizers it would be rather impossible to assure proper development of agriculture in the SADC Region.

That is why the decisions on fertilizer sector development in the SADC Region are extremely difficult and call for the thorough, complex and detailed analysis comprising related problems e.g. water supply and storage transport infrastructure.

Endowment of fertilizer-related natural resources is relatively rich in the SADC Region. Tanzania, Mozambique and Angola possess high quality natural gas that can be processed to ammonia and down-stream nitrogen fertilizers.

The majority of the SADC Members are endowed with phosphate rock apatite deposits necessary for production of phosphatic fertilizers.

Land-locked countries: Zambia, Zimbabwe and Botswana have potential for sulphur extraction and sulphuric acid production. Botswana, in its Sua Pan Lake has tremendous reserves of muriate and potash.

It is obvious that only regional integration and cooperation in the extraction and processing of those raw materials to fertilizer products marketed within the SADC Countries may contribute to agricultural production increase in Regional economies, all the more so that both, the cost and time of delivery of fertilizers from the international market to the SADC Region are extremely burdensome for all countries, in particular for the land-locked ones.

The Region is also rich in raw materials related to secondary nutrients: calcium and magnesium, as well as in microelements (Fe, Co, Mo, Zn, Cu).

Two fertilizer-producing complexes: in Swaziland and in Mozambique were shut-down in recent years. Though the decision on closing down nitrogen complex in Swaziland is irreversible, there are still prospects for the rehabilitation of the Mozambican Quimica Geral complex in Maputo area.

The third fertilizer complex seriously threatened to be closed down soon is TFC Fertilizer Complex at Tanga, Tanzania, if urgent decision and concrete actions regarding its rehabilitation and modernization are not taken.

Zambian coal-based nitrogen fertilizer complex at Kafue is being modernized at present with the World Bank support.

Zimbabwean fertilizer complex at Que Que (nitrogen and Harare (phosphate) are in relatively good technical state, in both, however, there is a room for modernization, intensification and revamping programmes, mostly through introducing modern processes and new technical solutions.

The most important conclusions, as far as short-term strategy for the fertilizer industry development in the SADC Region is concerned, is to increase fertilizer production level by 1992-94 from 130.000 MTPY up to 200.000 MTPY of NPK nutrients. This is a realistic target, and such a fertilizer production increase can be achieved in Tanzania, Zambia and Zimbabwe.

In order to make the Region self-sufficient in NPK fertilizers broad investment programme would have to be implemented in the Region by year 2000-2010.

According to UNIDO FAO scenarios, fertilizer demand in the Region by 2000 would be in the range of 1 mln MTPW of pure NPK. As much as 1 bin USD would have to be spent in order to achieve long-term target of production increase from 200,000 MTPW of NPK (short-term goal) up to 1 mln MTPW of NPK. Long-term programme maximum of regional self-sufficiency in fertilizer production, based on import substitution scenario:

Such a programme can never be framed of without support regional gov operation and limited concrete support from international communities, donor agencies, development organizations etc.

Of key importance for the long-term programme is the decision on the construction of the world-scale natural gas based ammonia plant. Tanzanian Kilwa Masoko or Mozambican Inharriz seem the most suitable locations.

This plant alone, of the capacity of 1700 TPD of ammonia, would cost approx. one third (i.e. about 330 mln USD) of the total capital investment needed for the implementation of the programme.

Should the long-term strategy be not implemented, the Region will have to be dependent on fertilizer imports from international market and on fertilizer grants. But that scenario, taking into account tonnage involved, seems to be impossible.

Worth noting here, as an example of decision going in proper direction, is latest PTA decision in setting up its first triple superphosphate plant (TSP) in Tororo, Uganda to cover growing fertilizer demand in PTA sub-region. This project, estimated to cost 127 mln USD, will contribute to a source of phosphate fertilizers for CADC region also.

Issue C. Organic and Petrochemical Industries.

Contents of the Organic and Petrochemical Parts of the Study as well as resulting findings were briefly presented by Dr H. Peltz-Schwartz, who stressed the following issues:

Basing on the fact that the world organic and petrochemical industries are based today in OCV on crude oil and natural gas, whereas production of intermediates such as acrylene, propylene, butadiene and benzene is the foundation of the modern industry in this branch of chemistry - it was concluded that the organic industry in SADC Member States has not started at all.

Such conclusion resulted in directing the mind of the study towards checking the chances of development of the region organic industry basing on own raw material resources, their locations, existing infrastructure development level (e.g. communication, technology locally available, services), human factor in all aspects and payment possibilities of the SADC Member States.

Raw material resources existing in the Region were briefly analysed as well as conditions of their utilization. The basic factors which determine industrial usage of the resources and directly affects the chances of organic branch of the chemical industry development were presented as follows:

- underdeveloped communication and technical infrastructure (location factor value),
- limited financial possibilities of the SADC Member States which necessitate to share capital investment expenses in case of large capital consuming projects with donors or foreign companies interested in access to the locally made final products,
- direct involvement in activities of the organic industry may not reach the required volume - preliminary reports have to



variety of reasons being not fully under control, which, however, could be decisive for the feasibility of the project and could directly influence future prices for the products.

Decisions of the industrial utilization of local raw materials are crucial in the Region when high probability (almost certainty) is taken into account that the level of production costs of organic products manufactured in the Region will not allow to compete with the same products available on the world market, irrespectively of the raw material base. As a direct consequences, the necessity of planning new industrial facilities to cover regional needs must take into consideration direct competition from world market should be taken into consideration.

The only SADC Member Country where the modern feedstock basis for the organic industry is available in full range is Angola, that has deposits of crude oil (naphta), LPG and methane natural gas. However, due to the reasons as explained erection of a petrochemical complex in Angola with the programme to cover regional needs by the year 2000 with the following products: plastics, fibres, detergents, rubbers, paints, pharmaceuticals etc., is not recommended.

The analysis carried out during UNIDO Study preparation has shown that petrochemical complex in Angola with the production programme limited to production of plastics (PVC, PE, PP, PS) to be the main source of supply for the Region could be considered.

Much broader raw material base for the organic industry is methane, available in Angola, Mozambique and Tanzania. Methane could be considered as a feedstock for organic chemical industry through a way of pyrolysis only, i.e. through recovering methane to the ethane and ethane to ethanol, the two main organic components for organic chemical industry.

That route creates necessity to establish simultaneously an nitrogen industry complex located in vicinity of organic complex and based on common raw material.

Both projects treated jointly create the necessity to cover high initial capital expenditure and both economic and technical risks, so they are not recommended to be studied and implemented within the presently considered regional development horizon.

Possibility to base the organic chemical industry in the SADC Region on ethanol does not practically exist, as possibility to manufacture ethanol is extremely limited. Intensification of the presently negligible ethanol production in the Region (appr. 60 MLV in Malawi and Zimbabwe) based exclusively on sugarcane, requires substantial investing into soil irrigation, whereas demand for ethanol as a fuel component is expected not to be covered during 15- 20 years not taking into account growing hopes for potential ethanol utilization for diesel fuels.

Route of coal utilization through direct or indirect liquefaction to produce hydrocarbons, traditionally available from refining of crude oil (SASOL Route) is not acceptable for the Region because of high degree of technical complexity involved and high capital investment required.

Taking into account:

- availability of coal deposits in all SADC Member States (except Lesotho), as well as its relatively low prices as compared with prices prevailing in developed countries,
- possibilities of low cost generation of electric power (both hydropower and thermal),
- inability to finance big industrial projects from local and foreign sources.

- inability to base organic petrochemical industry on imported raw materials naphtha, LPG for majority of the SADC Member States.

- supposed possibility of creating a feasible organic industry step by step basing on indigenous raw materials.

It has been attempted to analyse feasibility of basing the organic petrochemical industries in SADC Region on locally available: coal, electroenergy and limestone - i.e. the basic feedstock for producing acetylene from carbide.

An organic petrochemical complexes has been presented based on two raw materials:

- ethylene from naphtha - (Petro Route)
- acetylene from carbide - (Carbo Route).

For both routes feasibility calculations were elaborated for conditions, prevailing in:

- Western Europe,
- Angola,
- Zimbabwe,

accepting different location factor values for each location. These factors reflect different investing conditions.

The aim of the analysis was to compare feasibility of establishing the complex in the SADC Countries, based on acetylene from carbide with the one based on ethylene from naphtha.

Locations of the complexes (Angola, Zimbabwe) were chosen to compare feasibility in coastal and landlocked locations. Location in Western Europe was chosen as a comparative basis, with FOB Rotterdam prices of May 1988, having also in view that the location is close to places from where many chemicals imported to Africa originate.

Prices of chemicals FOB Rotterdam were increased by sea freight, inland transport and other charges, according to the actual situation.

A number of variants of African locations was calculated with various location factors (1.0; 1.3; 1.5) and different electricity costs (0.11; 0.13; 0.16 USD KWh).

The analysis of the results shows profitability of an organic petrochemical complex with the proposed product range (without optimization) based on pyrolysis of naphta for all locations chosen. The term 'profitability' relates to the place of the complex location without analyzing costs of transportation of products throughout the Region. The pay-off periods are from 3.3 years in case of Western Europe to 5.1 years in case of complex location in Angola.

Switching over raw material basis from "Petro" to "Carbo" makes the complex unfeasible for Europe only, bringing operation loss at cost of electricity 0.08 USD KWh.

Results obtained justify the conclusion that organic industry based on acetylene from carbide is fully comparable economically in SADC conditions with the one based on pyrolysis of naphta. The "Carbo" route may be even more attractive while comparing investment conditions, different for both routes.

The complex located in Angola to produce plastics only, based on LPG was discussed in two variants:

- with local benzene production.
- with benzene imported.

Calculations indicate high profitability of erection of such complex in Angola. The pay-off period for both variants discussed equals to 2- 3 years.

The main conclusion taken from the Study presented is that in SADC Region conditions, where no crude oil and LPG deposits occur (with the exception of Angola), an economic justification exists for creating the organic industry based on ubiquitous raw materials in that Region like coal, electric power and limestone. Basing organic industry on "Carbo" route shows in SADC specific conditions great advantage over the "Petro" route, mainly caused by:

- non-employment of free currency for raw material purchase,
- possibility of adopting a "step by step" industrial development option which in case of 'Petro' route does not exist. This is because erection of technically complicated and expensive pyrolysis installation of the target capacity is necessary in "Petro Petro" as the best option.

In the second investment phase in the 'Petro' route it is necessary to erect the big set of expensive technological installations for simultaneous processing of all pyrolysis products: ethylene, propylene, etc. (Appendix).

The profitability of organic industry based on acetylene from carbide "Petro" route in conditions average for the SACSS Region was proven by taking for calculations value of electricity equal to 0.02 USD/kWh, which is true in SACSS Region.

Generation of cheap electric energy in SACSS Region must be considered a cornerstone to enable solving fundamental economic and social problems.

#### Issue C. Inorganic Chemical Industry.

Presentation was made by Mr. Elizeus MARR, the author of Inorganic Industry Part of the Study.

This covers, in principle, four groups of basic industrial chemicals, i.e. acids, alkalies, chemical salts and industrial gases.

General presentation of the inorganic chemical subsector in the Region was made following more detailed long-term programme of alkalies industry development in the Region by 2000.

Alkalies industry (soda, caustic soda, salt, silicates and soda related products) was recognized to be the group of industrial chemicals least developed in the Region. Despite rich endowment of raw materials, in particular in Botswana and Tanzania, as well as in Mozambique and Angola (salt).

This group of inorganic chemicals was, therefore, chosen for presentation, all the more so that, according to Symposium Programme, the presentation of TISCO (Tanzania Industrial Studies and Consultancy Organization) that followed, was related to development of caustic soda and sodium silicate production in the Region.

The following were the most important materials and issues presented:

- Demand gap by 2000 for selected inorganic chemicals in the SADCC Region and the assumptions adopted for its calculation - GDP growth, population increase and others - according to the model adopted in the Study.

Chlor-alkali inter-relationship as a principal model illustrating the philosophy of evaluation of sodium oxide and chlorine demand and production. It was stressed, that sodium oxide and chlorine balance implies the balances of both, soda ash and caustic soda, indicating at the same time the limits of caustic soda production through electrolysis of salt brine, that depends on utilization of chlorine. Caustic soda balance may be covered through conversion of soda in "soda - lime" process. Soda ash production results from the final balance of sodium oxide.

- Optional alkali industry chart, presented at the Symposium, illustrates chlorine-free route of alkalies development in the SADCC Region. In this route natural soda is used as a raw material instead of salt, to produce soda ash, sodium bicarbonate, caustic soda and other limestone-based products. The whole range of products can be developed through this route in glass, soap, paper, drug, textile, chemical and many other industries.

Through interlinkage of chemical process industries alkalies belong to those basic chemicals that cover basic needs in hygiene and health care through soap, detergent and pharmaceutical industry, and in household through glass, paints and other industries.

- Options for development of alkalies industry towards 2000, including available raw materials (salt and trona from Gwa Pan and Natron Lake), different processes offered for soda ash and caustic soda production, energy requirements in each of the processes, as well as the recommendations of location of alkali industry plants and complexes in the SADC Region.

- Long-term strategy of and different approach to alkali industry development in particular in Tanzania, was presented and discussed taking into consideration inevitable competition from the international market and from soda ash producers from Kenya and Botswana (projects currently being implemented in Gwa Pan).

Both capacities and capital investment needed for the short-term development of alkali and silicone industry in Tanzania were presented.

The introduction as above was followed by presentation of the important findings and observations:

Basic inorganic chemical industry should be treated as a core branch of the national and regional economy strongly linked to many other industry sectors. This branch should be set up before others in the course of industrial development of the Region.

The SADC Region possesses almost all natural resources to develop its own sector of the basic inorganic chemical industry. Particularly abundant are these deposits which are connected with chlor-alkali industry (sea salt, natural soda, potash, limestone) supposed to be the bottleneck for future development of basic inorganic chemical industry.

The Region is potentially capable to create quite a large market for basic inorganic chemicals to meet the economy of scale in respect of installations capacities above an economical minimum.

**The Region has several advantages to set up and develop the basic inorganic chemical industry in a broad range of products**

such as acids nitric, sulphuric, hydrochloric, alkalis (soda ash, sodium bicarbonate, caustic soda, silicates, sodium phosphate, sodium water glass and sodium silicate), different industrial salts and bases.

The basic inorganic industry in the SADC Region can be characterized by the following features:

- Zimbabwe, Zambia and Tanzania are main producers of basic inorganic chemicals.
- Products manufactured are related mostly with fertilizer and mining industries.
- Acids are developed relatively well in the Region. While alkalis are virtually not produced.
- Inorganic salts and technical gases are produced in small quantities.
- Soaps, detergents, paints and pigments are produced throughout the Region, mostly basing on imported chemicals.
- Processing methods, equipment and plants used are simple.
- Certain capabilities for research, development and maintenance in the inorganic chemical industry exist in the Region.

For developing the basic chemical industry in the SADC Region in the long-term horizon by 2000 - 2010 as much as US\$ 300 mln would have to be spent in order to establish the most important plants and inorganic chemical complexes, so as to cover growing demand of these nations for principal consumer goods manufactured from or using inorganic chemical such as: glass, paper, soap, ceramics, leather, sugar, food, metallurgy, textiles, chemicals and many others.

Regional co-operation is the most important factor in the development of the basic inorganic chemical industry in order to overcome the key constraint: the size of the market **satisfying the economy of scale**, in inorganic chemical complexes to be developed.



In the process of industrialization the OASIS States should utilize their extremely rich raw materials base for diversified inorganic chemical industry development.

Alkali industry is the best example of advantages, constraints and opportunities for the development of that industry.

The Region has tremendous resources of salts in many various forms, including sea salts, trona, salt lake and borax.

Development of Botswanian Gha. Pan natural deposits and brines is the best example of obvious advantage of that action over dependency on importation from the international market.

Tremendous potential offered by the development of sea salt and brines from the Lake Natron (and other Rift Valley lakes) is the most specific feature and enhancement for alkali industry long-term development in the Region, all the more so that in many stages of processing there is a possibility to yield very many valuable technical salts.

Two principal routes of alkali industry development exist in the Region:

- production of sea-salt and caustic soda through electrolysis of salt brine (chlorine route),
- processing of trona and other natural salts to soda ash, sodium bicarbonate, caustic soda and other soda related products (chlorine free route).

It is a great advantage for the Region that, having no possibilities of utilizing chlorine to the extent needed from the caustic soda balance, it can use chlorine-free route of alkali family development.

### Issue 3. Methodology of Programming Development of the Chemical Industry

Methodology of Programming Development of the Chemical Industry in the UNIDO Study bases on a Decision Support System MIDA (Multiobjective Interactive Decision Aid).

This methodology proved to be an extremely useful tool in a computer-aided design of long-term operations and optimization of production programmes in the chemical industry development for SADC Region.

MIDA, the computer system - worked out and implemented through Joint Systems Research Department of the Academy of Mining and Metallurgy, Cracow, Poland, and Industrial Chemistry Research Institute, Warsaw, Poland - is devised to support decision makers who are to cope with integrated development programming of various branches of refining, petrochemical, fertilizer and chemical industry.

MIDA allows for guidance, assists and helps the decision maker in the following steps of the project priority selection analysis:

- Characterizing strategies of technological development.
- determining goals of development.
- determining impacts, constraints and enhancements of development strategies.
- indicating strategies best suiting achievement of the assumed goals.

In its implication to the preparation of the UNIDO Study, MIDA proved to be useful in particular through System Optimization Module, Space Allocation Module, Investment Scheduling Module and MIDA Toolkit Module.

During preparation of the UNIDO Study the very complex and diversified networks and chains of technological processes were applied, raw materials examined and capacities analysed. MIDA proved to be essential for optimization and design of long-term operations for the SADC Region.

- fertilizer industry;
  - organic and petrochemical industry;
  - refinery industry.
- The majority of the most modern processes offered at the international technology and investment fairs in the above mentioned branches of the chemical industry are incorporated in the form of project profiles in the MIDA database defining therefore powerful tool for analysis of alternative strategies and scenarios in those branches.

Individual project profiles are useful to evaluate and compare advantages of different processes raw material applied and locations chosen for the plants. Characterized by different capital investment for different units costs, off-sites and infrastructure costs.

More complex project networks chains and systems need to be designed under MIDA in the block diagrams. Before the user can run optimization procedures and analyse alternative strategies.

In this way it is an easy task to compare for instance and select better investment scenario of the nitrogen fertilizer complex based on natural gas and located alternatively in Tanzania or in Mozambique or split it between Tanzania and Mozambique.

Scenarios related to import- substitution and export- promotion can be analysed under MIDA. In such a case the results obtained are heavily affected by following factors:

- correct assessment of prices of raw materials, energy and final products in the SADCC conditions.
- application of proper investment location factor for capital investment, in particular for those plants that are considered to be built in remote areas of the SADC region.

- assessment of sea- and railway transport costs relevant to SADC conditions, in particular when regional intertrade is taken into consideration.

From works carried out during UNIDA Study preparation using MIDA system for the chemical industry development in the SADC Region it can be concluded that the most important factors for achieving reliable results of multiobjective optimization and project priority selection is proper estimation of critical conditions in the SADC Region including cost of transportation of raw materials and chemicals in question. This issue is recognized to be the most important in particular for analysis of regional strategies and scenarios since the determination of prices and transport costs in the Region is essential.

#### 2.4. Presentation of TISCO Study on Industrial Sectoral Plan on Industrial Chemicals, comments and discussion

TISCO - Tanzanian Industrial Studies and Consulting Organization, a semi-government organization under the Ministry of Industry and Trade, represented by Mr. J.F. Mosiki presented results of a study aimed at investigating investment opportunities with regard to three identified industrial chemicals: caustic soda, sodium silicate and starch.

Among the results of the Study presented (the Study was elaborated in July 1989) were general findings in the following areas:

- Assessment of the present and future demand of the three chemicals in question.
- A programme of action to meet demand for caustic soda, sodium silicate and starch in the SADC Region by 2000.
- **An assesment of techno- economic viability of the projects for implementation and project priority ranking list.**

Comments and discussion

TISCO, following UNIDO Study Final Report of July 1988, prepared its own Report of July 1989, concerning the development of caustic soda, sodium silicate and starch industry.

In contrast to UNIDO Study, covering about 30 basic industrial chemicals, TISCO Report concentrated in depth on the three a.m. chemicals, thus allowing for the analysis of supply demand balance, location, project priority selection and the analysis of investment economic and financial effectiveness. The effort made by TISCO to collect necessary data and to develop its Study was impressive and this work is a concrete example of the regional initiative toward development of the basic chemical industry in the Region.

Though several assumptions and data differ from those accepted and worked out by UNIDO Team, TISCO's work brought closer recognition of the problems, inorganic chemical industry may face in the course of its development in the Region.

Four remarks made by UNIDO consultants during discussion are as follows:

- No caustic soda demand can be envisaged properly, if sodium oxide balance and chlorine balance are not investigated thoroughly. TISCO's projections of caustic soda demand based on the actual and expected consumption should be reexamined, and caustic soda demand based on macro-economic correlations is recommended to be analysed.

- TISCO's ranking list of priority projects in caustic soda production indicates that caustic soda project in Mozambique (salt electrolysis based on the newest membrane process) is not economically viable, and what is more important, less effective than caustic soda projects (soda-lime based process) in Zimbabwe and Botswana.

It is worth noting that with the assumption of salt price 200750 MT and electricity price of 1.14 USD kWh made by TISCO, no caustic soda project can stand the viability criteria and be competitive with caustic soda imports as the costs of raw materials and energy only is enough to off-set even a project.

- It is not clear why the priority is given to location of caustic soda project in Zimbabwe before Botswana. When soda ash can be processed at the site to caustic soda, in Zimbabwean option soda ash quantity also almost same that of caustic soda would have to be transported to the Zimbabwean location to be processed to caustic soda.

From the economy of scale and the lower unit production manufacturing cost arrived at in Botswana indicates for the priority of the bigger plant to be located in Botswana.

- None of the projects presented is viable in terms of market economy, and therefore a very careful examination of assumptions made by TISCO is recommended.

Also optimization of the process, plant lay-out, investment cost and planned performance should be looked into in order to draw final conclusions on the economic and financial viability of each of the examined projects.

Therefore it is recommended that UNIDO and SADC mutually look for the possibility of study tour of TISCO specialists to one of the world known contractors of the caustic soda process, in order to enable TISCO a verification of assumptions and conclusions at the contractor's offices.

2.6. SADC/TISCO Recommendations and Approval  
of the Symposium Report, Closing of the Symposium.

**The Report of the Symposium was adopted by consensus at the Final Session of the Symposium on 12<sup>th</sup> September 1990.**

4. UNIDO TEAM CONCLUSIONS, RECOMMENDATIONS and ACTION PLAN  
AIMING at ACCELERATING CHEMICAL INDUSTRY DEVELOPMENT  
in the SADC REGION.

3.1. Fertilizer Industry

The necessity exists to adopt integrated approach to the fertilizer industry development in the SADC Region. Because of the complex nature of the programme, it is recommended that a regional FERTILIZER COMMITTEE is organized, to analyse and co-ordinate development plans of the fertilizer industry both on the regional and national scale.

It is recommended that the FERTILIZER COMMITTEE composed of the representatives of the Member States of SADC, regional co-ordinators, donor agencies and international organizations (including UNIDO, FAO and World Bank), analysed, among other subjects, the following issues related to the fertilizer industry:

A. Efficiency improvement and rehabilitation of fertilizer plants including:

- human resource development of technical staff and management,
- regional and national resources for technology evaluation and procurement,
- advisory and trouble-shooting support to the fertilizer industry.

B. Co-operation among parties interested for the establishment of fertilizer manufacturing facilities, including:

- feasibility and pre-investment studies for manufacturing plants and fertilizer blending units,
- strengthening regional capabilities related to the fertilizer industry,
- problems in planning, construction and operation,
- information on machinery equipment and spare parts including engineering and technical services.

- survey of joint venture potential for the development of the fertilizer industry in the Region.
- international co-operation in the design, engineering and manufacture of equipment suited to the regional needs.

C. Co-operation in regional trade in fertilizer intermediates and final products, including:

- long-term supply contracts and joint import schemes.
- assessment of regional marketing and pricing policies.

D. Assistance for the development of the fertilizer industry in the Member States of SADC including:

- contribution by financial institutions in support of fertilizer projects through innovative financial schemes
- strengthening negotiating abilities of regional and national decision-makers in technology transfer contracts.
- formulation of technical standards for machinery and equipment.
- development of regional and national centres for fertilizer information, research and development.
- co-ordinate technical assistance activities in regional and national agriculture.

As far as specific TECHNICAL ASSISTANCE projects and investment projects are concerned, there are several concrete recommendations to be followed in the short- and long-term programmes of fertilizer industry development in the SADC Member States.

The following are recommendations for actions to be undertaken under overall umbrella of the FERTILIZER COMMITTEE:

- ANGOLA
- Profitability study on sulphur extraction from the crude oil and natural gas. Should this study yield positive results, a feasibility study on local phosphate processing into SSP and TSP fertilizers is recommended to follow.



- ANGOLA, cont. - Feasibility study on economic and financial viability of DAP production in Angola based on imported ammonia and phosphoric acid.
- BOTSWANA - Prefeasibility study on sulphur extraction from Selebi Phikwe smelting metallurgical off-gases.
- Studies and research works on a laboratory scale and pilot plant experiments on processing of the Sua Pan brines into muriate of potash MOP
  - If these two studies were successful, a prefeasibility study on economic and financial viability of converting MOP into SOP (sulphate of potash) using local raw materials (MOP and sulphur/ sulphuric acid) should follow.
- LESOTHO - Feasibility study on phosphate rock processing and the viability of application of ground phosphate rock for local mountainous soils.
- MALAWI - Complex and detailed feasibility study on manufacturing A'NA'AN'CAN based on electrolytic route of ammonia production (as in Que Que, Zimbabwe) versus importation of ammonia (A) to be processed in the downstream units NA'AN'CAN.
- MOZAMBIQUE - Feasibility study on rehabilitation of the fertilizer complex in Matola. This study should follow after thorough inventory of equipment and buildings was made and a positive diagnosis on this complex rehabilitation was obtained.

- TANZANIA - Complex techno-economic diagnosis of a viability of rehabilitation and modernization of TFC fertilizer complex at Tanga.
- Feasibility study on economic and financial viability in the market conditions of the modernization and diversification of TFC production programme, including SA plant reconstruction, up-trailer, Minilink, Phosphate Rock Mine and introducing production of DAP in this Complex.
- SWAZILAND - Inventory and assessment of the available types of color stainless steel pipes in the area of the town Mankini Fertilizer Complex in the rehabilitation of Mankini Fertilizer Complex in Mozambique.
- ZAMBIA - Assessment of options, problems and constraints in the Kafue Nitrogen Fertilizer Complex in order to analyse short-term programme of fertilizer production increase.
- ZIMBABWE - Feasibility study on the ammonia production increase through revamping of the water-electrolysis-based ammonia plant at One One versus the alternative of ammonia production increase through the utilization of coke-oven gas from ZISCO.
- SADC REGION - Survey and complex evaluation of the fertilizer industry raw materials (RM) and long-term strategies of RM development.

SADCC REGION - Prefeasibility study on sulphur utilization  
cont. from various sources to meet growing regional  
demand for sulphuric acid in the SADCC Region.  
This study should be worked out jointly with  
Zambia, Botswana and Zimbabwe.

- Assessment and detailed analysis of short-term  
strategy of the fertilizer industry development  
in the SADCC Region in order to evaluate the  
possibility of fertilizer production increase  
from 100,000 MTPY to 200,000 MTPY by the year  
1994.

- Analysis and assessment of long-term scenario  
of fertilizer industry development from the  
level of 200,000 MTPY of NPK up to 1,000,000  
MTPY by 200-2010.

- Analysis of affinity of nitrophosphates to be  
produced regionally to local soils and crops in  
order to confirm possibility of adopting  
sulphur-free strategy of the fertilizer  
industry development in the Region.

- Analysis and monitoring of trends both in  
growing fertilizer demand in the Region, as  
well as optimum N:P:K:S:Ca:Mg ratios in the  
Region depending on soils cultivated and plants  
grown in order to design and update relevant  
development strategies.

- Feasibility study on designing an uniform bulk-  
blending compound granulation fertilizer unit  
for the SADCC Region to optimize and facilitate  
**designing, investment, operation and  
maintenance of similar facilities.**

- SADCC REGION - Prefeasibility study on the location, techno-economic and financial viability of the world-scale natural gas-based ammonia plant to be built in the Region, including locations in: Tanzania, Mozambique, Angola and Zimbabwe (pipelining of natural gas from Mozambique). This Study should be followed by a Study on optimum nitrogen fertilizer production programme including urea, nitro-technique, AN, DAP and other fertilizers, while taking into consideration local needs for specific fertilizers and their affinity to local soils and crops.
- Study on logistics, transportation, storage and distribution of fertilizers all over the SADCC Region, taking into account prices and transport costs for the two different scenarios: import of PM fertilizer intermediates and products from the international market, and regional self-sufficient scenario in PM intermediates and fertilizer products.
  - Study on financial implications of fertilizer imports and grants to the SADCC Member States for import-substitution strategy of the fertilizer industry development in the Region.
  - Organization of INVESTMENT PROMOTION CONFERENCE for the REGIONAL FERTILIZER INDUSTRY DEVELOPMENT.

### 3.2. Inorganic Industry

With regard to the long- term development of the subsector of inorganic chemical industry in the SADC Region, the following recommendations are made for actions to be undertaken by the SADC Member States and at the regional level:

- ANGOLA
- Feasibility study on rehabilitation and modernization of caustic soda factory in Luanda from the capacity of 3,000 MTPY to 5,000 MTPY using membrane process.
  - Assessment of investment opportunities for the new capacities needed in sea salt production through solar evaporation method to meet future potential demand of the Region for chlorine used in PVC production. This work and techno- economic appraisal are preparatory and complementary to plans at the petrochemical industry development in Angola.
- BOTSWANA
- Complex and long- term aimed strategy research and pilot plants tests in order to work- out the most effective, optimum and least harmful for the environment production programme of Sua Pan brines processing for soda. salts, sodium carbonates and sulphates, potash, bromine and others.
- LESOTHO
- Prefeasibility study on utilization of natural zeolites for water treatment and washing powders for the regional use.
- MALAWI
- Feasibility study on limestone processing to burnt lime precipitated calcium carbonate and cosmetic chalk.

- MOZAMBIQUE - Feasibility study on caustic soda production from sea-salt brine using membrane electrolytic process.
- SWAZILAND - Techno-economic appraisal of the viability of production of barium inorganic salts and pigments for the regional use.
- TANZANIA - Investigation and techno-economic appraisal of the viability of production of liquid CO<sub>2</sub> and dry ice from natural carbon dioxide deposits.
- Techno-economic assessment of the viability of rehabilitation and modernization of salt electrolysis plant to caustic soda, using membrane process.
- Prefeasibility study on establishment in the long-term horizon an optimal alkali production complex based on exploration of Natron Lake deposits and brines.
- Study should aim at defining potential possibilities of producing soda ash, caustic soda, sodium bicarbonate, sodium sulphate, sodium chlorate, fertilizer chalk and precipitated calcium carbonate.
- Study should also aim at defining the best option for production of silicates: sodium glaze, sodium water glass and sodium silicates.
- ZAMBIA - Prefeasibility study on the possibility of production of thermal grade phosphoric acid and sodium tripolyphosphate to meet regional demand.

- ZAMBIA, cont. - Feasibility study on possibilities of producing in Zambia different inorganic carriers of micronutrients.
- ZIMBABWE - Feasibility study on the establishment of the tannery chemicals chromium complex, based on local chromium ore, in order to meet demand of the Region and for export.
- SADCO REGION - Strategic plan and prefeasibility study on optimum alkali development programme in the region, supported with detailed long-term balance of demand for sodium oxide, soda, caustic soda, sodium bicarbonate and chlorine. Development programmes in Sua Pan (Botswana), Natron Lake (Tanzania) and Magadi Lake (Kenya) should be taken into consideration.
- Techno-economic appraisal of the development on the regional scale of the phosphoric acid production for sodium tripolyphosphate processing (wet process and thermal route for phosphoric acid processing should be compared).
  - Survey of the possibilities of producing on the regional scale of inorganic fillers for plastics and resins, such as talc, mica, calcium carbonates, caolin, silica etc.
  - Prefeasibility study on possibilities of establishing of small scale production of inorganic reagents and compounds of high purity.

SADCC REGION - Preparation of the integrated regional programme for realization of salt works and intensification of salt production in the Region.

### 3.3. Organic Petrochemical Industry

Due to specific character of organic petrochemical industry and its development conditions the long term recommendations are proposed only:

SADCC REGION - Feasibility Study to manufacture carbide for:

- \* reduction of imports
- \* sales for community as source of light and energy carrier to diminish deforestation of the Region.
- \* metal processing development and improvement as source of energy.

The study should give an answer on feasibility of local carbide production in SADCC Member States (e.g. Malawi, Mozambique, Tanzania, Zambia, Zimbabwe) and competitiveness versus its imports to the Region.

- Feasibility Study for the production of devices which could utilize carbide as a source of energy for various home and production purposes.
- Feasibility study of carbide production for chemical purposes like:
  - \* PVC production (foil for industry, packaging, agriculture, householding appliances, pipes for soil irrigation, other products of great value for national economy).



SADCC REGION      \*    acetic      aldehyde.    acetic acid,    vinyl  
cont.                polyacetate, ethyl acetate as feedstock for  
                      a number of specialized branches of organic  
                      industry    like:    footwear,    paints    and  
                      varnishes,    cosmetics,    pharmaceuticals,  
                      plastics etc.

ANGOLA            -    Feasibility study for plastic production  
                      (PVC, PE, PP, PS) based on LPG fields.

#### 3.4. Other Chemical Industries

Recommendations listed below resulting from the study  
national seminars and not necessarily cover the scope of  
developing of chemical branches called in the report of the  
study "Other Chemical Industries" as they were treated as  
additional.

#### Pharmaceutical Industry

SADCC REGION    Feasibility studies to increase production,  
                      rehabilitate and/or set up of:

- Vaccine and sera production e.g.:
  - \* Vaccine Institute, Gaborone,
  - \* Balmoral, Zambia
  - \* Mabido, Tanzania
- \* new laboratories in Angola and Mozambique.

- Herbal Drugs Laboratories and Extraction Units  
in all SADCC Countries.

- Household Herbal Remedies, (to establish a list  
and production to be produced locally and  
widely distributed in remote districts,  
following Indian example.

SADCC REGION - Drug Formulation Units in Angola, Mozambique  
cont. and Tanzania.

- Fine chemicals production for pharmaceutical  
purposes as raw materials.

- Production of packaging and dressing materials  
for pharmaceutical industry.

- Regional Institute for Quality Control of  
drugs both produced locally and imported.

#### Veterinary Drugs Industry

SADCC REGION - Study to set up Institutes to co-ordinate  
composition, production, quality a.s.o. of:  
\* acaricides,  
\* veterinary pharmaceuticals,  
\* biological bacterial and viral vaccines.

#### Leather Processing Chemicals

ZIMBABWE - Study to set up the chrome powder plant based  
on utilization of chromium ore mined in  
Zimbabwe to supply products within the Region  
(several studies are under elaboration).

#### Textile Processing Chemicals

SADCC REGION - Study to utilize indigenous Regional raw  
materials and to set up plants to manufacture  
various chemicals used in textile processing  
industry. List of chemicals suggested, basic  
capacities, estimated battery limits and  
locations are listed in the Report of UNIDO  
Study, page 279.

### Pesticide Industry

SADCC REGION - Feasibility study to increase utilization of existing plants (both manufacturing and formulating) and to set up new plants (e.g. in Malawi, Tanzania, Zambia and Zimbabwe). Particular suggestions are listed in the Report of UNIDO Study page 301.

### Householding Chemicals and Cosmetics

SADCC REGION - A Regional Study on manufacturing of surfactants and final products based on both locally available raw materials including essential oils and imported ingredients. Particulars are listed in the Report of UNIDO Study page 303.

### Utilization of Chemical Metals, Minerals and Wastes

SADCC REGION - Study for utilization chemical metals, mineral and wastes in the Region. Benefits that come from mining sector could be much higher should only mineral processing industries including chemical way of processing were developed even on small scale. E.g. pigments for paints and micronutrients could be produced. Particulars are listed in the Report of UNIDO Study, page 313.

### 3.5. General Conclusions and Recommendations

The most important conclusions and recommendations, strictly limited to industrial chemical production which could enable and facilitate the development of:

- development of transportation infrastructure both inland and by sea.
- development of complex measures to facilitate intraregional trade among the SADC Member States and with PTA.
- modernization and improvement of rules, juridical acts a.o.o. aimed at increasing efficiency of production and utilization of existing facilities, not limited to chemical production.
- creation of all necessary measures to enable the SADC Region population to enhance savings needed to set up conditions to increase possibility to finance industry development with own sources of capital.

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## SADCC INDUSTRY AND TRADE COORDINATION DIVISION (SITCD)

### INDUSTRIAL CHEMICALS WORKSHOP DAR ES SALAAM, TANZANIA SEPTEMBER 10 -11, 1990

#### BRIEF REPORT AND RECOMMENDATIONS

#### 1. INTRODUCTION

The workshop was organized and financed jointly by the United Nations Industrial Development Organisation (UNIDO) and SADCC Industry and Trade Co-ordination Division (SITCD). It was held to discuss industrial chemicals in the context of SADCC studies carried out by UNIDO and Tanzania Industrial Consulting Organisation (TICO) in 1987 and 1988, respectively.

Following his welcoming address to participants and comments, the chairman expressed concern of the fact that only nine member states were represented (see list of participants, annex I). He also explained that the delay in arranging for a follow up workshop on the reports of the two studies was unfortunate.

He further stressed that the objective of the workshop was pragmatic one, aiming at extracting from the reports the main industrial opportunities for regional cooperation within the framework of the new strategy, and an identification of the main steps to be taken towards such development.

#### 1.1 RECOMMENDATIONS:

The workshop recommended that SITCD in the future makes even stronger efforts to secure participation by all member states.

It was also recommended that better representation by the enterprise community be ensured through cooperation with the business councils.

#### 2. SADCC INDUSTRIAL STRATEGY

The 1989 SADCC Industrial Strategy was reviewed. Among its features particularly stressed were the need for development of intra-regional trade, improved investment climate and active involvement of the enterprise community. It was explained that 15 industrial sectors had been identified as being of particular importance for regional development. Among the chemical sectors identified were some of those which were discussed in this workshop. It was observed that the studies were carried out before the adoption of the new strategy, but this would not reduce the relevance of their findings.

#### 3. THE UNIDO REPORT

Introducing the UNIDO report, the report leader noted, among other facts that some of the information could now be taken from external sources, and also that the time lag made the presentation more difficult.

The UNIDO report contains in Volume I the main findings, in Volume II an explanation of the methodologies applied and in Volume III very substantial and detailed information relating to the four product groups investigated. The methodologies applied included consumption forecasting based on macroeconomic data and projections as well as a system approach based on modelling and computerized programmes. This part of the report is rather sophisticated. The four main sectors covered are: Fertilizers, Inorganic chemicals, Organic chemicals including oil refining and petrochemicals, and a number of additional and more specific sub-sectors.

### 2.1 FERTILIZERS

The workshop observed that the SADC region has got abundant supplies of raw materials for fertilizer production. It also noted the great economic importance of such products and that a growing market exists. The workshop therefore concluded that the SADC region should establish projects for production of various types of fertilizers in quantities reflecting the ratios of agricultural application and the overall demand of the agricultural market. Industrial development would also need to be balanced with other macro-economic developments, like the availability of transport facilities. The basic fertilizer production units should be of regional importance. The workshop also observed that in view of the international supply situation it would be unrealistic to reckon with an export market for manufacturing units in the region.

The workshop was informed that matters related to the production of fertilizers in the region have recently been studied also by the World Bank.

#### 2.1.1 RECOMMENDATIONS:

The workshop recommended that a Regional Working Committee on Fertilizers be organized. This committee should include representatives of the member states, relevant regional sector organizations and donor agencies and should liaise with representatives of the relevant business communities and potential investors inside and outside the region. The committee should analyse and co-ordinate developments pertinent to the fertilizer industry. Projects in this sector are of regional importance.

### 2.2 ORGANIC CHEMICALS

The workshop made the observation that no substantial part of the most important organic chemicals takes place in the region at present. This sector should therefore be developed. It observed that two routes are available: the petrochemical route and the carbon-dioxide synthesis route. Raw materials for both routes are available in the region.

The petrochemical alternative would be based on Angola's petroleum resources. This type of industry requires large scale plants and heavy investments. By nature the processes lead to a number of chemicals which must find a balanced market in order for the investment to be viable. The technology is sophisticated.

The alternative route is based on electric energy and coal which are both readily available in several parts of the region. The critical factor is the price of the electric energy. Production facilities for this type of processes can be developed step-wise. The initial investments and the financial risks are therefore more limited.

### 3.2.1 RECOMMENDATIONS:

The workshop recommended that SITCO, in cooperation with the business community, should identify potential carbon-based carbidoacetylene projects and their preferred locations, and allocate funds for feasibility studies. Development of substantial projects of this nature will be of regional importance.

### 3.3 INORGANIC CHEMICALS

This main group of chemicals can conveniently be divided into three sub-groups: acids, alkalies, salts and technical gases. It was observed that production of the major items in the acids group is extensively developed in the region. This is true even for the production of salts which is nevertheless inter-linked with acids and alkalies. Technical gases do not yet find an important market in the region but some raw materials are available. The group mostly in need of development is therefore that of alkalies. Chemicals within this group, or products based on them, are very important for industrial as well as household usage. Such products are now imported into the region.

Two routes exist for production of alkalies. One is based on sodium salt and the other on soda ash from trona in sodium lake or similar natural deposits.

Production based on salt is made by electrolysis. Such processes yield chlorine in equivalent quantities. This route may have economic advantages at reasonable electricity prices, but requires the chlorine must either be used since this very aggressive chemical is a real hazard for storage and transport over longer distances.

As for soda ash, the workshop observed that Tanzania's Lake Bangwe project is under implementation. All of the output, 1,000,000 tons per year, may become available for the CADC market. The workshop concluded that Tanzania's similar Lake Heron project can be expected to exercise great influence in the medium to long term.

### 3.3.1 RECOMMENDATIONS:

The workshop recommended that Tanzania's National Chemicals Corporation and/or other investors should be encouraged to promote the Lake Heron project, which will be of regional importance. To this effect, the workshop suggested information should be investigated in order to identify best routes and are made the overall situation should again be reviewed, including availability from Lake Bangwe possibly also from Kenya together with developments in the region related to other products of the soda ash family.



#### 4. THE TISCO REPORT

The 1982 TISCO study covered caustic soda, sodium silicate and starch. The study investigated the actual consumption of the three chemicals in the member states, together with the ruling prices for the products and their raw materials. Present and projected supply gaps were estimated. The report proposed projects designed to close the gaps, where required, and priorities for their implementation.

The workshop observed that the figures obtained for caustic soda did not tally well with the findings of the UNIDO report, which is based on a different methodology. However, it is clear that an important gap will exist by year 1990 with regard to supply of this chemical.

The two projects for caustic soda recommended by TISCO were one in Zimbabwe and one in Botswana, both based on brine ash to be produced from Sea Pan. A third project, in Mozambique, based on soda ash electrolysis seemed not to be viable, but this would depend on the actual energy applicable per unit as well as electricity power.

For starch, it was concluded by TISCO that increased intra-SADC trade should be encouraged, since the actual capacity in the region is sufficient. For sodium silicate, present plans for rehabilitation and expansion would cover the need.

#### 4.1 RECOMMENDATIONS:

The workshop recommended that SADC should encourage the business community to pursue the caustic soda projects proposed by TISCO, since these would reduce the supply gap. These projects would therefore be of regional importance.

#### 5. MISCELLANEOUS

The UNIDO report recommended a study on utilization of identified deposits for exploitation of potential for soda ash. It also stated that within the region, many of the opportunities identified related to retailing chemicals available in the region and to the utilization of processed waste. It was pointed out that production of soda ash can also be carried out in relatively small scale installations which will not require major investment.

#### 5.1 RECOMMENDATIONS:

The workshop recommended that SADC should finance the cost of the study related to identification and production of soda ash projects within the chemical sector. When a list of such projects is available other countries should be invited to the present study committee.

SADCC INDUSTRY AND TRADE COORDINATION DIVISION

(SITCD)

INDUSTRIAL CHEMICALS WORKSHOP  
DAR ES SALAAM, 10TH SEPTEMBER, 1990

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