STABILITY INDICATORS, A TOOL FOR ORGANIZATIONAL PLANNING AND CONTROL

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April 1992

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The present research introduces a methodology that helps to identify and measure Stability Indicators, as well as an interactive model used to monitor and follow them up. Stability Indicators are used as a tool for organizational planning and control. Because they offer a successful managerial system, these Indicators could guarantee an organizational behaviour oriented towards fulfilling the organization's objectives, strategies and policies.

The identification and measuring of Stability Indicators allow the essential variables occurring in a given process to be observed. In order to gauge efficiency, efficacy, and effectiveness, these factors have been considered to be the achievement of results, according to what was planned, thus making an appropriate use of resources.

The research was centred in developing a conceptual framework that uses the systemic, cybernetic and strategic planning approaches. They permit not only diagnosis but also the design of organizations. Such approaches are a help in the identification and measurement of the best indicators employed in the analysis of the organizational stability.

The activity of Carbocol, a Colombian coal enterprise, with Central Zone, a mining project, was taken as pilot sample within the study. The study of these approaches in the boundaries of Carbocol has allowed the researcher to actually identify a series of its most critical aspects which are underlined in this paper. The managerial ability has been strongly applied to the just mentioned aspects not only to learn from the company's past and present problems but also as means to solve them.

The research can be classified within the topics for Strategic Planning, Managerial Control, Cybernetics or Decision Support Systems.

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CHAPTER I

GENERALITIES

This chapter offers a broad definition of the purpose of the research, the existing motivations that moved it to be carried out as well as the context it has developed from. The main concern is to furnish a methodology to approach planning and control problems in complex organizations. The research focused entirely on Carbocol, a Colombian enterprise in the coal sector, as a pilot organization.

A. RESEARCH PURPOSE

The objective of the research is to develop a methodology for identifying and measuring Stability Indicators as well as an interactive model that permits to control and follow up. These Indicators could help the organization to establish and evaluate its own strategies to cope with the ever accelerating change of business environment, a characteristic of the present decade.

The purpose of this methodology is to offer the enterprise an action plan that would allow it to react to future changes in relation with decision taking and the definition of priorities. It will help to clarify the enterprise's future managing and will also define a better way to allocate resources in relation to the business environment. It will also define opportunities and characteristics in the short, medium and long term. Simultaneously, it would permit a better observation of the fundamental variables that are involved in any organizational process. The behaviour of the variables must be guaranteed by closely monitoring how they could be affected by both internal and external changes that may occur. The variables are Indicators of Stability. They make possible an evaluation of the organization in terms of efficiency, efficacy and total effectiveness, according to the results achieved and, finally, they can make the best out of resources.

The definition of an integrated set of Stability Indicators may generate the basis for more organizational or rational planning and control, including better analytical elements that are currently available.

The operation of the methodology is interactive and flexible. It makes it easier not only to adopt preventive and adequate measurements, but also to predict changes. Makridakis (1989) says: " The rapid change we are facing, does not permit us to wait until it comes to react and evaluate its impact in time. Notwithstanding, executives must anticipate future changes a long time before they happen, keeping in mind a clear idea of what the future may look like and what it is bound to bring along, allowing it to be shaped in all desired directions in such a way to make organization adapt more easily to the changes that await."

Interactive planning and control allows us to take decisions in time, based on the process of path selection. Each path is a series of foreseen uncertainty factors and critical situations that, once analyzed, will permit the creation of a better future. This is why, as part of the methodological research design, an interactive computer model has been designed to facilitate not only the taking of remedial action as soon as problemsshow up, but also to hinder problems occurring in the first place. Applying efficient technology of information and communication is enormously important in entrepreneurial planning and control. Computer forecasting helps to manage uncertainty up to a wide limit since a greater number of variables can be considered to obtain faster and more accurate information.

To implement the model, we must identify the information needed to create and actualize the data bases. This process will not be unchangeable throughout but rather representative of the best and most punctual effort in time. The data base must be altogether flexible in responding to a continuous feeding-back.

Generating an appropriate environment can furnish an easier flow of information through which communication, coordination and share participation would be feasible from any given area to another within the same organization.

The thesis is structured and numbered to adjust to the methodology and its steps. The subtitles in the third chapter correlates with the steps necessary to follow the methodology serving as a guide to the reader.

It is necessary to follow the methodology carefully especially when applied for the first time. After its advantages and limitations are known, the analyst is able to judge, modify and adjust the methodology to each particular organization. Even though it was designed taking into account the case of Carbocol, it is applicable to many organizations as an aid for implementing and as a follow-up for organizational plans, and also in organizational evaluation.

The terminology employed in this text is a specialized one that can be applied to other methodologies with different contexts. Therefore, the terms that appear here have acquired a special significance.

B. FACTORS THAT MOTIVATED THIS RESEARCH

There are some important factors that make necessary a change in the traditional method of an organization's planning and control. In the first place, the organization's survival has become dependent on its executives' ability to manage, adjust, and adapt to a complex environment, a feature of the decade. Secondly, there is a genuine need to integrate the organization's methods for planning and control. Such an integration will improve and increment the organizational capacity and thus to reach a better competitive position. It is also necessary to introduce some flexible methodologies that could permit a much better handling of uncertainty, thus smoothing down the control of the great number of economical and social variables implied in each organizational process. To fulfil the above mentioned necessity, it is essential to rely on flexible information systems and computerized models which will provide strong support for decision making.

a. Influence of the environment on handling organizations.

The historical evolution of organizations has forced different factors to influence managerial development at any given time. In the beginning, the emphasis was on optimizing a specific task, later the whole structure, then human resources, and finally on technology. Nevertheless, at present, the environmental complexity is the factor most influencing organizations.

The organizations of the 90's must be prepared to survive in response to changes in the business environment. The world is becoming more complex every day; we are immersed in a much more difficult environment. There are many new degrees of complexity: more people, organizations, technology, problems, opportunities, information, etc. Change is enormously complex and may come from either inside or outside the boundaries of the organization.

As change occurs at an unknown rate, organizations must be more adaptive and have a greater capacity of apprenticeship to survive and develop in the 90's. There is turbulence in the environment, with energy and environmental problems, new and growing technological change, new competitive forces, inflation, unstable foreign exchange rates, and a trend toward globalization involving the different economic situations of countries competing for a world market. Furthermore, there are difficulties arising from the various actors that affect organization i.e. shareholders, debtors, clients, suppliers, managers, government, community, consumers and others.

"There are important changes that happen in the political, economic, social and technological environment enterprises are operating in. These changes call for a large scale revision of strategy, structure, administrative processes and management style. The changes are the result of two powerful forces which will determine the identity of the firm in the future: the tendency toward globalization in consumer and industrial markets and the increasing importance of technology" Hax

(1989).

Managers should be given tools that will allow them to understand and cope with rapid changes in diverse organization status. Survival requires that not only the individual's but also their organization's increase in their amount of learning and adapting capacity. A great bottleneck today is found in the rate at which organizations change in order to adapt to new circumstances.

b. A need for integrating the functions of planning and control

Most organizations carry out planning and control functions separately. Most of the time, Planning and Audit Offices work independently one from the other. From the need for integrating an efficient planning and control system, strategic management has emerged. This type of management integrates the managerial cycle (planning, execution and control) making a greater emphasis on developing evaluation tools. Most of the systems developed by organizations up to the present have been centred on planning without having the appropriate tools to evaluate the organizations efficiency; thus creating a non-existing strategic planning implementation. This fact has caused Strategical Management to come into being in order to integrate the managerial cycle of planning, execution, and control by emphasizing the development of evaluation tools.

In order to obtain a corporate integration, it is essential to have previously reached the integration of both planning and control functions. For this integration to be functional, we must create new opportunities in the future. In addition to reacting on the environmental changes, the corporation must keep a constant observation of present conditions that would enable it to discover creative internal forms to improve the competitive position of the enterprise. Planning is thus adhered to the establishing of missions, objectives, strategies and policies. Control is related to how they could be evaluated through organizational stability measuring criteria, bearing in mind a constant analysis of the organization performance, either internally or externally.

Corporate integration must be the core of the strategic management process, allowing all the organization's parts to be planned both simultaneously and integrally, so that there will be no conflict among the different organizational groups. At the same time, the corporation must understand that the solution for all the problems of one specific area could facilitate a prompt change of strategies or policies belonging to another area.

Whenever an inappropriate or incomplete form prevails, strategic planning is limited. It thus creates resistance among the members of the organization concerning the above mentioned changes. The integration of planning and control functions will not be successful without timely information and a total commitment of the company, especially in the concerns of the higher level management. This

unanimous commitment, from the members of the organization as a whole, requires the development of an appropriate entrepreneurial climate (corporate culture) that leads to the opening of a frank dialogue over strategic items among the corresponding executives.

c. A need for flexible methods developing new approaches for planning and control

Planning and control instruments have gained undenied importance in organizational design and diagnosis. Nevertheless, there is a certain inaccuracy in predicting the future because of the empirical methods that have been used up to date. Problems have arisen in the statistical methods that have been used, especially in reference to the assumptions on which these are based and the restrictions that have been defined. Evidence of this inaccuracy can be found in the exactness, effectiveness and the use these projections have had.

By creating non-flexible and rigid systems, a huge amount of internal organizational hurdles hindering final productivity emerge. It is essential to introduce feedback, an apprenticeship of flexible methods, to allow handling uncertainty to shape or mould the future. There are always situations which are not considered when the methods that do not handle uncertainty are first designed. It is essential to analyze the best way to use uncertainty to get the best systems which in turn make the organization viable. Uncertainty, instead of being an organizational problem, is something that permits an enterprise to

survive and adapt to the changes of its environment. Therefore, the existence of uncertainty should be no excuse in avoiding the taking of decisions and defining actions to prepare for better coping with the future. The basic course of action involves getting used to the handling of uncertainty and reducing the surprising impact it brings along with.

It is essential for the organization to possess systems flexible enough to handle uncertainty, and thus to have effective and appropriate responses for the environment. Such systems must expedite whatever decisions making there may be.

It is necessary to understand and accept that all projections made about the future should be considered as uncertainty. Success lies on well integrated systems of planning and control that allow identification and prediction of better trends, by emphasizing the present facts through comparison with the past.

d. A need to design effective systematized models

As technology develops more rapidly, organizational structures become flatter or less hierarchical, making organizations more dependent on information. Information support must be completely articulated within the organization, backing up its strategies and guaranteeing that planning of information systems is done starting from corporate objectives, strategies and goals. Information changes decisions,

decisions represent a business strategy, so at the same time information will test strategies and their assumptions. Therefore, both information systems (IS) and the systematized models which were developed to handle these systems have become mechanisms through which, both only coherent linking of integration as well as organizational apprenticeship, are obtained.

Of all the steps which competitive organizations can make, technological change is the most important. Technology and innovation have changed both the environment and the world of business. With each passing day, technology becomes a more essential and competitive tool for survival and growth in the emerging economy and business environment of the 1990's. Every moment, it becomes more sophisticated; intelligent machines communicating in human-oral language are helpful in solving problems and supporting complex and subjective decision making. Telecommunications and information integration changes; the improvement of network capacity; the combined transmission of voice, data and images; the expansion of public data networks; the establishing of standards in equipment, telecommunication and policies have made it, each time, more difficult to close the gap between technology and organizational design. Therefore, it is of the utmost important that enterprises apply new technologies to handle information adequately, in such a way that they can think, reason, compare, and make pertinens decisions to obtain competitive advantage.

Executives should at all times, through implementation of managerial information systems and systematized models, analyze data at the very moment it is being generated. Also necessary, are information systems that allow for an adequate local handling of data which in turn make feasible the interconnection of decentralized systems to corporate ones.

The generation and recognition of flexible criteria is essential in the design of information systems capable to give management a support in integrating the systematized activities in the organization. This process starts from the data entry at operating level and proceeds up to the information needed in decision making at managerial level. It is also fundamental to have systematized models which use this technological development to make possible the handling of these systems of information.

C. CONTEXT ON WHICH THE RESEARCH HAS BEEN CARRIED OUT

a. Case study: Carbocol in Colombia

The study is based on Carbocol, a Colombian company in the energy sector which is involved in overseeing the exploration, exploitation, transformation and commercialization of the abundant coal reserves within Colombian borders.

Carbocol could not be considered an isolated entity, but rather, a dynamic organization taking an important part in the Colombian economy. Therefore, it is related to the other organizations which make up the country's economy; and thus is affected by the world economy. It is influenced by other enterprises and entities within and without the energy sector, and in due time, Carbocol would have to reinvest or pour some of its results over the Colombian economic means.

There are some issues which make organizing, planning, and controlling a firm of this kind very difficult. These issues must be dealt with constantly making the best use of effective tools for planning and controlling. In the process of selecting analytical tools for planning and controlling, a good number of organizations have found it necessary to adopt plans which unfortunately have not responded to realities and necessities.

By observing what occurs in the energy sector, we can see how fast the world is changing. There is turbulence in the business environment, especially in that related to the energy sector. These energy-located organizations have to be more adaptable to their corresponding environment by learning in order to survive. The prediction of some of their factors can only be evaluated once the occurring event is close at hand, consequently creating a tremendous risk at the time decisions are made. There are variables related to political, budgetary and national transactions that require anticipating major shifts in the international economic situation e.g. exchange rates movements. Success in the energy business depends entirely on good timing and effective managerial judgement. The present assessment of what managers ought to do is based on a cautious glimpse of the future. Since the so called oil crisis of the early 1970's, international energy prices have been difficult to predict. Organizations in the energy sector today have to restore their profitability by means of cost reductions rather than price increases.

Latin American organizations dealing with energy have been seriously affected by the problems of foreign debt and by the constraints for financing and investing. This has made planning and control, both in the energy sector and in related industries, more difficult.

"The analysis of the interrelationship between the debt, the adjustment policies and their impact on the energy sector, has obviously contributed to focusing on a problem whose implications have, so far, affected the economic and energy development, and consequently the future of coal as well. Only on the basis of the day-to-day lessons

left by the economic crisis will help to formulate an adequate strategy for this resource within the political and economic context of the Latin America Region." Sanchez Gabriel (1989).

b. A need for planning and control in Carbocol

The difficulties related to internal and external issues in Carbocol have both a direct and indirect influence in the development of activities for planning and controlling. These difficulties are essentially technical, financial and managerial and they generate uncertainty regarding organization planning and control.

Technical factors. The technical factors were identified based on mining criterion. Among these we find for example: the complexity and the great number of different contracts for the mining projects; the difficulty to have standard mining projects to facilitate their planning and control; the different faces of each project that make it impossible to establish standardization; the variety of necessary resources regarding quantity, quality, and operational schedule of the projects; the different geographical mine distribution that makes it difficult to share the same infrastructure, e.g. stock yards, land transport, harbouring, etc.; coal competition against other energy generating products; the different kinds of technologies as well as equipment brands used by the different mining projects that make them unique for a specific kind of project; as a result of a lack of technological transference follow up, it can not be used in benefit of the country;

the inexperience of colombian executives negotiating major technical projects has also created problems, for instance, determining long term profitability; the inexperience of colombian engineering companies in dealing with major technical projects. As a consequence the country has been forced to sign contracts with international firms which do have the expected for experience.

Financial Factors. Some of the important ones to be underlined are: mining projects representing long term investments that make capital return rather slow; oil price fluctuation that makes coal pricing unstable; the North Zone Coal Project financing problems have not only affected but also exposed to danger the continuity of other coal projects; the external debt and the high financing cost that cause the cash flow of the enterprise to be a negative factor; capital invested in social development in order for the company to be in good relation with the community.

Managerial Factors. Besides the aforementioned factors, there are some others that should be kept constantly in mind. They are: the national political instability that hinders the continuity of projects; the variations in the social, political, and fiscal stability that affect the future of Carbocol; the uncertainty in the industry production plans which do not guarantee the manufacturing of spare parts for the existing machinery; the impossibility to predict coal prices in the international market due to hard competition.

A detailed explanation of these factors is given below:

1. Technical Factors

-Technical contracts

The different kinds of technical contracts signed (association, service etc.) develop complex relationships between owners and operators of different coal projects. Carbocol's understanding of every phase in the contract for each project is very important in order to retain better control.

-Different kinds of projects with different dimensions

One worldwide problem, not unique to Colombia, is that it is impossible to find two mines having the same capacity, the same problems, the same geological location and the same general characteristics. Each project has its own dimension inherent only to it and not to another. Nevertheless, it is important to have a uniform criterion in preparing and discussing future mining projects in terms of characteristics, type, quantity of equipment, etc. Such criterion would provide a mechanism leading to a generalization or standardization that would prove easy in evaluating the viability of the projects.

-Different phases in each project

An open-pit mining operation may be split into three phases: exploration, preparation, and exploitation. Each of these phases may be divided into a larger number of operations, but not all of these are always and simultaneously present, since some of them may be avoided, and may not be altogether necessary in every project.

-Variations in quantity and quality of reserves

The carrying out of every stage requires physical, economical and managerial resources which vary from one project to another in terms of quality, quantity, and timing schedule. The whole operation depends on the characteristics of the mineral, the mine, expected production, production plan, consumer needs etc.

-Geographical distribution of mines

It is difficult to anticipate the capacity, costs, and timing of operations for different mines since they may also vary widely from one mine to another. As well as infrastructure and transportation costs may greatly vary according to the geographical location of each mine.

-Determining substitutes, coal derivatives, and commercialization

Natural gas, nuclear resources and oil itself have been overlooking the potentialities of coal because of their undenied advantages. Nevertheless, coal recovered certain amount of prestige due to the oil existing problems. For this reason, Colombia must do whatever it deems possible to exploit coal in the best of conditions, looking for maximum profit in order to attain its interest objectives.

-Different kinds of technologies used in the projects

"Efforts have been made to adopt unification of technologies and equipment, whenever possible, to make situations comparable and the 'modular projects' applicable one after the other by simple multiplication of the standard modular equipment. The concept of 'modular projects' is merely a simplification in approaching the real

project. For example, we have to take into consideration that not all the equipment which could be foreseen in one 'module' has to be supplied and/or used at the same time; It will be used in due time and only when needed. In other words, production will determine its full operation. Solitary, sophisticated machinery and sophisticated technologies for exceptional applications are not practical to be used in the country, maybe it is better to aim at simpler technologies applicable in a mass scale dimension which probably do not require any particular transformation or implication in the local mechanical sector, and represent an important volume of work for it". (Milocco, 1983).

- Follow-up- omissions in Technological Transference

Although Carbocol is an organization leading the development of coal in the nation, it is difficult to quantify the technological transference that has been implemented, especially in regard to mobility of personnel. This creates a major problem for the organization, as new deposits have been discovered and mines developed. It is also necessary to find specific programs in order to choose and adapt the best of technologies to increase the technical knowledge of Carbocol employees to make the best technical contracts.

-Colombian executives' inexperience

The inexperience of Colombian executives in developing long term technical contracts has produced serious misunderstandings in certain projects. An example of this is the problem involved in defining a time scale for the life span of a project. Difficulties arise when taking decisions concerning a long term perspective (over 20-30 years), and in

the light of both economic and social return and the exploitation of the resources in the distant future. Profitability could be less than optimal as a result of the environmental uncertainty and the risks involved in such a perspective.

Because of their lack of experience, Colombian executives have had some difficulties in foreseeing long term tendencies affecting the real benefits Carbocol receives. There is no institutional memory which would help executives learn from past mistakes in the negotiation of projects, and, make the best from the experience gained.

-Large Colombian Engineering Enterprises' inexperience in dealing with big technical projects

This inexperience has forced the opening of international contracts for exporting coal from new mines, obviously regarding better economical benefits. The Colombian engineering company has had a hard time establishing the kinds of National Contracts that could compete internationally.

2. Financial Factors

-Mining projects are long term investments

Mines development should not be regarded as a rapid capital return. In other words, the financial sector as well as the investors must not expect fast returns from any new mine because of the time needed for preparing and achieving an optimal production level. This normally involves years, rather than months.

-Oil Prices

"Permanent changes in oil prices have caused difficulties to many businesses worldwide. Oil has once again started to gain back lost confidence in international demand, while other substitutes are just now showing up into international markets. The price of unrefined oil has been estimated to vary from U.S $15 to U.S $16 per barrel in 1992". Extracted from an internal document issued by the Carbocol Planning Office (1989). Notwithstanding, the Middle East problems created by the Iraqi invasion of Kuwait in September 1990 caused the oil prices to shoot up to U.S $40.4 per barrel. The stability of this price would depend enormously on the capability of the United Nations to handle the total embargo voted by the U.S.A. and backed up, among others, by the Soviet Union.

-Financial problems affecting the continuity of coal projects.

Between 1984 and 1990, the external economy of the coal sector continued to deteriorate in relation to the macro-economic factors. Some of these factors include the loss of exports, the U.S currency devaluation in relation to other strong currencies, the increase in external interest rates, the closing down of international capital markets, and the total accumulation in the foreign debt of Latin American countries. These factors have created a tremendous amount of difficulties for external credit acquisition. For example, "The expenditure of external credits delay caused only in the first semester of 1989 a great economic deficit in the public sector, which consolidated total reached 136.1 million pesos, equivalent to 2.56 % of the gross national product -GNP" "Carbocol en bancarrota". El Siglo (1989).

As a result of these problems, the executives from Carbocol have had to waste an enormous amount of time looking for alternatives solutions to guarantee the continuity of investments in the North Cerrejon project.

- Foreign Debt

Carbocol has been seriously affected by a Government applied policy on the allocation of foreign credits. Eduardo Sarmiento (1989) quotes the following: "The debt policy followed through by the Country these last years, has not been oriented toward reducing external transference to minimum but to improve the Country's foreign image. This implies a great flow of capital exports. The resources and foreign exchange have been used to cover external liabilities and not to expand the investment and the installed capacity. In this way exportations have turned into covering liabilities and debt and not to accelerate growth".

Carbocol's share in this foreign debt is minimal although it is difficult to finance its financial costs from this source. "In Colombia, the energy sector shows a 41.4% of the foreign debt. Of this percentage, 8.5% went to coal production". OLADE (1988). Therefore, if Carbocol wants to pay back its foreign debt, it must not only use this coal production percentage but also investment from its associates.

Added to the above mentioned situation, there is a negative effect corresponding to a major devaluation of the peso, making the external debt grow continuously. Income per unit-coal exportation rise when devaluation is accelerated. The debt in terms of foreign currency also rises and the importation gains continue to be smaller than the

financial costs of such debt.

-Financing difficulties

"Carbocol has one of the most complicated financing situations among the entities conforming the mining sector. There are two relevant factors: firstly, the company financed The North Cerrejon with external credit resources that were mostly contracted in a rather short term. This initial investment reached US $ 1.500 millions; Carbocol invested 50% of the total and Intercor-Owner covered the other 50%.

Secondly, it was due to the nick of time. When the project was carried out, prices up to US $ 80 dollars a ton for the middle of the present decade were forecasted. The quotations descended in 1987 under US $ 28". Mejia (1988).

These difficulties have emerged from the very birth of the North Cerrejon Project, since the idea of the Colombian government decided to develop the mine by means of foreign currency. "As soon as the mine exploitation began, the analysis showed that at certain periods of time, incomes were not even sufficient to cover operational cost, let alone financial ones. The North Cerrejon profitability estimates were based on an income scenario of 50 dollar per ton. In 1988, for instance, while international price was 28 dollars per ton, Carbocol's financial costs were 34 dollars and its production costs 27. Although prices recovered last year, oscillating from US $ 38 to US $ 40, it is hard to achieve the income programmed forecasting when the decision to exploit the North Cerrejon was taken." Semana magazine (1990).

As we can see, exogenous factors have influenced Carbocol's financing problems i.e. the international setting of coal prices. Additionally, operational costs, sale expenses and financing costs have been quite onerous. These series of factors means the enterprise continues to face financing difficulties. However, there are good perspectives of financially recovering by mid term and the company is expected to produce net benefits by 1995. The good quality of the Colombian coal eases entry into international market. If the ascending trend of price continues and the pre-established top production is reached (15 million ton a year per 1994), the enterprise will be able to obtain more operational profits and less net losses in the next five years.

-The social return on investment

The social return on investment is very complex because issues such as ecology, employment, government investment (not private), social ecology of the region, use of the country's resources, administrative overhead at the national level, and intergovernmental relations all have potentially serious positive or negative impact on the project. As a consequence of these relations, Carbocol spends resources on plans and programs for development at a regional level. The objective is to develop a peaceful relationship with the communities in the long term.

3. Other Factors

-National political instability

The Colombian President is elected for four years. Due to political

reasons, the president of Carbocol may be either removed or reconfirmed at the end of such a period, leaving most projects unfinished and the continuity of planning therefore halted.

-Changes in the social, political and fiscal order

The economic measures are not the only factors affecting the development of economic sectors or business. Changes in the social, political and fiscal order are also related, sometimes more than expected, to Carbocol's future. Therefore, in this sense, it is necessary to bear in mind the frequent measures imposed for purposes of order, personal positions with politicians and candidates over foreign investment, the protection of national industry, the opening of imports, the peace treaties issued in the country, guerrillas, attacks and destruction of oil pipe lines.

-Autonomy of the firm

Although covered by the same regulations as private counterparts, Carbocol derives certain benefits from its status as a commercial and industrial government enterprise. For example: its budget is autonomous and self-controlled by the firm, Carbocol is tied to the Government's International loans programs, and is tax exempt.

-Uncertainty in planning production in local industries

Local industries can produce spare parts for existing machinery for the coal projects once the designs have been developed. However, it is difficult to know what can be locally produced, as this depends not only upon the capability of the manufacturers, but also upon the variety of

machinery in use at the mines (not to mention economy of scale).

-Competitive Prices in the international market

It is difficult to predict international prices, not only because of the unexpected flow of international currency but also due to fluctuations in the world coal market. The coal prices constitute a function of the market conditions and a consequence of buyers ability to negotiate them.

c. Central Cerrejon as a pilot model

For the purposes of this research, a pilot-prototype for the Central Cerrejon project was chosen. As an opencast coal project, it can produce steam coal both cheaply and profitably. This project belongs to The Cerrejon Community, nevertheless, by means of a contract, Carbocol managed the mine with mine operators and commercialized the coal directly until to the first semester of 1990.

The communities corresponding coal zone has reserves estimated at 650 million tons, but only 300 million tons are exploitation viable. The remaining coal is located a 150 meters deep, making extraction expensive. Central Cerrejon Zone has had two major contractors for its operation so far: Domi-Prodeco- Auxini and Pinsky.

For the exploitation purpose of the area, Carbocol signed a ten year service contract with a Colombian-Spanish consortium, (Domi- Prodeco-Auxini), beginning in 1982. This Operator had the responsibility to

produce, process, and load the coal. Carbocol paid the consortium per ton produced and in return received the production on trucks. The consortium's contract involved the construction of the necessary infrastructure for the mine as well as the mining operation itself for the exploitation of 10 million tons. Carbocol not only handles the project completely but also markets its production directly.

The Central Zone production began in September, 1982, at a rate of 25.000 tons per month, reaching a total of 90,602 tons that year. The mine had a production level of 346,857 tons during 1983. It produced 572,541 tons in 1984, 639,000 tons in 1985, although under the mining contract, it was expected to reach yearly 1,500,000 tons from 1985 to 1991. The Carbocol Board of Directors decided to adjourn the contract in August 1985 because of the high production cost and low profits under it.

1,681,181 coal tons were exploited altogether and 10 million m3 steril (earth the coal is buried in) were removed by the Operator. Carbocol sold 80% of this coal in International markets. Due to the breach of contract, Carbocol had to pay a liability to the Consortium Domi-Prodeco-Auxini. As a result, from August 1985 until March 1988 the mine was closed. Only equipment and installation maintenance remained working during that time.

A new contract with Pinsky, a Colombian engineering company, was signed to produce 500,000 tons in 15 months from May 1988 to June 1989. This Operator was responsible for producing, processing, and loading the

coal. Carbocol paid the operator per ton produced and in return received it on trucks. The contract was extended until March 1990. Pinsky was able to produce about 690.000 coal tons, and to remove an approximate total of 3.500.000 cubic metres of sterile. Carbocol sold the entire production in international markets.

The extension of Pinsky's contract after 1990 would have been advisable if they had proved capable to cope with their part of the contract, but unfortunately this firm came to a regulating agreement or governmental treaty in 1988, as a result of poor financial and technical management.

The Cerrejon Community decided to begin an international bidding in March 1990 with the purpose of finding a trustworthy and capable international or domestic company that would provide a better exploitation of the mineral. The community expects to deliver the zone to a chosen company in the next few months by means of a multi-year contract that will provide the community with optimal profitability. The chosen firm will have to consider and select not only the mineral transportation system but also a reliable loading port.

CONCLUSION

The influence of the complex and changing environment of organizations today makes it necessary to introduce swift mechanisms to allow their permanent evaluation. A better integration of planning and control functions can expedite this evaluation, although a constant communication between these two functions is clearly necessary.

It is essential for an enterprise to identify the Stability Indicators to better plan and control the organization. They should handle relevant information in such a way to come to think, reason, compare, and take the best decisions in obtaining competitive advantages within the industry they are located.

It is necessary to develop methodologies and flexible models whose handling and monitoring of the above mentioned indicators adequately consider the new available technologies. These methodologies should facilitate the handling of environmental uncertainty and predict the tendencies of the future. This research intends to introduce a methodology for identifying and measuring Stability Indicators as well as an interactive computer model for the purpose of handling and monitoring relevant data.

Central Cerrejon Zone mining project of Carbocol, a colombian enterprise in the coal sector, will be taken as a pilot organization to test and develop the methodology. This organization was chosen because of the

great amount of indicators it wields. They demand a great ability to plan and control such an organization.

There are, in Carbocol, internal and external financing, technical, and managerial factors that make planning and control difficult. Without adequate methodologies and models for identifying the most suitable Indicators, it would be very hard to evaluate the enterprise.

CHAPTER II

SELECTION OF APPROACHES FOR IDENTIFYING AND MEASURING STABILITY INDICATORS

The following chapter is a bibliographical review of authors who had influenced this research. It relates the different approaches to identifying and measuring of Stability Indicators. This chapter also discusses diverse conceptual approaches which can guarantee the development of efficient planning and control systems.

There are three very useful approaches that, once integrated, allow the development of efficient systems of planning and control: the systemic, the cybernetic and the strategical planning approaches. When selecting the most suitable approach to orient the analysis, the above considered methodologies were chosen because they possess the requirements necessary to carry out this particular scientific task.

A. IDENTIFYING AND MEASURING STABILITY INDICATORS

The Indicators help to observe, in the organization, the fundamental variables whose behaviour must be influenced and at the same time permit to observe how the different changes may affect these indicators. (Throughout the present research, these indicators will be referred to as Stability Indicators).

There is Stability in the organization if the indicators behave around a standard value, on the other hand, if there is fluctuation, the system is considered to be unstable.

It is every day more difficult to identify Stability Indicators due to the great environmental and organizational complexity, characterized by a myriad of unexpected events or situations in which a decision is taken. A complete set of well defined indicators should permit how to appreciate the most complex organizational situations.

A correct identification of the above mention indicators is a guarantee that the established strategies and objectives are possible. Starting from a defined acting strategy, the indicators are defined as variables that filter for the executives the relevant information to evaluate such strategy. In this way, it is possible to say that the set of stability indicators constitute the enterprise's most valuable end-product, since it permits a continuous evaluation of the organizational behaviour and, at the same time, creates its own future.

There is not even a simple rule to identify Indicators of Stability belonging to different kinds of organization. As every organization has its own particular process, the defined indicators would be only relevant to that specific company and not to any other one. To make the identification of indicators easy, it is paramount to find what should or should not be included in their definition.

There is high risk in ineffective or poorly defined indicators. Indicators are frequently identified on criteria that are not, all the time, acknowledged by the area of control of some executives. Some other times, indicators consider what is important only from the point of view of a working group. Still, some other times indicators determine what is considered to be an optimal behaviour at local level but under optimum through the whole system. It is difficult to define concrete indicators in some areas, for example, the service area. From a conceptual point of view, it is equally certain that, in what concerns these areas, the executives must try to get under hand situations extremely complex for the administration per se.

An identified and correctly measured indicator behaves as a "detector of vital signs" in such a way as to inform about the tendency of the values or any arising abnormal situation. For each identified indicator, the executives should established a normative value (the value that should be), a strategical value (the could be reached value), and a tactical result characterized by the value reached in the present.

Significant Indicators as measurement of behaviour must be the product of executives and employees' innovation and creativity because they are directly involved in their definition. They should identify where mistakes and irregularities are likely to arise, document controls to anticipate their detection, and recognize effective indicators from those whose behaviour is undesired.

The executives' purpose is to maintain the stability of indicators and the whole system by developing stability criteria, capable to detect the instability of the system and make corrections whenever necessary. Notwithstanding, the subjectivity of such measurement should be reduced since different high level executives, facing the difficult task of evaluating indicators, tend to use a personal measuring system. This brings, as a consequence, an inherent difficulty in assigning priorities and significative measurements to certain indicators in the short, mid, and long term. The executive responsible for each indicator must have sufficient authority and possess the most suitable means to take corrective measures whenever necessary, no indicator would be valid without making sense or being useful for those who are going to work with it.

Therefore, a methodology and a model to identify and measure the basic indicators is unavoidable. The different approaches on which methodology and model are based comes next.

B.SELECTION OF APPROACHES TO SOLVE THE PROBLEM

This research has been influenced by the work of different writers on The General System Theory. This includes the work on Management Cybernetics carried out by Stafford Beer and Raul Espejo, who have developed and improved models and methods such as the Cybernetic Methodology and the Viable Systems Model in order to study organizations. Another influence has been the work developed by different strategical planning schools such as The Boston Consulting Group, The Arthur D'Little Inc. Institute and the work developed in the M.I.T Alfred P. Sloan School of Management by Hax and Majluf.

The work has also been influenced by Espejo's ideas extracted from his lecture on Management Information at the Aston University from 1986-1987.

It is important to realize that which ever approach is applied within the reality of the organizations, must first of all, understand them beforehand. This comprehension requires not only a complete understanding of each method, but also their integration. It is necessary to better understand the different components to manage business in the 90's changing world. The approach should emphasize the identification and measurement of the essential variables so that they could be planned for and controlled within and without the organization.

According to Kast and Rosenzweig (1981), organizations are systems

looking to achieve or fulfil goals within frequently changing environments. Considering the organization as a system helps to analyze it both in its different components, and internal and external interrelations thus allowing identification of essential variables.

Cybernetics, by offering a new way to state the problems, may help in providing a solution more efficiently by means of analyzing the complex situation which help to identify essential indicators for planning and control. According to Ashby (1977) "Cybernetic methods can be decisive in dealing with certain difficult problems, not because it finds solutions but because it shows the problem has not been correctly analyzed or has been based on erroneous assumptions. Cybernetics does not study concrete objects but ways of behaviour. Therefore it does not ask "What is this?" but instead "What does it do?".

Strategic planning allows a better understanding, either internally or externally, of the organization. Internally in relation to the definition of the organizational mission, strategies, objectives, policies and plans. Externally because it helps to better understand the environment. It becomes necessary to identify the essential indicators allowing the fulfilment of pre- established results to reach strategies, objectives, and plans.

For organizations better handling of their problems and make the best of their opportunities, the systemic approach, the cybernetic approach and the methodologies of strategical planning offer great possibilities to

improve understanding and learning from reality in such a way that organizations could be adaptable in order to develop successfully.

a. Systems approach

The businesses environment has changed radically in the last few years. There are many variables political, social, economic and technological that have created a business environment which offers us a great deal of opportunities. The complexity of the present world makes the development of a hybrid discipline necessary to understand and solve most of our society's problems. Both scientists and consultants realize that the phenomena related to their field possess systemic characteristics. To be able to understand them, it is necessary to keep in mind many interrelated variables. It is impossible to act without causing multiple reactions throughout organization. As organizations grow up and become more complex, their analysis and design can not be done based solely on the business' separate functions (financing, manpower, production, marketing, etc). It is important to analyze these function coherently.

Better understanding of each part or subsystem within the organization (supply, distribution, marketing etc.), is essential. The relationship among these subsystems or parts and their interactions with the environment constitutes an integrated system (Fig.1). Analyzing the enterprise as a whole helps to identify these important Indicators and their interrelations for managerial planning and control purposes. As

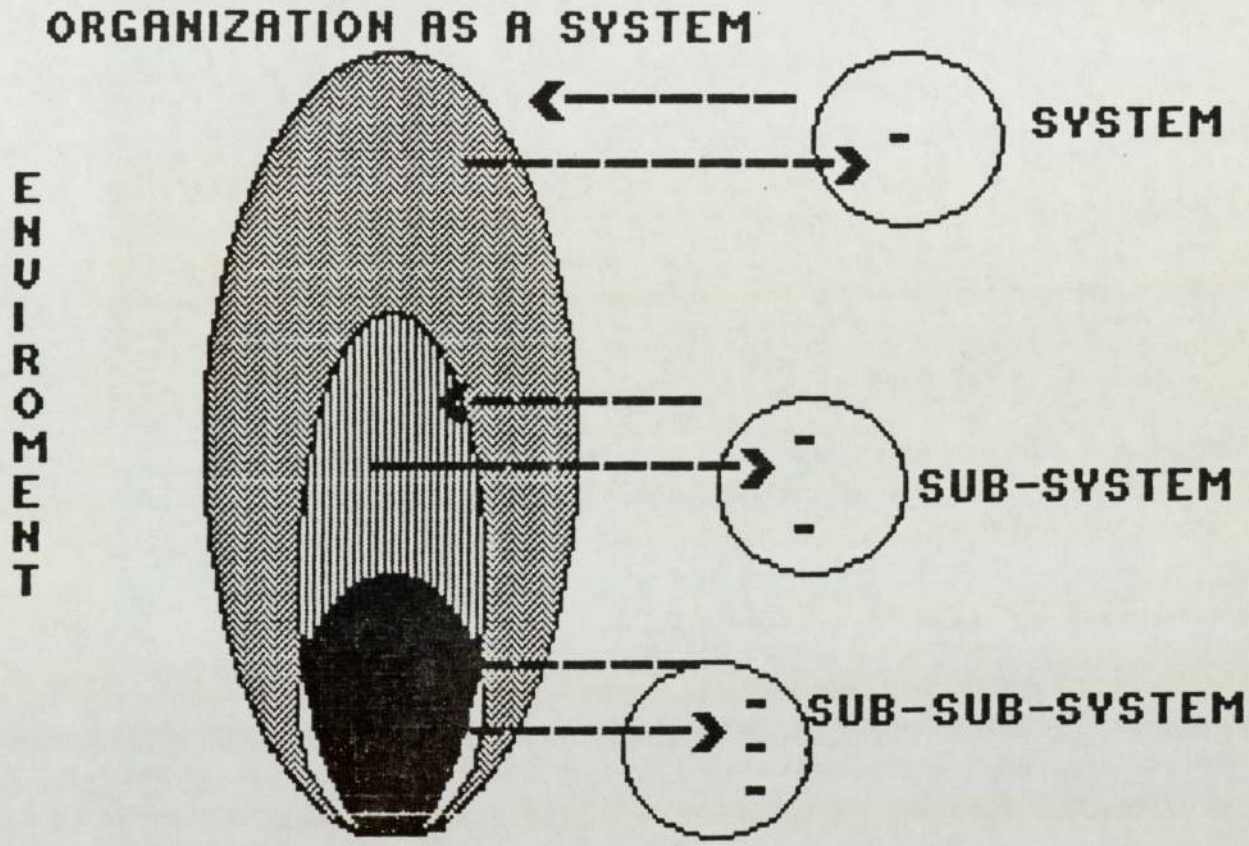

ORGANIZATION AS A SYSTEM
ENVIROMENT
SYSTEM
SUB-SYSTEM
SUB-SUB-SYSTEM

FIG. 1

an example, in any enterprise, the decision to widen production in one unit, could affect inventory levels, working capital, acquisitions, amount of manpower required in production, quality control, maintenance, working schedule, transport, sale levels, use of equipment and many other factors.

As part of this plan it is necessary to investigate the capacity of production and to know whether new equipment could be relevant, where it could be placed as well as its desired capacity. This kind of problem causes either the executive or consultant to consider not only on a great number of important Indicators but also to balance them according to a complicated net of dynamic restrictions which varying with time are difficult to control. If management bases its decisions on only a few factors, it could be altogether risky. There is a need to obtain a strategic tool that provides us a better planning and control of the principal Indicators, necessary for the decision making process. The systems approach becomes important for the decision making executive who needs a broader knowledge of the organization as a whole, in a multidisciplinary fashion.

Corporations should be alert in recognizing and monitoring externally and internally these indicators, so as to permit the evaluation of the organization as a whole. In due time, the planning and control of these Indicators must enhance the organization's survival. Corporate survival depends upon the executives' ability to manage, adjust and adapt to the complex environment and at the same time to acquire a greater competitive capacity.

Reaching major productivity, increasing quality, improving customer service, using innovative technologies and looking for an effective marketing, without obviously overlooking the human resource, a basic ingredient in the corporate culture, become outstanding factors.

b. Cybernetic approach

Norbert Wiener has been considered the father of cybernetics. His work has had significant effect on developing this new discipline and, even today it constitutes a basic fundamental reference stage in the study of cybernetics. Cybernetics studies problems of control and communication in complex systems. Particularly, in the managing area, it establishes a set of "viability laws" allowing both organizational problem diagnoses, and effective organization design. From the application of these laws, among other aspects, the criteria for planning organizational activities and developing information systems derive.

Beer defines Cybernetics as the science of studying organizational effectiveness in the managing area. Similarly, this science also increases management's capacity to interpret and analyze extremely complex situations by helping to identify the essential indicators which measure effectiveness.

Adopting the Cybernetics approach implies a complete change in how we see organizations. The approach helps executives to develop an adequate

criterion to define specific queries about a given situation and offers new ideas for the resulting organizational design. Furthermore, it helps to identify the important variables involved in the organization. As seen previously, Cybernetics brings the techniques of control and communication in an enterprise. It is especially useful in those cases where there is a great deal of complexity in the structure, making it necessary to apply adjustments continually to keep the right relationships intact.

Social systems, where organizations are located, have from Cybernetics point of view, an independent existence from the individuals who make them up. This is why, in cybernetics is important to consider the organization as a whole, with all its inherent characteristics and unique organizational culture.

According to Wiener, the secret permitting any community, either human or animal, to behave as an organized unit is the intercommunication of its members. Therefore, there must be a permanent communication among the members of an organization if they are to behave coherently. They, as a group, can possess more information than as individuals. That is why integration and coherence are very important organizational characteristics.

1. Self-regulation and Self-organization

Self-regulation and Self-organization are two powerful tools employed by Cybernetics to handle the organizational capacity in handling

information. Without these tools the flat organizations (horizontal, without hierarchy) in the future could not exist, since the tools are essential for the planning and control functions.

Self-regulation is related to the system's behaviour in accordance with a set of references that allow it to adapt to its environment. Self-organization is related to the structure and the possible changes required to maintain the organizational capacity. In the long term this is a mechanism for survival.

Every complex system must be both self-regulated and self-organized. Self-regulation implies that the different organizational parts develop the information flows required to control its behaviour. For this to be so, it is necessary to design a regulating capacity which has to be consistent with a desired level of performance defined by references. A self-organization process implies the organizational capacity of creating structure and changing these references .

To make these two processes possible, the organizational structure must adapt itself continually so that it has enough flexibility to encompass all the areas of complexity that are relevant for its development. In such a way, the planning and control functions are guaranteed. The Viable System Model, described below, is a tool that permits such flexibility and guarantees organizations are self-regulated and self-organized despite environmental disturbances.

2. The Viable System Model

Stafford Beer created this model while looking for organizational viability. He was extremely sensitive to systems viability, that is, systems capable of an independent existence. "Survival is an inherent characteristic to every organization allowing it to survive as a system; to do so, it must be capable of learning, adapting and developing. A system including all these components is known as a Viable System Model (VSM)" Beer (1987).

The development of the Viable System Model has been one of the greatest contributions of Cybernetics to Management. The Model allows the organization to be analyzed dynamically, and without rigidity. This technique helps executives to understand the necessary requirements to maintain internal stability in accordance with organizational strategies, and to understand the external stability which requires that an organization itself to adapt the business environment.

This VSM offers a methodology to diagnose and/or design the organization and understand how it performs through its total operation. It permits a **flexible** analysis of the organizational structure, from the corporate point of view, helping segregation of its managerial complexity in its different levels of recursion. Here the term "recursion" refers to the process where the system segregates and goes from one level to another within itself. This way the organization is represented as a structure of black boxes within black boxes. In such a system, these are solutions, under certain conditions which as soon as they enter the following level of "recursion" again produce the same solutions.

A property to each organization is its structural segregation, through which, the relationships among the different organizational levels are obtained in accordance with this "logic of recursion". "Modelling structural levels is modelling the structural answers that pick up the complexity of the organizational tasks. This is a description of the structural unfolding of real complexity". Espejo (May 1984).

The VSM model analyzes the organization as a whole because the different organizational units are integrated in a feedback loop. This insures an organizational survival both internally and externally, irrespective of present and future forces. The model analyzes the organization interactively, just like a Cybernetic System, processing information in closed feedback circuits. Each level handles a particular type of information and controls, one way or another, the activity at the lower levels. Simultaneously, each level is controlled by a higher one.

All the levels are so tightly interrelated that the higher ones must recognize a necessity of change regarding the what, how, and when of the lower levels. Both sub-systems and super- systems must follow the same structural principles since it is a scheme, designed, to handle variety.

Coherence and consonance among these recursion levels are necessary and unavoidable characteristics in reaching an organizational adaptability. Coherence is understood as the connection or linking required from the different recurrent levels to be in constant adaptation. Consonance is understood as the existing harmony or rhythm among the different levels

of recursion for the processes to be altogether carried out. There is a specific language for each level.

3. The Viable System Model in the identification of Stability Indicators

The VSM is one of the most outstanding tools helping to identify of Stability Indicators since it goes deeper in the idea of dealing with the managing functions and their integration. The VSM decentralizes the managing functions into five basic functions: **Implementation, Coordination, Control, Intelligence and Policy.** Going from the formulation of a policy to its subsequent implementation requires the participation of all the organization s structural levels. These levels must be sufficiently flexible and autonomous for policy to be successfully implemented.

The VSM allows understanding of these functions in detail, in order to know how the organization operates, to identify responsibility for each function within the organization. An efficient identification of these functions facilitates the analysis of the information flow among the different levels of recursion, making it possible to identify the different filters and amplifiers of this information. Every level of recursion could obtain the information relevant only to it. The definition of stability indicators becomes easier once filters and amplifiers have been identified.

To understand how these functions operate, we must bear in mind that the

organization is influenced both by its internal as well as its external environment (Fig.2). The internal environment is related to those functions dealing with implementation of policies, the people responsible for the day to day organization, and those who are actually implementing these tasks. The external environment is related to the intelligence function which is in continuous interaction with the environment surrounding the whole organization.

There are multiple external and internal indicators that must be continually analyzed when defining policies. The organization must be made adaptable to the external situation. The complexity of both the external and internal environments must be handled according to available information, requiring formulation of policies to behave effectively. This information should reach the political function through a series of filters belonging to the organization (internal) or to the environment (external). The executives are directly responsible to transmit this information generated by means of internal or external indicators to the political environment. The operational characteristic of the VSM helps to identify the indicators at each level of recursion according to the necessary information for the managerial function to be carried out correctly. A description of the different phases and necessary systems to make this model operational comes below:

When the VSM is used, the analysis of the different processes is carried out at the different strategic business units (see numeral c). Portfolio Planning Models). The first level of recursion, constitutes what we know as **Implementation Function.** To better understand each

ENVIRONMENTAL DESCRIPTION

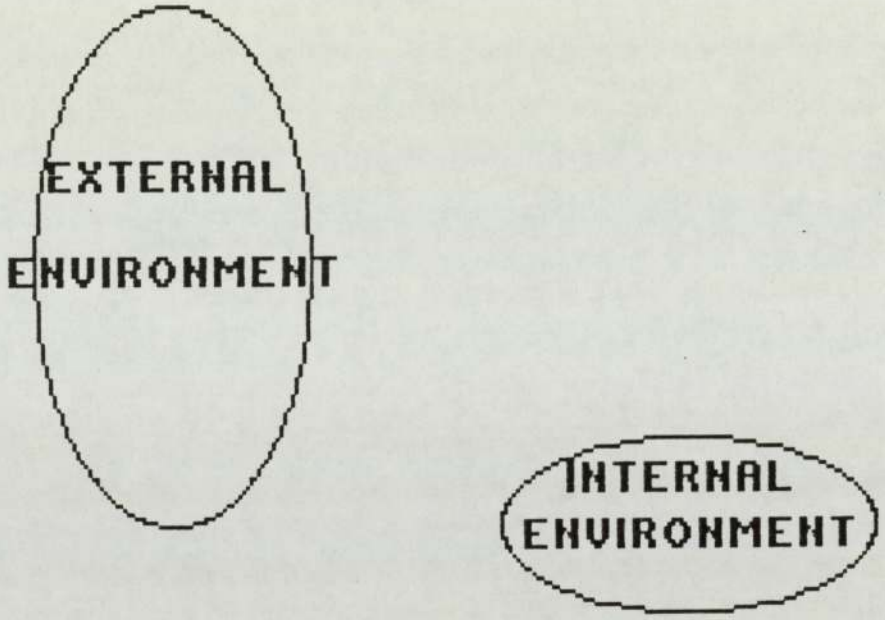


FIG. 2

process, a distinction among environment, operation, management, and models must be undertaken beforehand.

When using the VSM, the information must flow upward starting from the collection of data generated in real time, through the different processes that constitute **System One.** Therefore, this system is directly related to the **Implementation Function.**

These strategic business units manage their own information in order to optimally reach stability. The information must, after being filtered, go to the upper organizational recursion level enabling the state of the system to be analyzed. It is necessary to coordinate and transport the gathered data from each organizational unit to the managerial information system in a coherent and consonant way. This is understood as the **Coordination Function** (Fig.3). In relation to VSM, the organizational units must altogether optimize this function which constitutes **System Two.**

Both System One and Two act as filters. Each system can not transmit their information unless deviations or deficiencies are produced. The behaviour of the different processes must be monitored in real time and then sent to the relevant executives, where control or corrective action can be taken. When this happens, exception reports of outstanding items are generated. These measurements limit the variety of factors to merely important transactions.

SYSTEM TWO

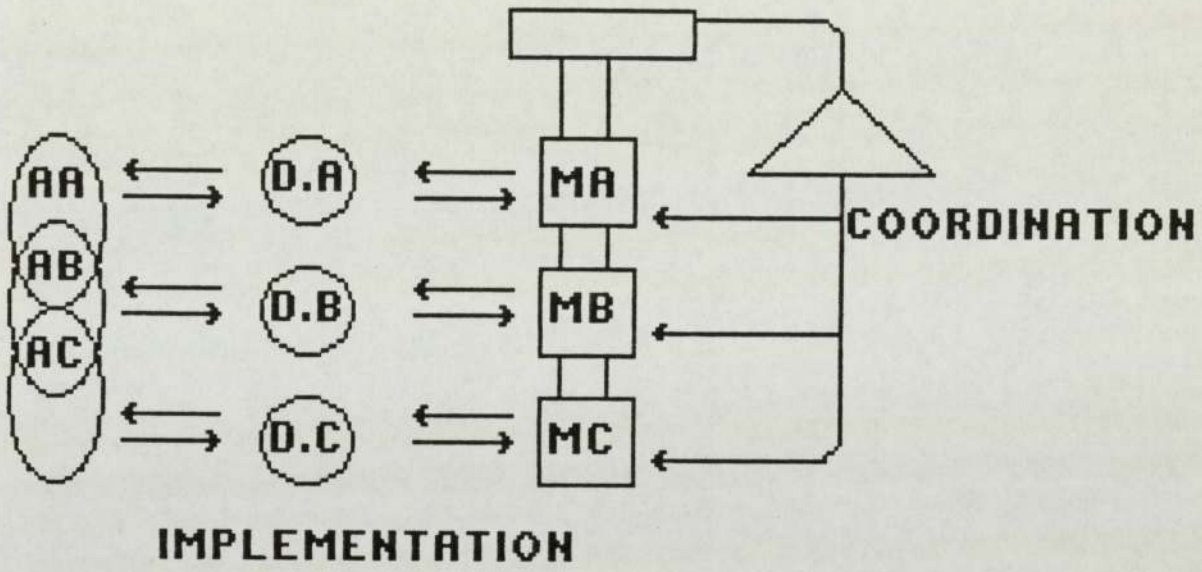


FIG.3

There are two major functions in structuring information, control and intelligence. The **Control Function** is **System Three**. This function filters and controls internal transactions (Fig.4). Control function is carried out by a groups of people from the different levels, who study what the current state of the organization and its capacities to fulfil the tasks that have been previously defined. That is why understanding the measurement of behaviour as a managerial controlling tool is critically important.

The **Planning Function** constitutes **System Four**. This function demands that external changes should be acknowledged, including: technological, marketing and political changes, etc. (Fig.5).

While the **future** is related to planning as a part of **intelligence** function, the **present** is related to the **control** function within the VSM. Planning refers to the establishment of missions, objectives and policies. Control is formulated to guide the necessary activities to fulfil objectives, either implicit or defined.

The Control Function creates and forwards information related to the internal organization to the Planning Function. Within the planning function an internal assimilation is made between the new technological development and the existing organizational culture.

Thus, by using innovation and creativity, external opportunities and threats, internal strengths and weaknesses, future alternatives are

SYSTEM THREE

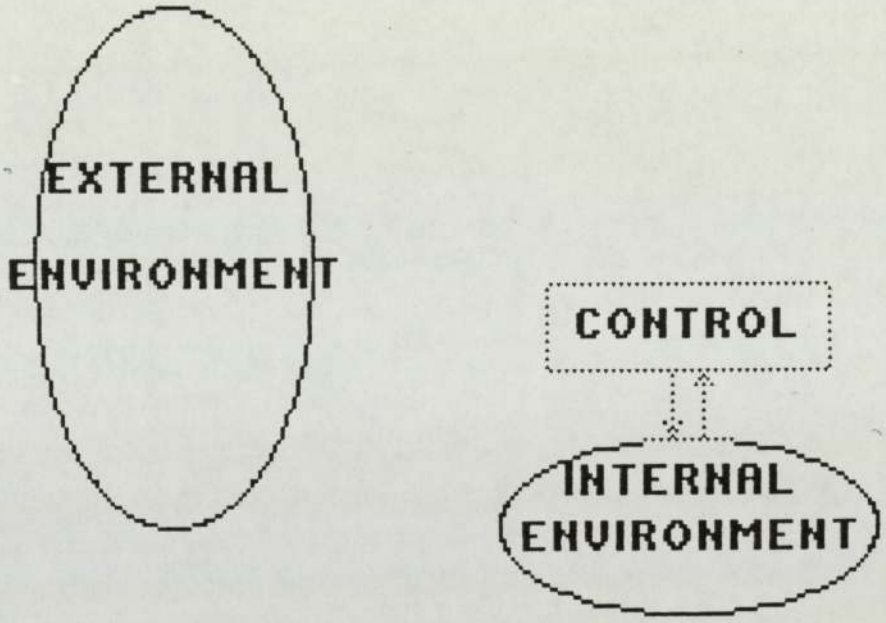


FIG. 4

SYSTEM FOUR

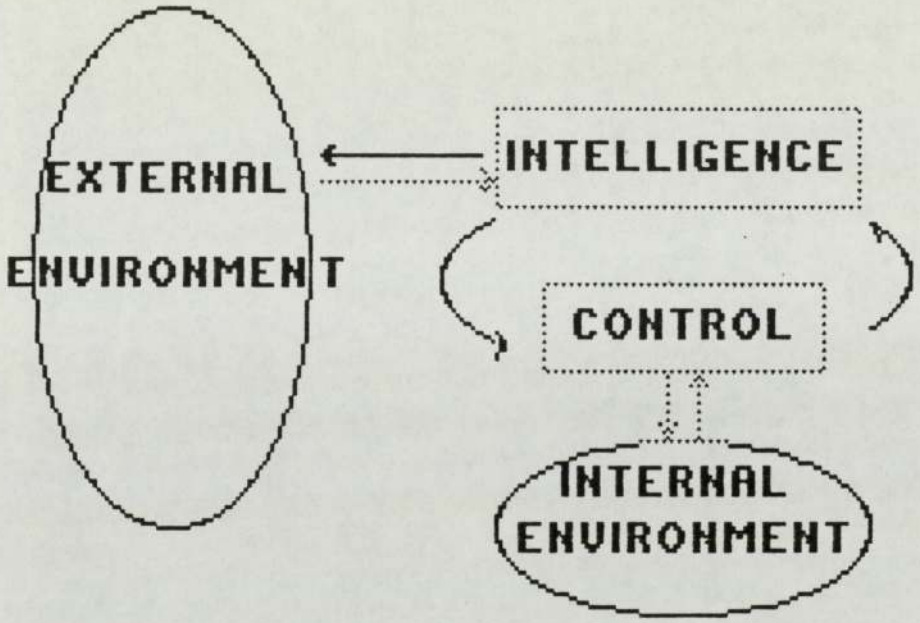


FIG. 5

reconciled with the organization.

The planning and control functions help to select the most convenient internal and external Indicators. These functions must be both self-interrelated and self-interconnected in such a way that all relevant planning situations (intelligence function) requiring an organizational response should be related to those in charge of the internal organization performance (control function).

System Five is the **Political Function** which relates the communication regarding Planning and Control functions with the Political function. If all of the information related to the external environment in the organization is fed and transmitted to the political function, this would result overloaded with information.

Further transmitting everything which happens in the external environment to the Political Function would be not only impossible, but also irrelevant. It would be inefficient to have a Control function transmitting everything in the organization. To offer effective policies to high level executives within the organization, planning and control must be so closely interrelated a permanent two-way balance between Planning and Control and Control and Planning (Fig.6).

There must be filters to reject, before reaching the corporate level, those two-way ideas good only from one point of view. Thus, a large quantity of reports, which delay performance, would be taken away from the Political function. Most of the time those in charge are only aware

SYSTEM FIVE

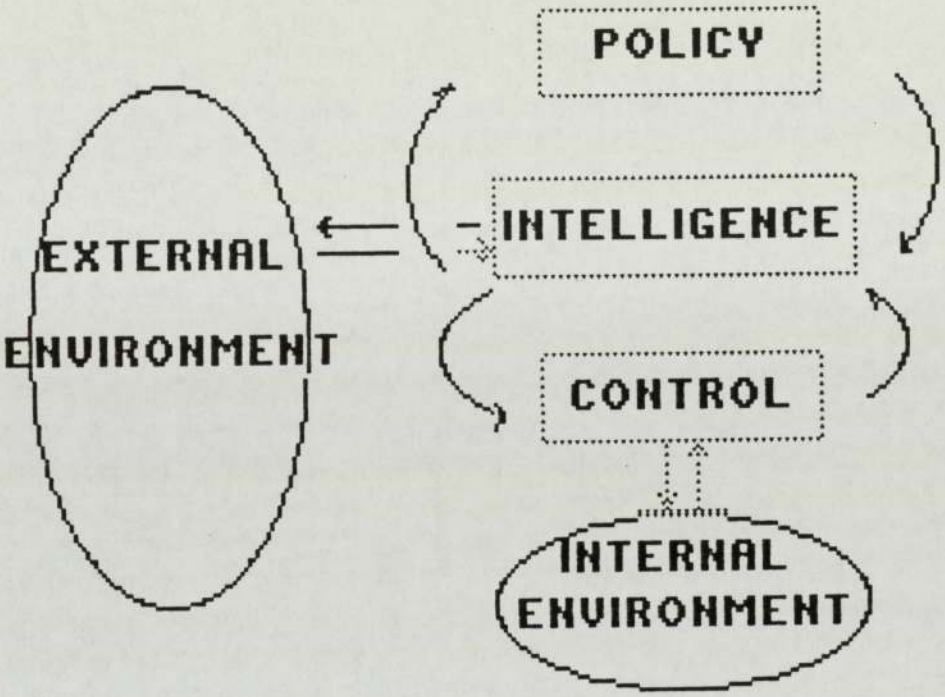


FIG. 6

of specific items, ignoring the day to day organizational routine. The relevant indicators in the decision taking process get only to the political function and nowhere else.

Planning and Control functions must be well balanced, so as to be equally complex. The Political function basically orients organizational functions to keep this balance. It acts as an adapting mechanism within the organization, responding only to an adequate filtering of policies. Thus, the Political Function performs only by exception, through a review of organizational problems. Only the aspects having gone through this filtering process would be sent to a superior level. The Political function does not have to consider the detailed, aspects of these two functions, but must monitor and get the best solution for the problems faced by the organization.

Fig.7 provides a broad view of the Viable System Model. Viewing the organization in a recursion graph shows observing how each level is formed by an ensemble of operative units viewed as black boxes. The organizational structure is the same in each level, with a sub-structure of black boxes (operative units) within the larger black boxes which are coherently related to centralizing and decentralizing problems. The great complexity of the organization makes necessary a continuous analysis of multiple facts. The integrated flexibility of this model allows the organization to become even more adaptable to internal and external situations.

For the organization to be completely effective, we must ascertain that

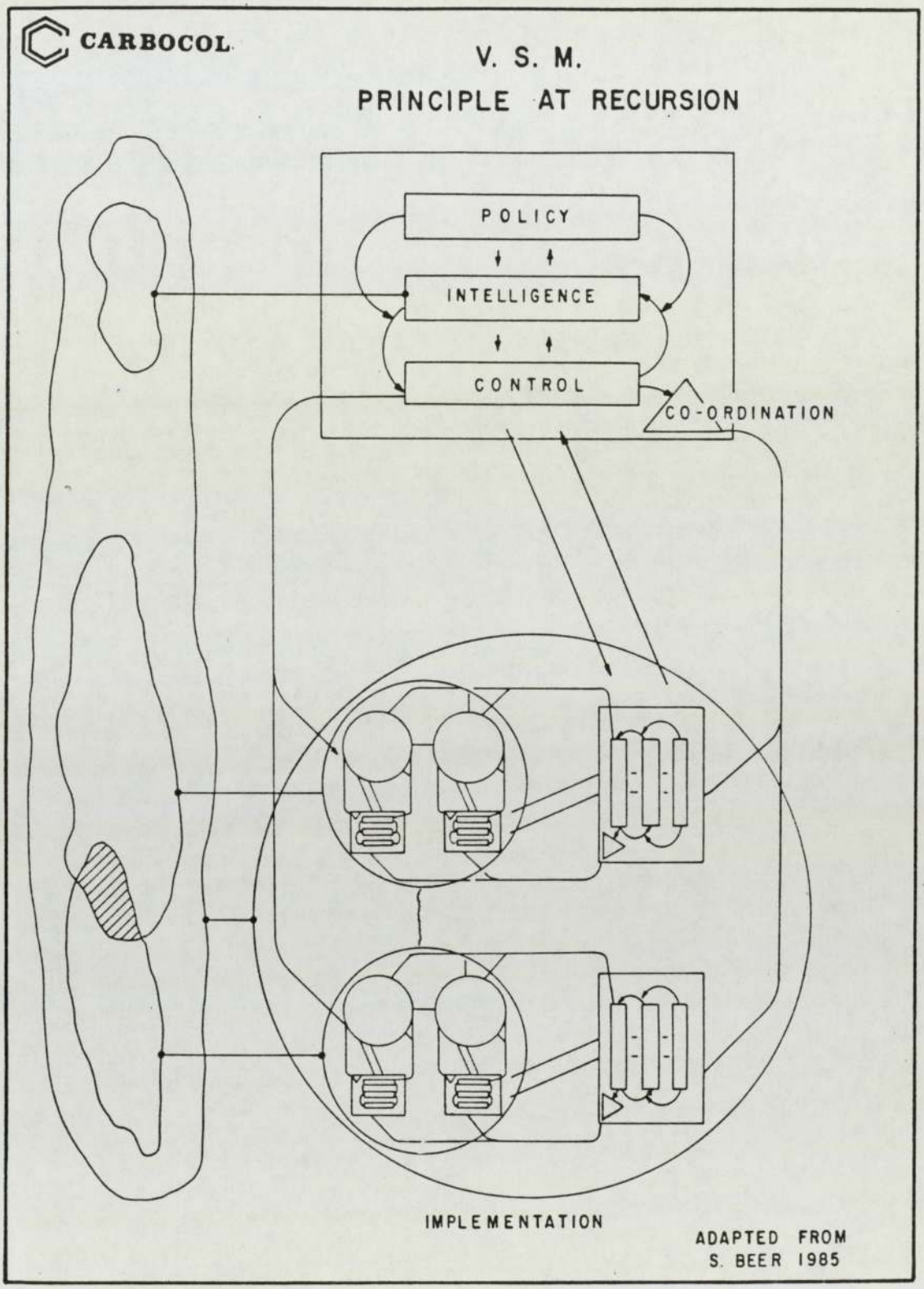

CARBOCOL
V. S. M.
PRINCIPLE AT RECURSION
POLICY
INTELLIGENCE
CONTROL
CO-ORDINATION
IMPLEMENTATION
ADAPTED FROM
S. BEER 1985

FIG. 7

all these indicators are kept within standards or limits considered normal. The organization is wholly and permanently self-regulated through these indicators which evaluate its behaviour, the force of destabilizing factors. When destabilization occurs, deviations or exceptions are reported on a continuous basis. Whenever there is new information, the indicators should be adjusted and adapted constantly to suit the environmental demands.

The executives at each level of recursion, who handle either the external or internal environment, are responsible to bring into effect organizational policies. The more complex the environment is, the greater flexibility is required at the time of implementing organizational policies. This means that, at the organizational level, those executives wanting to solve their problems within the environment, get faster answers to their questions. The executives in charge of defining these policies will have to monitor the interactions jointly present in the Planning and Control functions. To do this, Indicator systems are required to produce continually relevant and timely information so as to allow planning, follow up, and monitoring of the organizational behaviour.

c. Strategic Planning Approach

Strategy planning can be defined as a systematic process of looking towards the future, to identify how far the enterprise could reach. At the same time, strategic planning serves to find the most convenient way for an enterprise to create its own future. In this way Strategic Planning furnishes tools to construct an organization more adaptable and responsible to its ever changing environment.

It is well known that businesses are not a fortuitous result, but rather follow patterns of competence and positioning. If the indicators necessary to analyze the behaviour and competence of an organization are identified, subsequent following up and monitoring of activities would allow for a better future for the enterprise.

The organization needs strategies to make a continuous analysis of its competence. The strategy is a kind of behaviour for achieving an objective in a competitive environment. Further, it implies a conception of ideas, plans, handling of time, and simulates competence within the organization. The design of strategies must be considered a systematic mental action capable of anticipating likely futures together with their consequences. Corporate strategic planning must, therefore, integrate all decision making patterns by determining relevant strategies, objectives, policies, and necessary plans.

There are a great number of essential indicators to be kept in mind in the organization. These indicators will help executives to evaluate

their strategies, objectives, and goals regarding their corporate planning. The type of business, the managing competence and its intensity, as well as the turbulence in the environment, make the selection of indicators necessary to guarantee that planned results are consistent the reality. Therefore, in order to have an efficient system of planning and control, the executive should understand not only the need to develop new ways to generate strategies but also the necessity to evaluate them by means of Stability Indicators.

1. Different planning approaches through time

Early thinkers on management, such as Fayol, have described the managing process in terms of "planning, command, coordination, and control." Nevertheless, planning became more important throughout large companies in the late 1970"s. 1973, the year of the oil crisis, marked the end of an era of relative stability and the beginning of a period of uncertainty, characterized by booms and deep economic recession.

According to Taylor (1984), "Corporate planning has evolved into a broad range of philosophies and techniques designed to help the executive to build an organization that would be adaptable and responsible to a rapidly changing environment."

There have been serious deficiencies in implementing the different strategic planning approaches to date. These deficiencies have not permitted a rapid growth and usage of planning technic to help organizations cope with the competitive business environment of today.

The deficiencies could be explained by considering the development of such approaches through time.

a) Financially oriented planning

One of the main drives, behind the development of corporate planning in the early seventies, was the desire of top management to have a better control over the allocation of capital and other key financial resources.

Financial control was adopted as a managing system that has responded to pressures for better cash management, higher operational efficiency, cost reductions and constrained financial resources. As Hax & Majluf said, (1982): "Firms include, in their master budgets, all those activities whose monitoring is judged to be important for a healthy development of the firm's business: sales, manufacturing, managing activities, investment and cash management."

The close association existing between planning and financial control has blurred the main objective of strategic planning because it has been wrongly mistaken for a super-especialization of extended budgeting.

In the past, financial indicators were used to evaluate the behaviour of corporations. The financial control system used to consider merely a limited number of financing reasons or indicators, which were employed by executives to perform the monitoring. This approach enables management to maintain control of the monthly behaviour of various

functional activities of the organization's business units. The financial control system commonly include absolute measures of performance, related to the size and growth of the firm's operations, and include sets of selected financial ratios. The use of financial ratios facilitates the comparison of performance among units of different size for firms competing in the same industry.

b) Market oriented planning

Over the past decade, the practice of corporate planning was to develop marketing approach techniques as a response to pressures from inside and outside the organization. The pressure was centred on competing for the different markets in an industrial approach. The pressures forced different firms to pay special attention to the understanding of their markets and the rationalization of their profits in order to obtain a defensible position.

Strategic marketing has been developed around the idea that the whole business should be organized to deliver what the customer wants. There are a variety of conceptual frameworks that enable management to evaluate strategic marketing within and without the organization. The most impressive of these planning techniques has been the increasing use of scenarios in the portfolio models.

c) Portfolio Planning Models

A great variety of conceptual frameworks have been developed to select

strategic planning techniques since the last part of the 70's. Many large industrial enterprises implemented different techniques related to the handling of portfolios, (according to Haspeslagh (1982), 36% of Fortune 1000 and 45% of Fortune 500 in 1979), which resulted in the success of management consulting firms which applied these techniques. However subsequently harsh criticism has been aimed at the misapplication of these models, the assumptions upon which they are based, and the inadequacy of their analytical scope for defining not only appropriate **strategic business units** but action as well.

To understand the portfolio technique, it is important to investigate the concepts used. Portfolio planning is an analytical technique in formulating competitive corporate strategy that must be used to diversify multidivisional into separate "strategic business units " (SBU). SBU's are those units through which executives could determine strategies and analyze objectives independently from other SBU's (They would be explained in detail throughout the next chapter). Each SBU is evaluated in terms of competitive positioning and dimensionalization in a matrix consisting of its market structure, competitive position and a development of appropriate strategies.

When developing a strategic portfolio planning model, the following steps should be taken into consideration:

Step 1- The corporation is segmented into strategically autonomous business units. The levels and relationships among them are identified and analyzed.

Step 2- The relevant dimensions of competitive business-level are identified and analyzed.

Step 3- The relative importance of each business level strategic factor is assessed and a matrix constructed by using either single or composite variable dimensions.

Step 4- The SBU's are positioned within the planning matrix and their attributes are based on measurement by means of the dimensional matrix. There are various kinds of portfolio matrices developed by different management consulting firms (Fig.8). In general these matrices can be easily constructed for major competitors to generate valuable internal insights into strengths and of weaknesses related to potential responses to possible behaviour.

Step 5- It is necessary to diagnose the portfolio using corporate objectives and constraints as a guidelines. The position of each SBU in a matrix is a measure of the strategic alternatives appropriate to them, and their role in overall corporate strategy recommendations are formulated for each SBU in the form of a generic strategy or a directive depending on each approach.

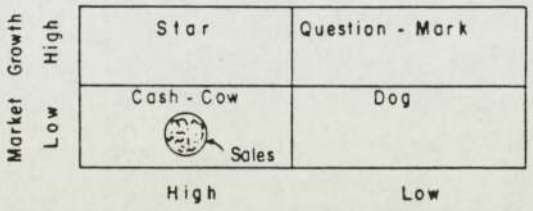
It is important to recognize that portfolio planning techniques are no solutions to the problems encountered in strategic planning. On the contrary, they are useful conceptual constructs which can contribute insights into developing successful corporate direction.

CARBOCOL

PORTFOLIO MATRICES USED IN STRATEGIC PLANNING

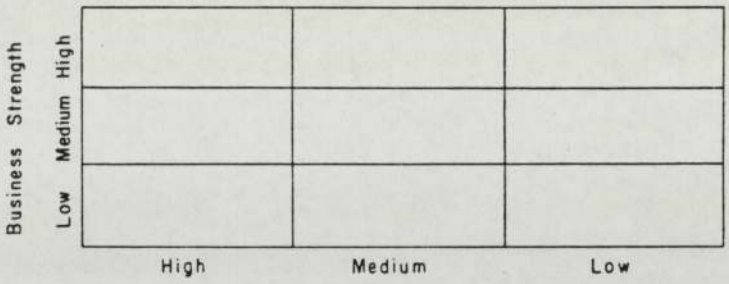
THE GROWTH-SHARE MATRIX

(Boston Consulting Group approach)



The Industry Attractiveness - Business Strength Matrix

(The General Electric - Mckinsey approach)



The Life-Cycle approach

(Arthur D. Little, Inc.)

Stages of the Life-Cycle

Competitive Position	Embryonic	Growth	Maturity	Aging
Dominant				
Strong				
Favorable				
Tenable				
Weak				
Non-Viable				

FIG. 8

2. Control in strategic management

Pioneer executives found in controlling an unavoidable element for any managing process, and thus this function has come to be analyzed from different points of view. With the current boom of strategical management, it has become more important as a critical element to control and to evaluate strategies. Strategical management emerges from the need to evaluate strategical planning that is in the process of being developed, by introducing an element of control factor.

The word control has been considered as a cohesive process by some executives, thus creating a misunderstanding of the whole function. Control has been considered a hurdle hindering the accomplishment of processes in some enterprises. Within other enterprises, there is little or no control. The existing control has been abused, making the enterprise absolutely inoperative. Some enterprises are very strict in fulfilling operating control without acknowledging that failures exist in defining policies of control. There is the danger that control can be misunderstood as watchfulness, power, downright mistrust, without sufficient tools to facilitate fulfilment. These enterprises disregard benefits of an adequate control system.

On the other hand, modern definitions of control consider it a continuous follow up and monitoring process of the organizational behaviour, can not be isolated from the planning function. The most refined methods of corporate control can be explained by the accuracy of

having every planned organizational strategy under control. An effective control implies, therefore, a dynamic balance in the behaviour of the organization in response to its environment. The control function must keep stability among certain levels considered acceptable.

To make this acceptance possible, flexible tools, capable of allowing planning and control of a greater number of economical and social variables are required. This controlling function must constantly interact with the executives activity in such a way as to help them to reduce both uncertainty and risk within the organization.

3. Strategic Management

Strategic management allows executives to identify and evaluate their strategies. John Kottler says in his book, Factor of Leadership:" The growing forces, diversification, globalization, and technological development, have make business more and more complex every day. The establishment and implementation of sensible strategies to negotiate are not easy. Most of the time, the technology, the competence, the marketing, and the economical and political uncertainty make the process of decision taking tremendously difficult."

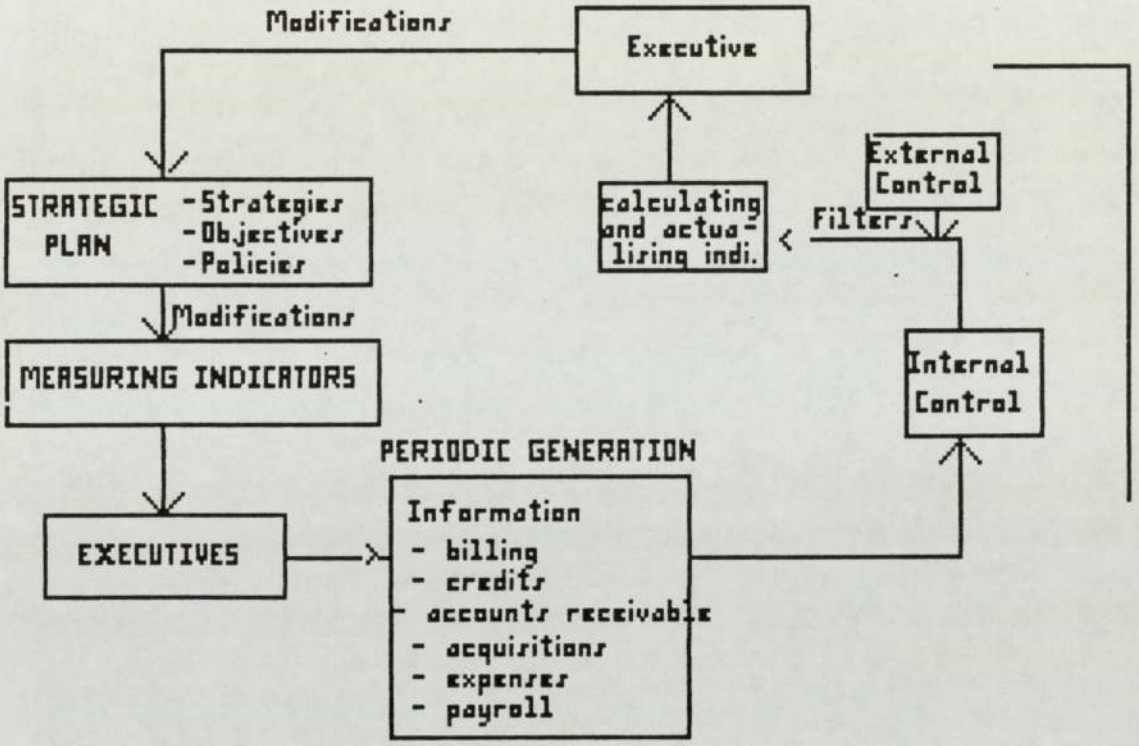
The design of strategies should be considered a systematic mental action that helps to foresee future acts and their consequences. It is a mistake to try to define a strategy as "rational", for we have to recognize that planning involves both judgments and techniques. This is a creative mental process that must be structured by all individuals and

groups involved in the planning, as well as the managerial process as a whole.

Organizations mould their corporate strategy systems in such a way as to adjust them to their expectations, organizational culture, and their managerial process. To do this, they use Stability Indicators as means to develop, implement, and evaluate their strategies. Having a system of control of strategic planning and evaluation by indicators, permits an organizational integral development, from an internal and external point of view of the organization. Thus, problems which would normally be quite difficult to observe can be detected.

A good Plan must be both concrete and specific, that is, its strategies, objectives, and policies must be well defined. It must be based on facts and valid information, and be accepted by those who will carry it out, as well as those who will be affected by resultant change. A good plan must be flexible and easy to modify if unexpected facts show up or the assumptions have not been well thought out. On the other hand, at the time of planning, it is necessary to establish standards and specifications on which the systems of monitoring and control are built into the Plan. This monitoring and control is obtained if the Stability Indicators have been both correctly identified and measured.

It is important to grasp the planning and control cycle occurring in the organization. Fig.9 allows us to observe this process in such a continuous way so that strategies, objectives, policies and plans are modified in the light of new information. In this figure we can see how



SCHEME OF PLANNING AND CONTROL CYCLE

FIG. 9

the planning formulation process is completed; its success or failure would be controlled by identifying and measuring the Stability Indicators.

To implement the selected strategies, the executives involved must establish the action to be taken in the short term. The strategies must be formulated in terms of concrete tasks that are the subject to frequent monitoring and whose contributions to the organization can be measured in quantitative terms through Stability Indicators. To do this, it is necessary to identify the tasks required carry out the strategies, the sequence of necessary steps, and to define resources and responsibilities to carry out the tasks. As well, a system of indicators is required events which allow for analysis, in an integrated and interrelated manner, both inside and outside the organization. For instance, a sales increase of 20 % in one year could be satisfactory from the point of view of the organization, but if the business sector grew globally by 50 %, it means the company is losing ground.

With this kind of planning systems, it is necessary to point out the potential dangers of each indicator. Without an integral evaluation system, most of the time, it may be impossible to perceive that 80% of the resources have been spent to obtain only 20% of the results.

Planning is a process that needs a strong key executive participation, where strategies are defined at the top levels in an organization and the alternatives and analysis of these strategies are suggested at operational and managerial level.

The planning process is an important communication tool by means of which executives may communicate their personal beliefs on the organizations behaviour and could, therefore, exchange valuable experiences and apprenticeship opportunities. The executive should use the planning process either to produce organizational agreement or to adjust stability positioning. Planning requires the development of a managerial team sharing values, philosophies, corporate priorities, and last but not least a deep understanding of the organization. Besides, such a team should have enough professional background and managerial competence to create and innovate so that the organization will be able to compete.

It is important to keep in mind that an organizational context which is correctly designed requires that top level executives be sufficiently capable to understand and appreciate the production, marketing, etc. conditions which are faced by the SBU's, as well as the competitive strategies they are trying to implement. When the executives design an organizational context in the light of these considerations, they could anticipate the impact these variables would have in their SBU s behaviour. A follow up and monitoring of the Stability Indicators defined for evaluation is required to implement the strategies. Even the most sophisticated strategies could be unsuccessful executives if the corporation does not pay enough attention to definition and evaluation of these indicators.

C. INTERRELATION AND INTEGRATION OF THE APPROACHES

The interrelation and integration of systemic, cybernetic, and strategical planning approaches is helpful in the identification of Stability Indicators which, finally, can offset organizational problems found internally and externally. They could also allow organizations to learn from their past experience.

a. Integration of systemic and strategical planning approaches

In relating the systemic approach to strategic planning, we can see how, in the past, organization had a more functional orientation with an emphasis on financing and market functions. Those approaches considered functional planning, in a centralized manner, in such a way that it was difficult to promote efficiency in the organization as a whole. Functional planning, as the name suggest, requires only a knowledge of the area or function in which a study should concentrate.

However functional planning has been strongly criticized for leaving out important determinants necessary for corporate success. As Porter said (1987): "Management theory had concentrated merely on the functions of business- e.g. production, finance, marketing, logistic. Each one has been pursued as a separate subject with its own concepts and methodologies. Yet there is no theory on how to integrate these factors."

It is here then, that the systemic approach plays a paramount role, for it helps both the planning and control processes to be considered globally as a whole. In functional planning, resource allocation is normally carried out on a project basis. It is relatively easy to evaluate a project in isolation, but it is quite difficult to assess the actual value contributed by a project to the organization as a whole.

"In a world that is rapidly changing, organizations should become more adaptable and learn to manage change better. From a systems point of view, change is enormously complex and can come from inside or outside the boundaries of the organization. A major key to managing change is to make a proper problems and situations diagnosis, keeping in mind that the performance of the whole is not only the sum of the individual parts, but also a consequence of the relationship of performance among the parts. Those problems cannot be solved separately, since they are interdependent". (Huse, 1980).

Now that many companies have merged to form corporations, emphasis is being placed on managing corporations as systems. Companies have installed planning systems to deal with their various units and their interrelations, but have continued to rely on performance measurement and to reward systems. It is important to bear in mind that the performance of the whole corporation is more than just the sum of the performance of the various organizational units. This last concept is known as synergy.

"It is necessary to join the company to caterers, customers, and

supplying executives. This interrelations demand important changes in the managerial infrastructure." Hax (1989). It is thus critical to consider the behaviourial relationship among these units.

In the business policy context, synergy is frequently described as the "2 + 2 = 5" effect. Some firms search for a posture in their products or their markets, bearing in mind the relationships among the various units, which produces, a greater corporate performance in total than the sum of the individual parts.

b. Integration of cybernetic and strategical planning approaches

Both cybernetic and strategic planning approaches are shown as being complementary which is worthwhile to outline in detail how Strategic Planning and the Viable System Model have obvious complementing points. Both, Cybernetic and the Viable System Model, help executives to understand the necessary requirements to ensure organizational stability by adapting to the changing environment through Indicators. Also, the development of the capacity needed by organizations to adapt and learn from themselves is a basic cornerstones of viability. Criteria for planning, either at corporate level or strategic business units level, is applied to organizations and strategic viable business units.

The cybernetic approach, especially the VSM, allow for recognition of feedback loops, which explain the constant search for strategies, objectives, and organizational goals by the members of the organization.

These feedback loops are essential in the strategic planning approach. The fact that organizational viability depends on a continuous shared understanding by the employees of strategies, objectives, and goals to be fulfilled, must not be overlooked. Feedback cycles are developed to adapt each changing situation and model the organization in such a way that it is understood in its complete operation. Thus the structure is seen at different levels to be made up of tiny organizations making the problem resolve.

c. Integration of systems and cybernetic approaches

The compliment of these two approaches is a fact. Cybernetics is based on the systems approach and is related to the studying of complex systems, especially regarding communication, control and information flow within a system.

The cybernetic approach has placed a special emphasis on feeding back loops within the system, particularly concerning self-regulation and self-organization of the system. The cybernetic approach is focused on strategies, objectives, and goals through feedback mechanisms with the organization considered as a system. It is important to keep in mind that feedback is a regulating action of the system under study. Feedback permits modification of pre-established patterns and behaviour whenever necessary, in order to evaluate, in a different way, the same experience to be lived in the future.

To understand an organizational recursion, the systemic and cybernetic

approaches are very important. Considering the organization as a set of self-contained systems, sub- systems, and processes, the concept of organizational recursion allows to describe the organization as made up of organizations, sub- systems made of sub-systems and processes made of other processes in a self-contained manner. It is analogous to Russian dolls or Chinese boxes. The analysis of the organizational structure is achieved by segregating its managerial complexity at the different recursion levels.

CONCLUSION

A synthesis and integration of Systems, Cybernetic and Strategic Planning approaches, allows for the development of a conceptual framework to carry out this scientific research. These approaches offer good possibilities of improving understanding and learning of the reality of the organizations. A better comprehension of the organization, internal or external, permits better adapting to the ever changing environment and at the same time to allowing for successful future development.

The Systems Approach gives an overview of the organization as a whole, and identifies the different systems, sub- systems and processes present in the organization. This clarifies the identification of the best Stability Indicators for planning and controlling the organizations.

Cybernetics increases the capacity to interpret and analyze extremely complex situations. This method is used to diagnose organizational problems and create effective organizational design. The different essential indicators to measure efficiency, efficacy and effectiveness at the different recursion levels of the organization can be accurately defined.

With the strategical planning approach, it is essential for the executives to understand the need to develop new ways of designing or generating strategies as well as how to analyze and evaluate them by

means of Stability Indicators. Having a Strategic Planning System controlled and evaluated through indicators permits the successful development of corporate frameworks. In this way, an efficient system, involving Strategic Planning and Management Strategy is obtained, in which the control function is critically important.

CHAPTER III

STABILITY INDICATORS AS A TOOL FOR PLANNING AND CONTROL

There are two major steps to be considered when dealing with Stability Indicators: Identification of Stability Indicators, and developing a set of their measurements. For these two steps to be developed, this chapter provides a methodology, to identify and measure Indicators, and an interactive model to permit their follow up and monitoring.

To identify Indicators, the different approaches studied before are used. There is emphasis on the complementation and integration of systemic, cybernetic, and strategic planning approaches to gather the necessary steps to develop the methodology.

Indicators measurement: valuing indicators is a mean to identify their problems and suggest the best way to improve them. Besides, feeding back the values permit their adjustments whenever a standard measurement has been poorly defined.

A computer model as a supporting tool for the identification, measurement and follow up the indicators, provides, as a comparative advantage: the development of an enormous capacity of analysis by means of which a panoramic overview of the organization is obtained. This is essential, especially when the enterprises are immersed in an environment characterized by volatility, complexity and uncertainty.

In the same way, data bases of all the different indicators enable them to be compared with measurements obtained from other enterprises belonging to the same sector or industry. That way, it is possible to determine the strategical positioning of the organization aside from the others.

Both methodology and model furnish flexible methods that, once correctly used, permit measuring the dynamic of the organization, this way helping to define objectives, strategies and policies (of the organization) within a stable behaviour of Indicators according to prevailing conditions in that sector. It also helps to determine the most suitable way to reach these objectives, strategies and policies, the expected results for the following periods of time, and the necessary control mechanisms to secure success.

A. METHODOLOGY

The methodology provides a valuable help if the indicators must be identified and measured. Fig.10 depicts the structural steps to be followed in applying the methodology. The different steps of the methodology are described in agreement to the numerals and sub-numerals in the chapter. These steps guarantee that the relevant identified indicators (Indicator System) are those that are most applicable to real situations.

In order to attain an efficient Indicator System, it is necessary to: Look for the origin of problems in planning and control in the organization (A), create the best organizational conditions for the process to be operating all the time (B), structure correctly the organization under study (C), Identify and handle Stability Indicators (D), Measure such Indicators (E), and handle efficiently the Implementation Process (F).

Through a continuous feedback of the different steps in the methodology, the best Indicators System is attained. If these steps are not carefully followed, it would be difficult to identify, measure and implement the relevant indicators. Keeping them in mind permits, finally, to obtain a trustworthy Indicator System, whose successful implanting would facilitate sharing experiences with those directly responsible for each indicator and the interrelations that indicator may have with another.

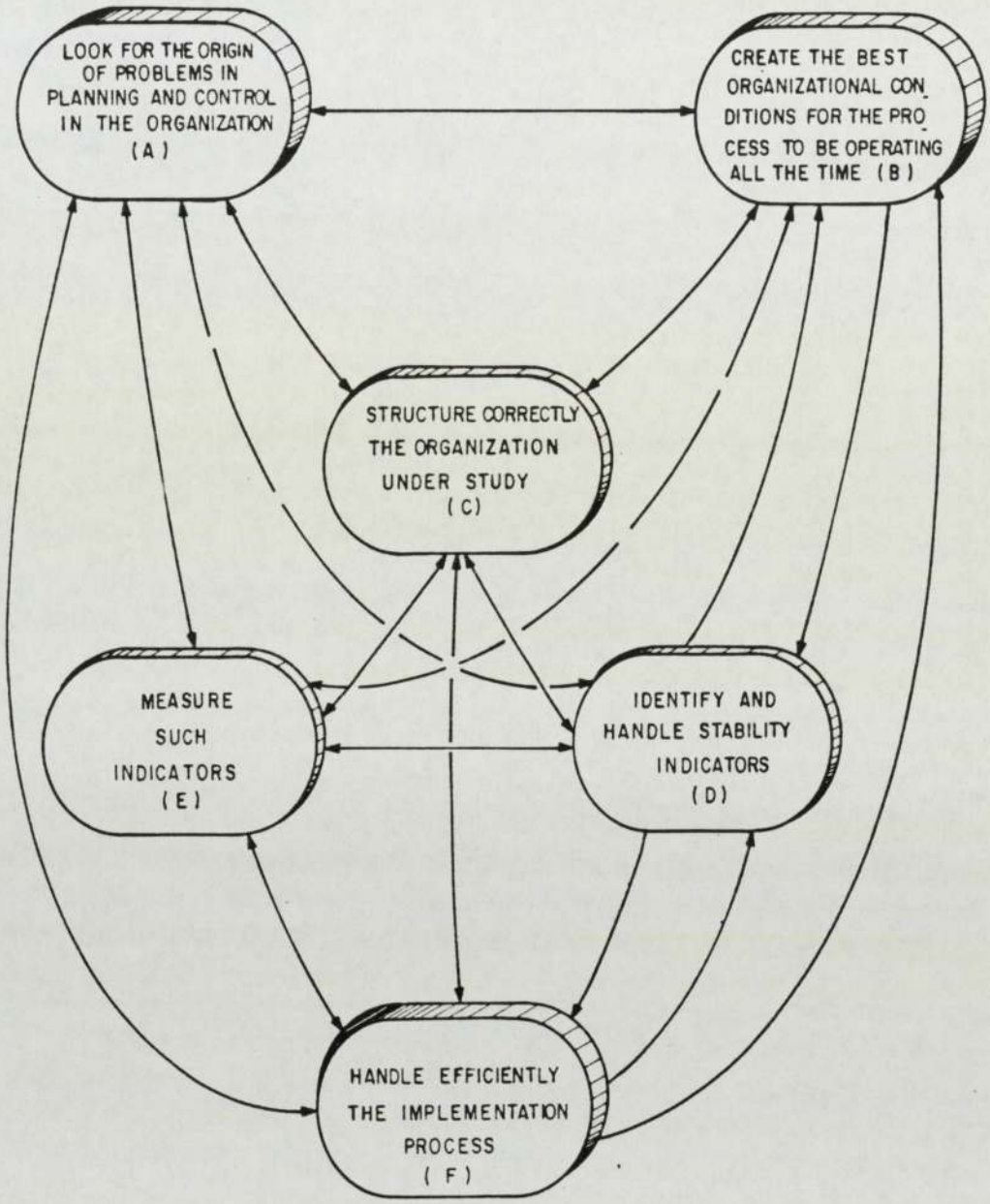

LOOK FOR THE ORIGIN OF PROBLEMS IN PLANNING AND CONTROL IN THE ORGANIZATION (A)
CREATE THE BEST ORGANIZATIONAL CONDITIONS FOR THE PROCESS TO BE OPERATING ALL THE TIME (B)
STRUCTURE CORRECTLY THE ORGANIZATION UNDER STUDY (C)
MEASURE SUCH INDICATORS (E)
IDENTIFY AND HANDLE STABILITY INDICATORS (D)
HANDLE EFFICIENTLY THE IMPLEMENTATION PROCESS (F)

FIG. 10

The steps are continuously intertwined and feedback the ones to the others, and all of them among themselves, as stated by the present figure. Although they are sequentially distributed, they could follow any given order.

The permanent feedback of these six steps must be a continuous apprenticeship process for the executives, whose information, coming from the behaviour of each indicator, could lead either to organizational adjustments, or to re-define the indicator, the measuring patterns, and the patterns of behaviour. Or, simply, to adjust methodology and model altogether. Here feedback is understood as the method executives have to control a situation and then, re-insert in it, the adjusted results from the previous behaviour. This is attained in accordance with filtering processes and amplified information at the different levels of recursion.

As it was pointed out in Chapter I, Carbocol and Central Zone, mining project, will be used as pilot sample to illustrate the methodology. Steps A, B, and F, belonging to the outside triangle of the figure, will be explained next. These three steps are described exactly as they have been developed by Carbocol.

Steps C, D, and E, belonging to the inside triangle, are described first theoretically in relation with identification, measuring and handling of indicators, which is simultaneously enriched by being applied to the Carbocol case. It is important, for the reader to become familiar with methodology and model, and read, at the same time, the theory and its

applicability to the Carbocol case.

a. Looking for the origin of problems in planning and control in Carbocol

In order to preserve the national interests, and to inform those that have invested not only in Carbocol but also in its diversity of coal projects, the administration had made efforts to plan and control the performance of the company. Among other efforts, it is worth mentioning strategies, objectives, goals, and organizational policies development. Nevertheless, the company has been facing, so far, difficulties with planning and control systems and the identification of indicators. Perhaps in the morrow they will be no longer relevant to Carbocol s context.

In this stage of the methodology, our intention is to perform a diagnosis of Carbocol s internal possible causes that make up planning and control, and the identification and measurement of Stability Indicators and its use as a planning and control tools such a hard task.

The success of the methodology is partly based on a permanent diagnosis of the emergence of these problems and to find their causes. The present diagnosis was accomplished using the survey dealt within Appendix B. The survey includes several questions related to the system or planning process and the plan effectiveness; they permit to find the cause of planning and control problems. The relevant questions are

selected out of the survey to suit the executive who is being interviewed. The help of Carbocol's executives made the analysis possible.

Some of the difficulties that were detected are explained next:

- Commitment with Strategic Planning

The planning process must be an integral participation of all the members in the organization. Therefore, a unanimous agreement of every body - not only a few- is required. This process must be sufficiently receptive to the whole staff; the most important thing must be the promotion of self-control, self- motivation, and self-organization.

- Integration of Planning and Control functions

Planning and control are functions grasp separately in the enterprise. The managerial cycle should try to integrate the functions of planning, execution and control. At the time of designing the Plan, there are no concrete measuring indicators to allow accomplishing goals, and objectives strategically formulated, therefore, it could not be guaranteed to fulfil what had been planned. This requires a control function to follow up the established plan, adjust and correct standards if it is necessary.

- Planning targets based on achievements

Long term planning does not work under changing external conditions and intense competitive activities in companies such as Carbocol. The present planning system is focused in the short term, and this does not

allow predicting Carbocol's possibilities for the next five years. There is not even a Colombian Energy Sector Plan for the medium term.

Now, concerning resources, the enterprise allots them by objectives and not by results. If assumptions for each scenario or the environment change, some of these objectives will be no longer relevant.

- **Weakness in plan structuring**

Carbocol planning cycle tries to integrate to the planning process, a strategic, operative, and individual plans. However, the mixture of different levels of planning creates a collection of activities which, sometimes do not seem to be a part of the same integral sequence.

- **Weakness in the planning process.**

The planning process for the last few years has been quite centralized by the Planning Office, who produced the final document entitled "Strategic Plan" for each year. In other words, the planning process has been so mechanical that methodology is perceived as something static limited to designing and processing of filling-forms.

Strategies, objectives, and policies are suggested by the President of the Company and approved by the Board of Directors. Nevertheless, the other areas do not feel they have had enough participation in its design, therefore, as this plan has been imposed by becomes difficult to implement. The methodology implanting process is also considered an up-down process without a down-up feedback. This makes the employees

feel they are not participating in the whole process and their innovation and creativity is, thus, hindered.

- How to measure the plan

Follow up and control of the Strategic Plan does not permit an integral evaluation of the enterprise to know its positioning, when desired, and help to determine its general objectives in time. The plan evaluations are focused towards employees performance rather than the enterprise as it should be.

The way of measuring Carbocol's Plans has had problems not so much related to the value of real goals but to its planning horizon. Goals are created to be accomplished within a certain length of time, disregarding the fact that, at any time today or this week, any of these goals could change the results of any event enormously; such changes are bound to affect the achievement of the goal in time.

- Lack of internal and external coordination, participation, and communication

Methodology should be reestablished as a consequence of a lack of coordination, integration and communication among the different areas of the company. The problem with an organization, as Carbocol, is that information does not usually flow across organizational areas very easily. Part of the problem is trying to determine and understand what information should flow between functional groups. In response to this communication problem, committees integrated by a number of different areas where established throughout the company, but unfortunately they

have not been working as successfully as they were expected to. It is important to improve the functioning of these committees.

- Management Information System

Although, lately, efforts have been made to design a Management Information System (MIS). There is no management information system as such, but a set of independent systems not integrated as it should be and without a sense of oneness. There is no area, with corporate vision, to handle data bases to integrate, for example, the production and commercial areas.

- Carbocol s image in international markets

Given the present relationship between Carbocol and Intercor, and the existence of an "Operator" (something rarely seen in the coal environment), Carbocol has not impressed a direct image in the International Market. The entity can not be classified as supplier, intermediator, or distributor of the product.

b. Creating conditions for effectively solving the problem of planning and control in Carbocol

From the previous diagnosis, the need to create an effective planning process, to be inserted in the company, emerges. At the time of formulating the plan, the indicators to be attained must be defined and then, they should be followed-up. A continuous comparing of the "real world" and the "abstract model", is essential to identify and adjust

indicators if organizational development must be reached and performance adjusted. To make this possible, a participating methodology is required. The employees general consensus may be helpful, doubtless, to create a better future for Carbocol. This consensus is achieved through permanent meetings to evaluate the enterprise. The evaluation must be based on Stability Indicators, since they generate a continuous debating to re-establish, follow them up or, if it is necessary, define some new ones.

To adjust the "Indicators system" to the "real world", both executives and employees at Carbocol have been involved in the research work so as to guarantee the identified indicators as the best reflection of the company each one has. A successful indicator system on the cooperation of the executives involved and their understanding of the organization. This is how they participate in observations, interviews and continuous debates that help them reach this optimal Indicators System.

1. Observations and documents readings

No written documentation is one of the peculiarities of Carbocol and the scarce information is not trustworthy since it is spread all over the areas of the organization. This is why gathering data has been so important, some through plain observation and still some others through structured interviews to make information gathering efficient. Actualize information and its constant feedback of executives and employees interviewed is essential.

To develop the present research the most important facts have been collected concerning business environment, strategies, objectives, policies, goals, resources and operations (Carbocol and Central Zone). Carbocol s planning for the period 85-91 contain a broad perspective of the company and besides, they include a first hand knowledge of its performance.

2. Interviews

Chatting with Carbocol s executives and employees were the primary source of information to determine indicators. The technique of structured interview through surveys was also used. Various kinds of surveys were designed some of which are shown in Appendices B and C. B is used to perform a general analysis of planning and control systems and C to identify the best indicators.

To carry through and then analyze the interviews demands an enormous amount of time, therefore, they should be prepared a long time before.

The individual conversations help the different groups to accept the research. This has been a continuous process due to personnel alternations. For the purpose of individual conversations, and with the help of Story Board software, some conferences, with the help of the computer, were carried out. Besides, an instantaneous feedback of personnel inquiries underlined the importance of the research.

In order to sell the trustworthiness of the Indicator System, there was

a first conversation with the then President of Carbocol, who besides backing up the research identified Central Zone as a pilot project for the designing, validation, and evaluation of the methodology.

A preliminary list of executives to be interviewed was prepared. Executives from Central Zone and the areas principally connected to the planning and control functions were selected. A tremendous effort was made to solve any question by asking them directly from top management during the following conversations or relevant reports.

During the second set of conversations at Central Cerrejon Zone project mine, there was a forum with the director of the project as chairman. All the employees were able to debate pros and cons of the project. It was deemed to work in group since it increases creativity and effectiveness in the implementation process.

3. Indicators Identification and Discussion

The process of identifying and discussing indicators took most of the time allowed to the conversation. The most valid information, without bias or interferences was obtain through structure interviews (Appendix C). All the issues were constantly debated to attain a continuous feedback for the process of collecting and adjusting the information. The difficulties arisen in a specific interview were used as experiences for the other ones. The information gathered was used to define the steps of methodology and model in order to structure -- the organization--, identify, measure and wield the indicators corresponding

to numerals C, D, and E of the methodology.

The group's initial efforts were concentrated in getting to a consensus in what concerns the key Stability Indicators. These indicators are the enterprise's most valuable end product. There are hundreds or thousands of possible indicators but just a few of key indicators for any given group.

Firstly, there was a work group to identify the Stability Indicators with actualized information concerning defined strategies and objectives for each process and evaluation. The relevant development and the communication of strategies, objectives, and policies of the enterprise and the Central Zone project together with translating the resulting logistic commitment into financing, production, marketing, and other equally significative indicators were essential prerequisites to emphasize on the best Stability Indicators.

Secondly, the group examines strategies and objectives to find a clear articulation regarding tactics and competitive strategies at each and every organizational levels. Then, the defined indicators for budgeting, financing, production, marketing, and commercialization, and in general every indicator belonging to the control system, were taken as suitable ones. Consensus decision taking was used to help the group hit a general agreement regarding the Stability Indicators.

Thirdly, The group identified the Stability Indicators the same way as they are defined by each area. The constant performance of the

organization as a whole could be evaluated through Stability Indicators in accordance with efficiency, efficacy and effectiveness criteria. Besides the criteria helps to analyze the interrelationships of indicators with internal and external impact of the organization.

An indicator s permanent feedback is paramount to adjust them to the real situation "any maladjustment or mismatch between the "real world" model and the "abstract world" model taking place, suggest the possibility of betterment. While these improvements are directly related to the causes of a problem situation, they can contribute in the creations of necessary conditions to solve problems effectively ". Espejo (1986). This improving method contributes essentially to handle efficiently the solving process.

c. Structuring the organization under study

To better understand and structure Carbocol as the organization under study, some well defined steps, sequentially related, are followed in Fig.11. These steps are grouped in three principal phases: organizational and operational modelling, and Strategic Plan. A correct structuring of the organization could just not be thought of without these three modelling items.

The study of the organizational structure is easy to understand once the different approaches, dealt with in the last chapter, are integrated and complemented because they provide an easier organizational and

STRUCTURING THE ORGANIZATION UNDER STUDY

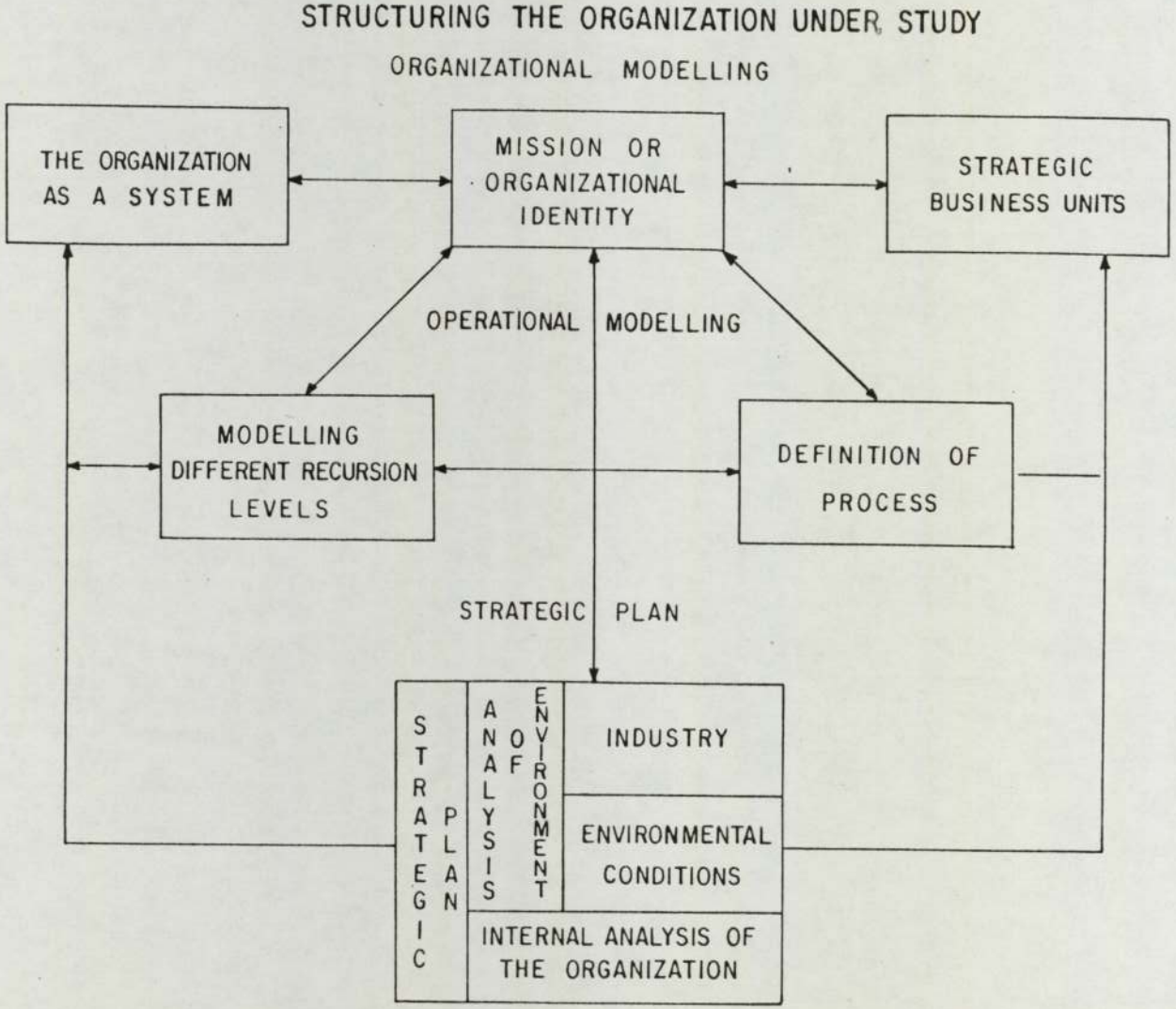


Fig. 11

operational modelling, and a better Strategic Plan design. The selection of wrongly defined indicators is, doubtless, the consequence of an organization poorly structured.

The way the enterprise is operating could be verified through diagnoses or an organizational design. If there is a well defined Strategic plan and clear and rational proceedings and structuring, the stability indicators to be identified will have to be the most appropriate ones.

It is paramount to find the best way to structure and organize the enterprise in order to achieve the desired flexibility to uncover the basic activities that should be measured. Therefore, the application of different aids furnished by the systemic, cybernetic and strategic planning approaches are so necessary.

The systemic approach provides an integral view of the organization under study. The cybernetic approach helps to understand the relationship among the different managerial levels of the business units. In particular, by permitting the necessary adjustments, the Viable System Model helps to diagnose the organization. To do so, it is essential to observe which way each sub-system belonging to each "recursion" level fits into the parent subsystem which it is interrelated with.

Strategic Planning emerges from an organization definition of strategies, objectives and policies and allows them to be evaluated in accordance with their results. The more knowledge is obtained from the

organization, the environment, and the relevant information, the better the plans to be proposed and, consequently, the identification of the necessary Indicators for evaluating such plans would be also easier. Then measuring each indicator should be a little bit more in accordance with reality, and contain adjusting mechanisms.

A detailed description of the different steps to be followed in these two phases comes next (it is noteworthy to emphasize on the observance of how each one of the steps, in the previously defined approaches, is complemented).

1a. Organizational modelling

To advance in the identification and measuring of indicators, this organizational modelling should be obtained as the final output of a well established Strategic Plan. The following steps should be carefully followed: Step 1, where the organization is described as a system. Step 2, in which a definition of the identity or organizational mission that uses systemic and strategic planning approaches is given. Step 3, where strategic business units or primary tasks are identified. This identification requires the Systemic Approach, the viable system model, within the Cybernetic approach, and the Strategical Planning.

a) The organization as a system

The concept of organization as an integrated system is essential in developing the ability to find innovative -superior courses of

action-and policies. The systemic approach plays an important role that expedites an analysis of the organization.

Systems are understood as a group of elements dynamically related in time according to coherent patterns. It is important to consider within this concept: the parts, that is, an unlimited variety of components of the system; the relationships, the core mechanism that keeps the system together and operating as a whole; and the patterns, the observer s purpose as part of the system.

Generally organizations are perceived in a rather different way depending on the point of view of the onlookers or observers. It is important to remember that the whole idea originates in an organizational diagnosis within an emphasis on describing the organization as it really is and not as it should be.

Observer, observed phenomenon, and the process of observation itself, make up a wholeness that could be separated into different elements. This fact has had great implications in a better organizational understanding. According to Espejo (1986), studying the organization is to consider it as a system where special attention should be paid to **the** transformation, taking place within the **actors, clients** and owners. These components are related as:

-**Transformation:** What input information is transformed into what output information?

-Actors: Who is going to carry out now or then the activities of such a system?

-Customers: Who are or would be, either beneficiaries or victims of this system?.

-Owners: Who controls or would get to control the system?.

b) Mission or organizational identity

Once the system under study has been wholly identified, the definition of the organizational mission is not so easy. To facilitate an elaboration and revision of mission, the name of the organization should, first of all, be analyzed and then, a list of products or services offered plus a list of the different clients for either products or services should be made. In the same way, it is relevant to identify the need these products or services together with the coverage would be fulfilling for the clients.

Mission is defined as the modus vivendi or existing need of the organization. It is important to make clear, in the mission, what the organization is looking for, in other words what its scope of action is and, at the same time, to identify what should be made feasible or viable. " The organizational effectiveness depends on its ability to make its organizational identity viable " Espejo (1989). A poorly defined organizational identity creates problems when determining the criterion in defining the organizational effectiveness.

c) Strategic Business Units

It is necessary to identify the different Strategic Business Units after the identification of the organization under study together with its mission.

The Strategic Business Units (SBU's) as stated by Strategic Planning Methodology or Primary Tasks according to Espejo are those in charge of implementing the necessary activities for the organization to have its own identity and at the same time fulfil its mission. Most of the time, it is necessary to segment the corporation in SBU's, at different levels of recursion, to reach strategies, objectives and policies at corporate level.

A **Strategic Business Unit** is defined as the "natural" and "homogenous" business of an organization. The executive ought to determine strategies for each SBU s and analyze its objectives independently from the other ones.

Espejo recognizes the SBU's as the primary tasks of an organization. Similarly, the VSM deals with the organizational units bearing in mind the same idea but, we define a SBU as that unit helping to implement the implicit tasks in the organization identity, in other words, SBU's are those units that could survive by themselves because they are directly or indirectly responsible of producing what the enterprise wants to make viable. In other words, they could be either products or market

services organizational viability depends on.

The SBU's are obviously determined in relation to the market where different businesses compete or products sold. They agree with their behaviour or price characteristics and depend on how they are produced, distributed or financed.

For the sake of strategic business planning purposes, the establishment of appropriate boundaries, for the different SBU's, is important from a strategical point of view and in accordance with production parameters. The theoretical and practical fabrication of such boundaries is, nevertheless, indispensable in making portfolio planning methods suitable for corporate strategic planning.

-Hax & Majluf (1982) suggest that SBU's could represent collections of products and markets, in which a well- defined group of competitors is serving simultaneously a homogeneous group of clients. It is also suggested that SBU's could be composed of a close product substitutes impacted by changes in quality and style and affected by price fluctuation.

The outlining of a SBU is principally based on conditions determined by external markets (group of clients and their needs) instead of internal factors such as production costs as stated by manufacturing or technical common facilities (common products/ processing technologies). Although there is a number of possible and available strategies for each SBU, the corporate strategy is more than the sum of the strategies of each SBU.

The definition of a SBU s could be based not only on observation patterns and prediction of price and cost discontinuity but it could also include as a final objective, the competitors. A lot has been written on the problem arising at the moment of defining the SBU and importance of making it autonomous. Some articles are inconsistent and quite contradictory when they talk of correct business segmentation. Different authors provide different definitions out of which the following could be selected: group of clients, function of clients, characteristics of the product, viability of conditions, in case the enterprise separates from the parent corporation, etc. Therefore it is worthwhile to clarify certain issues when defining a strategic business unit:

-Competitors- It is interesting to analyze the business competitors since they are directly related to the substitutability of their offer. The identification of relevant competitors, could be considered a difficult task from a strategical point of view. According to Y. Win and V. Mahajan (1981) "Supply substitutability occurs when a firm engaged in the production of one good could shift its operations quickly and inexpensively to produce another. In this way a firm could effectively be in various markets at the same time. Even if, at a given moment, it could be only selling in either, one market, or a few. The ability to increase profits is what makes the firm suitable for other markets".

-Distribution Channels- According to the behaviour of a group of

customers, isolated dissimilar distribution channels are sufficient to discriminate distinctive strategic units, from the product/market point of view. "Even when the same products are similarly used by the same end customers, sometimes it may be advisable to distinguish between two or more markets on the basis of the distribution methods used." B. Catry and M. Chevalier (1979).

Geographical identification of competitors requires in fact, not only the areas, where a product is currently sold, but also the minimal transportation costs should be included in them.

-Operational Autonomy- Halls (1978) suggests that SBU's should be defined according to the degree of freedom granted, operating managers for the management of such functional activities such as manufacturing/engineering, marketing, and distribution.

-Internal Financing Activities- Day, (1975): "No more than a sixty percent of the expenses of a SBU should go to the cost shared with the other Strategic Units, and no more than sixty percent of the revenues (returns) from the sales, to the vertical integration (downstream) with the other subsidiaries".

Abell and Hammond (1979) give a good example on how to define, from a practical point of view, a Strategical Business Units.

"The important factors to be considered are:

(a) Each business unit should have the same trade characteristics of the nature of the products such as growth and competitive positioning.

(b) The executives must have agreed unanimously on the definition for each unit.

(c) There should be information and data readily available for each defined Business Unit".

1b. Carbocol: Practical case

a) The organization as a system

Carbocol is described as a system, focusing especially on the Central Cerrejon as the sub-system chosen as pilot sample. In this description, the kind of exploitation contract signed with the operator is paramount since it limits Carbocol's participation in planning and controlling the project.

Transformation, actors, clients and owners must be considered in this step.

-Transformation:

It is important to consider the transformation that coal has (Central Zone, coal project pilot model), from its natural boundaries until being transferred to the end user.

-Actors:

The production and transportation operators as well as Carbocol s salesmen are in charge of loading, transporting, stocking and selling

the coal.

The production operator used to be Pinsky, the end transportation operator, Sanchez Polo and the shipping operator, Intercor for the pilot model. Nevertheless, some workers from Carbocol indirectly support the activities related to production, transportation and sales.

-Customers:

Consumers would be beneficiaries, that is the internal or international markets. The community also benefits by developing the region and the small miners entrepreneurs. It would be interesting to analyze competitors since they are directly related to offers substitutability.

-Owners:

Central Cerrejon, the Cerrejon community, Carbocol's management, and its investors are the owners in charge of controlling the system. The government is considered merely a policy orienting entity.

b) Mission or Organizational Identity

Once the System and Subsystems, on which this pilot study is based on, has been defined, the next step is to elucidate the mission. Carbocol, as a company, has the responsibility to oversee the exploration, exploitation, transformation, and commercialization of the abundant Colombian coal reserves.

Its mission is as follows:" **Carbocol was created to guide**

industrialization and commercialization of the Colombian coal sector. This was done in order to increase the competitive capacity of the market both internally and externally, as well as to obtain an adequate financial and social profitability of the exploitation by means of a management agreeing with the State's policies."

Carbocol was assembled, at the beginning, as a classic functional organization with production, marketing, commercialization and financing areas. According to the phase in which a specific coal project evolved (exploration, preparation and exploitation), some of the areas may have been, at certain moment, more relevant than the others. For instance, due to the uncertainty in the acquisition of investment resources for the exploration and preparation phases, as well as loans, interest, and capital investment returns, Carbocol s executives have spent a lot of time looking for financial solutions. For this reason the financial area was so important in the initial stages of North Zone Cerrejon Coal Project.

Besides, the project infrastructure preparation phase involved different relationships between Carbocol and the community with considerable time and resources spent in different regional development programs to improve the community well-being.

In the exploitation phase, marketing is very important. Carbocol commercializes its own coal and also that from other state own mines supported by an international network of agents that has being established.

These functional issues are what make it difficult to pin-point the best way to structure the company, production oriented, market oriented, or regional & miner development oriented. Currently, Carbocol is a mixture of these three tendencies.

c) Definition of the Strategic Business Units

Definition of Business Units in Carbocol must consider the way producers and clients are organized. Nevertheless, Carbocol has identified only as basic tasks the commercial and the socio-economic ones. These two activities have been considered responsible for the enterprise s image. The basic task of production has not been so far considered an activity pertaining to the company. It seems to be a sub-product of the commercial basic task. Notwithstanding, the commercial, socio-economic, and production primary tasks are economically independent activities seeking for managerial autonomy.

So far Carbocol has kept a double role in relation with commercialization and miners fostering. As any other private company, Carbocol has been forced to strive towards reducing risks and uncertainties associated with low prices and large- capricious fluctuations of supply and demand of coal. To do this, it possesses commercial orientation that is "business" structure with operators and customers. On the other hand, being Carbocol a socio-economic organization, it is oriented to foster coal projects.

"From the beginning, the company has enjoyed an accelerated growth by developing an organization which must perform a double role which has been assigned to it:

-A governmental entity in charge of the fomentation, exploitation and control of the coal sector as well as to coordinate exports.
-A mining and marketing company investing directly in coal projects.

The contracting system for exploiting the coal mining projects encompasses a wide gamut of possibilities, including service contracts, contracts of association, production sharing agreements, technological compensation, joint ventures and several other arrangements."(Carbocol, Annual Report January/85).

As the industry must reach full potential, the existence of a contribution, for management to improve efficiency, is required, particulary in the way it wields royalties, charges, taxes, etc., because they required wider economic needs without hindering the development of the industry.

Carbocol must be studied as an enterprise leading the coal sector if production is to be considered a SBU, as it is in charge of allocating resources and leading both the private and state miners. Carbocol has to maintain a foothold in the International markets. Colombia has set for itself, as an essential objective, attaining the technical development of coal mining in the economic and social fields. Therefore, Carbocol's first duty is to commercialize the coal resources

derived not only from its own mines but also from other state-owned ventures.

The function of commercializing a coal deposit is quite different from selling coal to final consumers. As the deposit belongs to the state and its commercialization affects the country's economically, socially and politically, it must be included in the production business unit.

Carbocol should not merely enclose itself into selling the coal, but also making good deals with the mines operators so that, by establishing a better contracting method, whether for exploration, preparation, and exploitation of mines, it could make excellent profits.

According to the above item, we can deduce that Carbocol's biggest problem at present is selling its own coal produced by third companies. Such a situation creates some confusion among the international buyers in what concerns the "control" function the enterprise may exert on production and consequently on the availability of deliveries. So the continuity between the activities of production and commercialization is under question since, as it was mentioned before, Carbocol commercializes its own coal and that from other mines.

The above issues make it paramount to identify three basic Primary Tasks in Carbocol: Production, Commercial, and Particular and Small Miners Sponsoring. These three primary tasks must work under a group structure Fig.12, in order for them to be coordinated by Carbocol at corporate level. This makes the enterprise highly efficient and competitive

INTEGRATION OF PRIMARY TASKS IN CARBOCOL

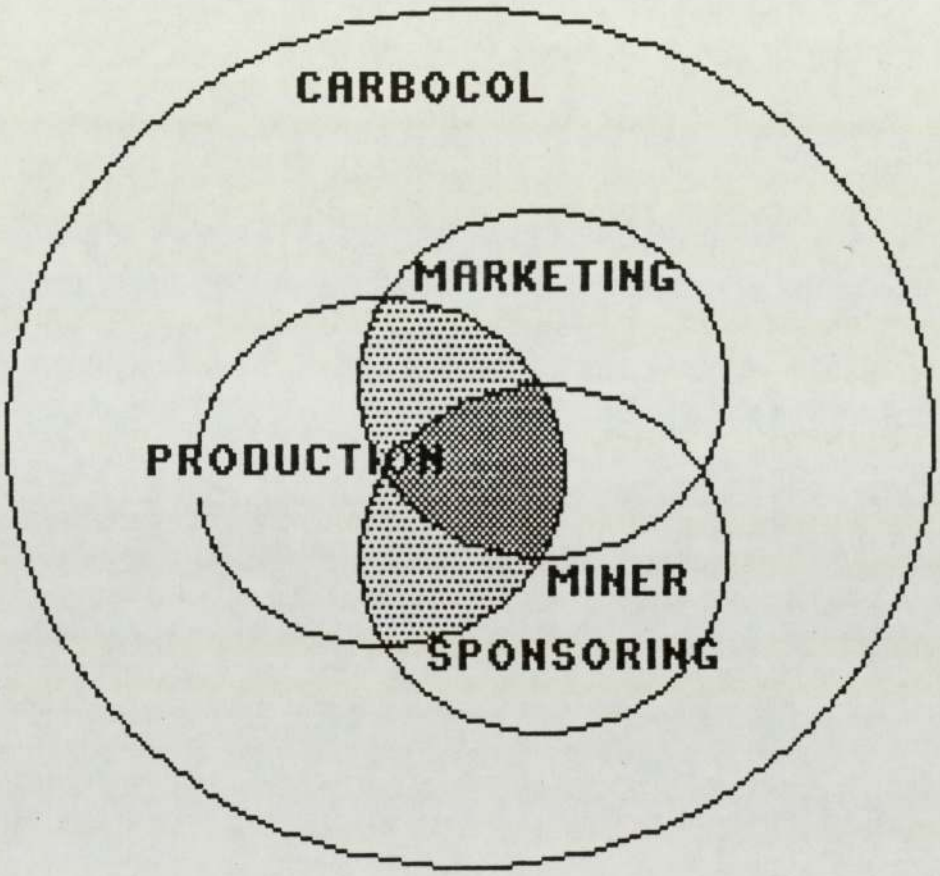


FIG. 12

because it optimizes investments and minimizes production cost and maximizes fulfilments since, in this way, it gets the best prices for coal.

Managing the supporting activities in Carbocol have to be implemented in accordance with the needs of the three basic primary activities of the company.

1) Production Primary Task (SBU)

Although it is not formally considered a Primary Task, production is a Unit oriented towards exploration, preparation and exploitation of mining project business because it tries to obtain the best mines operators contracting at minimal production costs for the aforementioned phases of each coal project.

A new active positioning regarding negotiation of new deposits is required, for this reason, a unified managerial capacity related to this task becomes necessary. Ignorance of this primary task could mean that production, as a business area, should be carried out in the short term. The present image, Carbocol has, suggests it worthwhile considering this task independently from the Commercial Primary Task.

The relationships among Carbocol (Corporation) and the different coal projects depend on the type of contract that has been signed with the coal operator for each mine. The Government has granted Carbocol the capability to sign contracts with private investors, either Colombian or

foreigners, for the coal exploitation and production. These contracts are analyzed in order to find the best alternative for the country, in terms of social and economic profitability. Such contracts are awarded through a selecting bidding process, though it is possible to contract directly if this becomes necessary.

Even though Carbocol co-owns the mines, in terms of contracts, it does not hold any operational authority. The operational or implementation tasks are performed by the operators of the different coal mines according to the definition of Primary Task or Business Unit. Carbocol's participation is merely that of an "Interventionist" of both the mine operators and producers at corporate level where it participates in the formulation of policies. Besides, there are contracts that enable the operator to produce and sell the mineral directly, as it is the situation of the Drummond project. Because of the previous reflections, Carbocol can neither be classified as producer- seller, the situation of the manufacturing organizations, nor distributor or intermediary.

A reduction in production costs, plus an optimal exploitation of the best producing mines, are some of the principal goals of the production primary task. To make optimal mines exploitation a reality, Carbocol should be all the time linked directly with both the mines operators and producers as potential customers for coal exporting. It is also necessary to operate within a directrix-framework of Carbocol's pre-established policies for the miners operators. The whole thing is basic to give discretion to control.

Considering price fluctuations and coal a long term market, it is obvious that a need to improve its profitability depends on reducing production costs rather than increasing prices. To bring production to a lower cost, the enterprise corporate management should absorb a great amount of operational details that guarantee production monitoring and control.

2) Commercial primary Task (SBU)

The commercial activity is considered one of the principal businesses of Carbocol. Presently, Carbocol receives the coal produced directly from the different coal projects and commercializes it. That is why the state of sales should be constantly identified to help determine the stratification of the market Carbocol is competing in.

Having sales agents is a competitive advantage regarding other coal exporting companies, since not every one has this kind of agents actively working in other parts of the world.

The function of this business unit gives the Colombian coal not only an optimal positioning in the world market but also establishes the country as a new and reliable coal supplier, making it profitable by minimizing costs, maximizing profits, and consolidating a strong position (foothold) in a highly competitive world market. This commercial task must first of all ensure that coal of the exact quality, according to customer's requirements, would be constantly available at the best of

prices.

As a primary task (SBU), it should be supported by the technical, financial, production functions the legal back up included.

3) Particular and small miners sponsoring Task.

The mission of this primary task (SBU) is to design, prepare and follow up coal industry supporting programs to improve mining operation of thirds and develop a coal domestic market. The main objective of this business unit is the technological, economic, and social development of coal mining, from the identification of coal reserves to the final use of the product.

Carbocol sponsors programs to improve the technical and economic growth of the regions by supporting the small and particular miners. These miners produce coal for the internal markets and is used for home, industrial and electrical consumption. So, directly as well as indirectly, Carbocol is not only generating new jobs, thus fighting back unemployment, but also supporting the national economy. The internal resources, allocated to this primary task, particular and small miners sponsoring, have a direct impact on the socio-economic sector and constitute real costs, in part covered by the National Coal Fund.

As with the commercial primary activity, the above mentioned task demands technical, managerial, and legal support.

2a.Operational modelling

The operational modelling should be the output of rationalizing different organizational processes at the distinct levels of recursion.

Operational modelling should also consider the following steps: Number one studies recursion in the organization, considers SBU s, different levels comprised, analyzes and designs the best regulating mechanisms and the correct distribution of discretion and autonomy. The Viable System Model is essential in attaining this step. Step 2 provides the guidelines to define adequate processes for each of the Subsystems; Modelling expedites identification and measurements of Stability Indicators.

a) Modelling different recursion levels

The Viable System Model contributes substantially to determine the autonomy of each SBU, defines the interdependence present and identifies the different levels of recursion, either at corporate level or within the boundaries of each SBU.

Segregation of complexity, in general terms, implies autonomous structural levels. As a result, visualizing the distinctive managerial function in each of the various levels of recursion is very important. This way, the existence of complex internal or external relationships, that must be identified in the SBU s, could be easily inferred.

From an external point of view, each SBU at structural level, could be observed to be in constant interaction with its own complex environment that, in turn, is connected with the appropriate environment of a higher level of recursion. Therefore, the environment of the enterprise must contain all the relevant environments that belong to every SBU.

From an internal point of view, analysis and design of regulating mechanisms permit a better monitoring and a more expedite communication at each and every level of recursion. The Viable System Model furnishes the regulating mechanisms to detect operating instabilities in implementation, coordination, control, intelligence, and policy functions either at corporate, SBU, or at the different levels of recursion.

To produce an effective organizational structuring, it is paramount to differentiate the primary tasks from the supporting ones. The SBU's or primary tasks are described in the organizational design, as a functioning part of the enterprise; the supporting ones only show the end results of primary tasks (accounting, personnel, etc). Accounting, for instance, could be only shown as primary task if services provided are described in the boundaries of accountancy.

Once the difference (between the two kinds of tasks) has been established, discretion and autonomy, basic characteristics of a viable subsystem, should be studied. "At any particular structural level, while discretion is the power to manage a well defined policy (a higher

structural level), autonomy is related to the power to formulate and manage a policy" (Espejo, May 1984).

It could be concluded that modelling the different levels of recursion provides an overview of the decentralized organization, at different SBU's in the various processes. The Viable System Model, shown in Fig.7, expedites the process.

b) Process Definition

Based on the previous concept, the whole organization could be considered a self-contained set of sub-systems made up of their own processes in accordance with each recursion level. In other words, a process is made of resources, transformation and products (Fig.13).

To expedite evaluation, the organization should be analyzed as a compound system of interrelated processes. Each process is considered to be a black box (Fig.14). The "black box" concept plays a fundamental role in Espejo's work (1984b). The basis of a correct "black box" analysis helps to attain a perfect balance between information and communication. To investigate a black box orderly, it should be established, first of all, the set of inputs to be used and the set of outputs that are to be observed. Espejo considers "black boxes" the only way to experiment and understand the great complexity of the surrounding world, organizational situations included. Espejo & Watt (1984).

TRANSFORMATION PROCESS

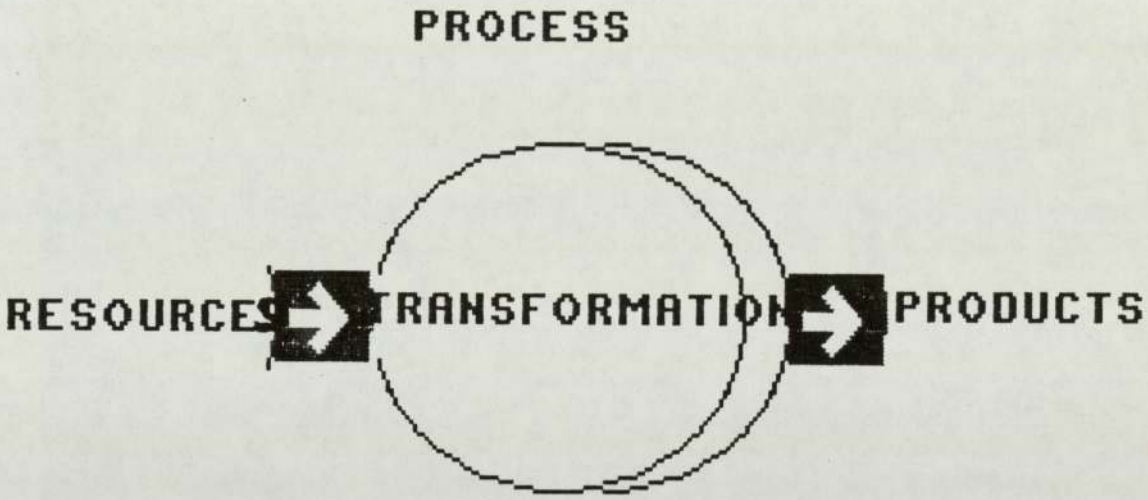


FIG. 13

ORGANIZATIONAL SYSTEMATIZED PROCESS

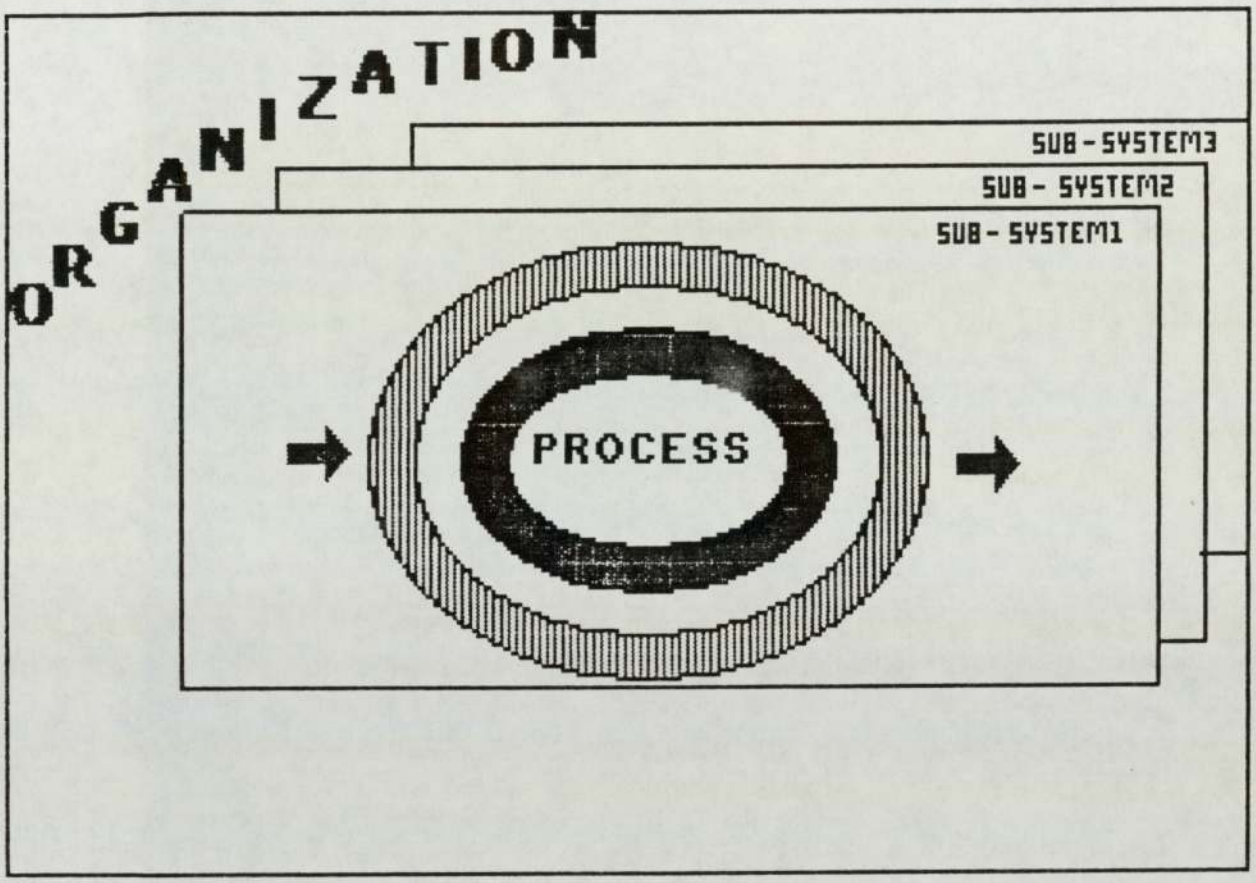


FIG. 14

The identification of processes is carried out, within the organization, either at corporate level or within the boundaries of each SBU's. Each process transforms the different organizational resources into products.

Identification and analysis of the different processes comprised by the organization is priority number one and comes before identification and measurement of indicators. Indicators participating in each process could be measured only when income resources, output products and transformation occurring at diverse organizational processes have been quantified. An isolated performance of the different organizational processes could not be thought of, without a constant interaction. Sometimes this interaction could adopt cyclic characteristics. A cycle is made up of functions that, in due time, become an important task for the performance of a process or integrated group of processes. A key determiner of cycles is the observance of the net-effect coming from systems, sub-systems, and processes. It should not be forgotten that interaction is accomplished by means of an accurate and timely information.

2b. Carbocol: Practical Case

a) Modelling the different Recursion Levels

Fig.15 shows the graph of structural recursion outlining the necessary levels to carry out Carbocol's policies. In this figure, the organization could be seen as a whole entity, three primary tasks with three necessary recursion levels for each business unit in accordance

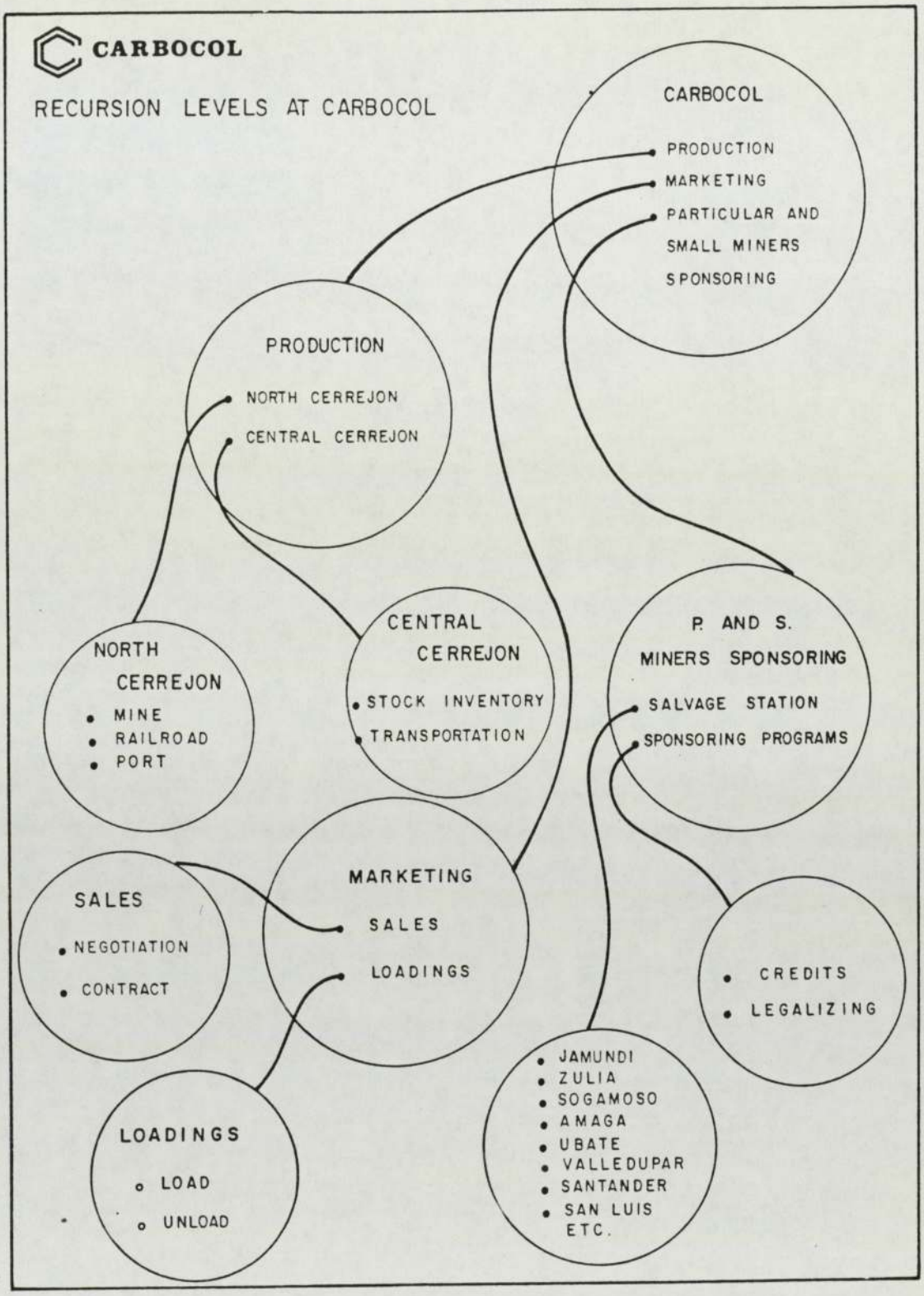

CARBOCOL
RECURSION LEVELS AT CARBOCOL
CARBOCOL
PRODUCTION
MARKETING
PARTICULAR AND SMALL MINERS SPONSORING
PRODUCTION
NORTH CERREJON
CENTRAL CERREJON
NORTH CERREJON
MINE
RAILROAD
PORT
CENTRAL CERREJON
STOCK INVENTORY
TRANSPORTATION
P. AND S. MINERS SPONSORING
SALVAGE STATION
SPONSORING PROGRAMS
SALES
NEGOTIATION
CONTRACT
MARKETING
SALES
LOADINGS
CREDITS
LEGALIZING
LOADINGS
LOAD
UNLOAD
JAMUNDI
ZULIA
SOGAMOSO
AMAGA
UBATE
VALLEDUPAR
SANTANDER
SAN LUIS
ETC.

FIG. 15

with the segregation of complexity.

Fig.16 depicts the way, the Viable System Model could be used to determine the autonomy of each unit and the interdependence among all the units. The existence of complex relationships, whether internal or external, that must be identified in these primary tasks is therefore easily inferred. From an external point of view, it could be observed that each of these three units, at structural level, is interacting with its complex environment and this is related to a higher-level environment adequate for Carbocol as corporation. It could be concluded that Carbocol's environment comprises all the relevant environment that belong to each of the three business units.

From an internal point of view, acknowledging these three primary tasks is a cybernetic conclusion not explicit in the enterprise since formal recognition of production primary task does not exist in it. A general analysis of the structural recursion in Carbocol identifies a maladjustment between its formal structure and the demands required by the production task. Although, from the point of view of formal structure reflected in the organizational chart, this task could be implicit in the other SBU's, there should be written evidence that this task is not only properly defined but also intertwined with the others and that Carbocol is an integral entity that comprises, directs and controls them all.

For the production function to be defined as a primary task in the plans of the enterprise, Carbocol's management has to adopt a clear role in

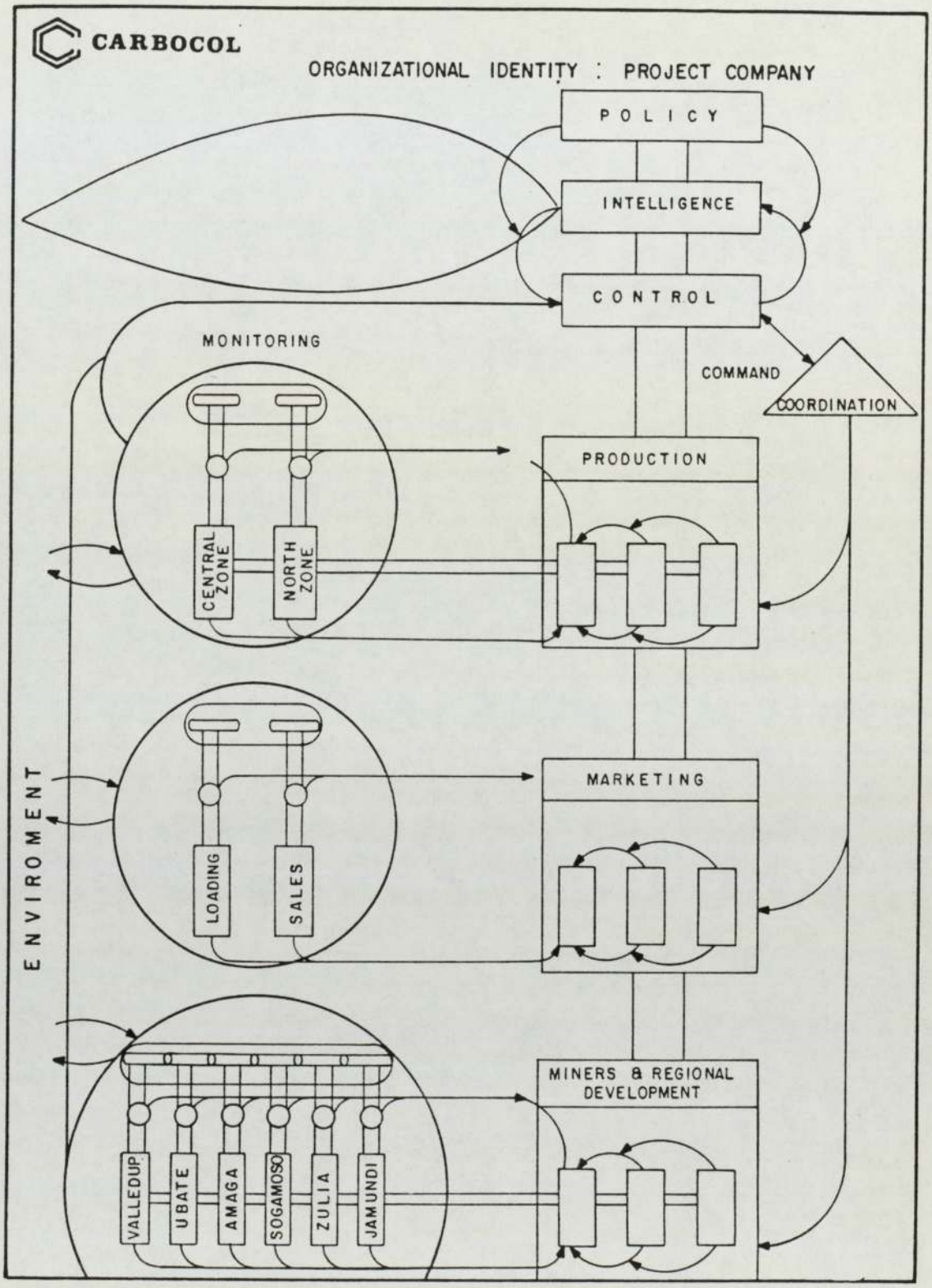

CARBOCOL
ORGANIZATIONAL IDENTITY : PROJECT COMPANY
POLICY
INTELLIGENCE
CONTROL
MONITORING
COMMAND
COORDINATION
PRODUCTION
CENTRAL ZONE
NORTH ZONE
MARKETING
LOADING
SALES
MINERS & REGIONAL DEVELOPMENT
VALLEDUPAR
UBATE
AMAGA
SOGAMOSO
ZULIA
JAMUNDI
ENVIROMENT

FIG. 16

its development. Undoubtedly, its organizational structure should match that of the business unit to facilitate control and coordination of the different projects, whether customers or miners.

The Viable System Model (Fig.16) also furnishes the regulating mechanisms used in the detection of instabilities if the operation of implementation, coordination, control, intelligence and policy functions are understood as present widely in Carbocol and at every recursion level.

Besides what has been already described, the VSM permits questioning and analyzing situations such as:

-What kind of relationship is there between Carbocol and the different operators for each coal project?

-Are the phases of exploration and preparation of coal projects part of the intelligence function?

-Is there any kind of feedback for the VSM to permit, as soon as coal has been uncovered, studying the possibility of carrying out the exploration phase?

-When do these phases become primary tasks of a given coal project?

-What kind of strategies could be developed to reach a more efficient commercialization?

-Could it be possible to make the commercial area of Carbocol a viable commercial entity, within the private sector, to thus, disregard the extremely bureaucratic official procedures?.

-Could the Colombian government eventually regulate the coal exporting price?

-Is it possible to modify the tasks and functions as soon as the strategies come to be modified?

Fig.17, shows the Viable Model for the first level of recursion in Carbocol as a corporation focusing on the Central Cerrejon project under the Pinsky contract. The ability to determine the necessary actions to implement, coordinate, control, plan and decisions taking helps to decide the critical issues whose Stability Indicators must be identify in order to attain planning and control for Carbocol as a whole entity. Fig.18, shows some of the mechanisms that could be better understood at the second recursion level related to Central Cerrejon. It is its task to manage the operation of the coal project with efficiency, efficacy and effectiveness. The VSM applied to the second level of recursion helps to plan, control, coordinate and implement factors to take decision related to the project exploited by Pinsky.

It is worthwhile observing the existing differences related to each managerial function in each of the different recursion levels. For instance, whilst at corporate level (first level of recursion) the

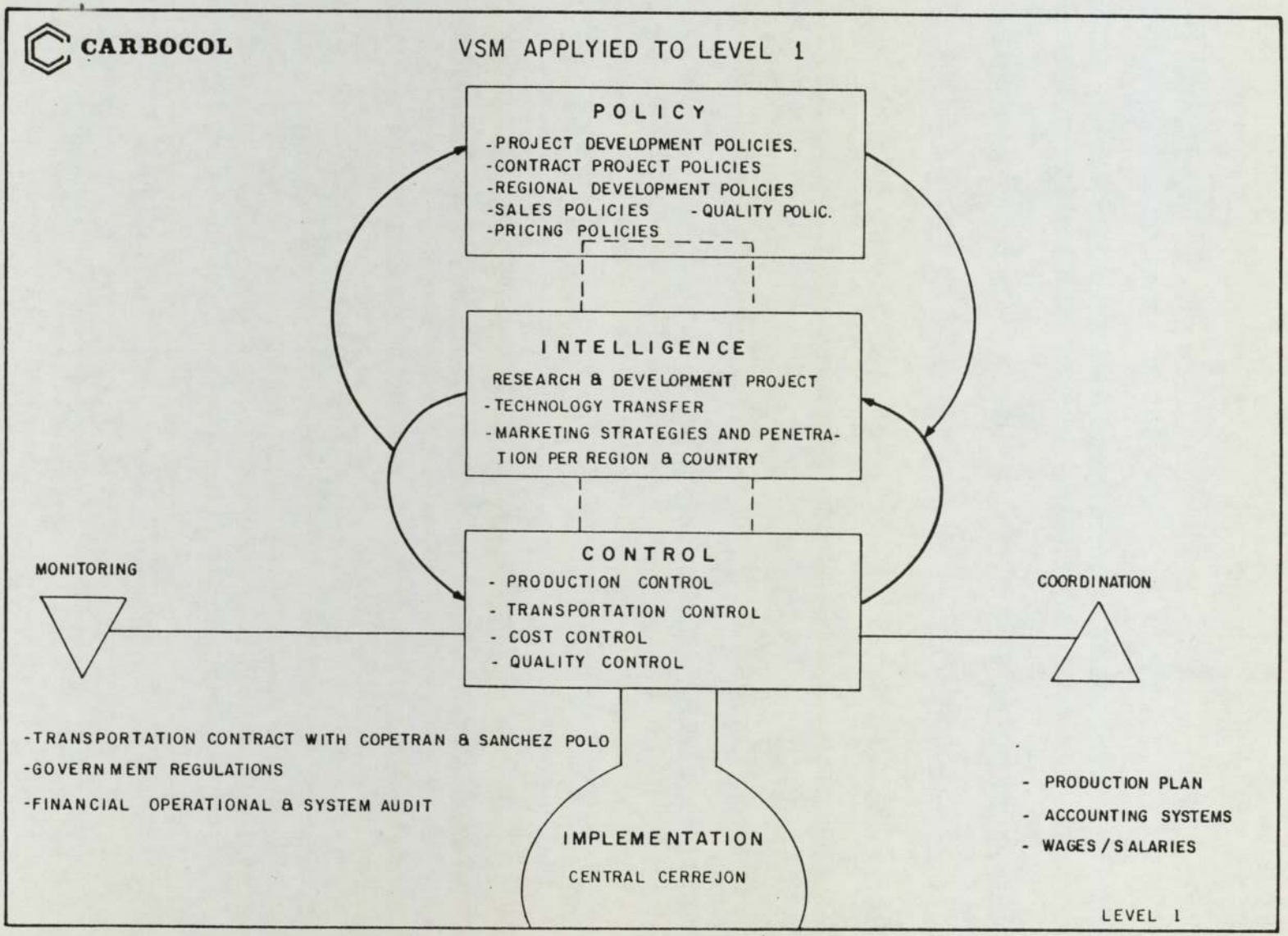

CARBOCOL
VSM APPLYIED TO LEVEL 1
POLICY
-PROJECT DEVELOPMENT POLICIES.
-CONTRACT PROJECT POLICIES
-REGIONAL DEVELOPMENT POLICIES
-SALES POLICIES - QUALITY POLIC.
-PRICING POLICIES
INTELLIGENCE
RESEARCH & DEVELOPMENT PROJECT
-TECHNOLOGY TRANSFER
-MARKETING STRATEGIES AND PENETRATION PER REGION & COUNTRY
CONTROL
- PRODUCTION CONTROL
- TRANSPORTATION CONTROL
- COST CONTROL
- QUALITY CONTROL
MONITORING
COORDINATION
-TRANSPORTATION CONTRACT WITH COPETRAN & SANCHEZ POLO
-GOVERNMENT REGULATIONS
-FINANCIAL OPERATIONAL & SYSTEM AUDIT
IMPLEMENTATION
CENTRAL CERREJON
- PRODUCTION PLAN
- ACCOUNTING SYSTEMS
- WAGES / SALARIES
LEVEL 1

FIG. 17

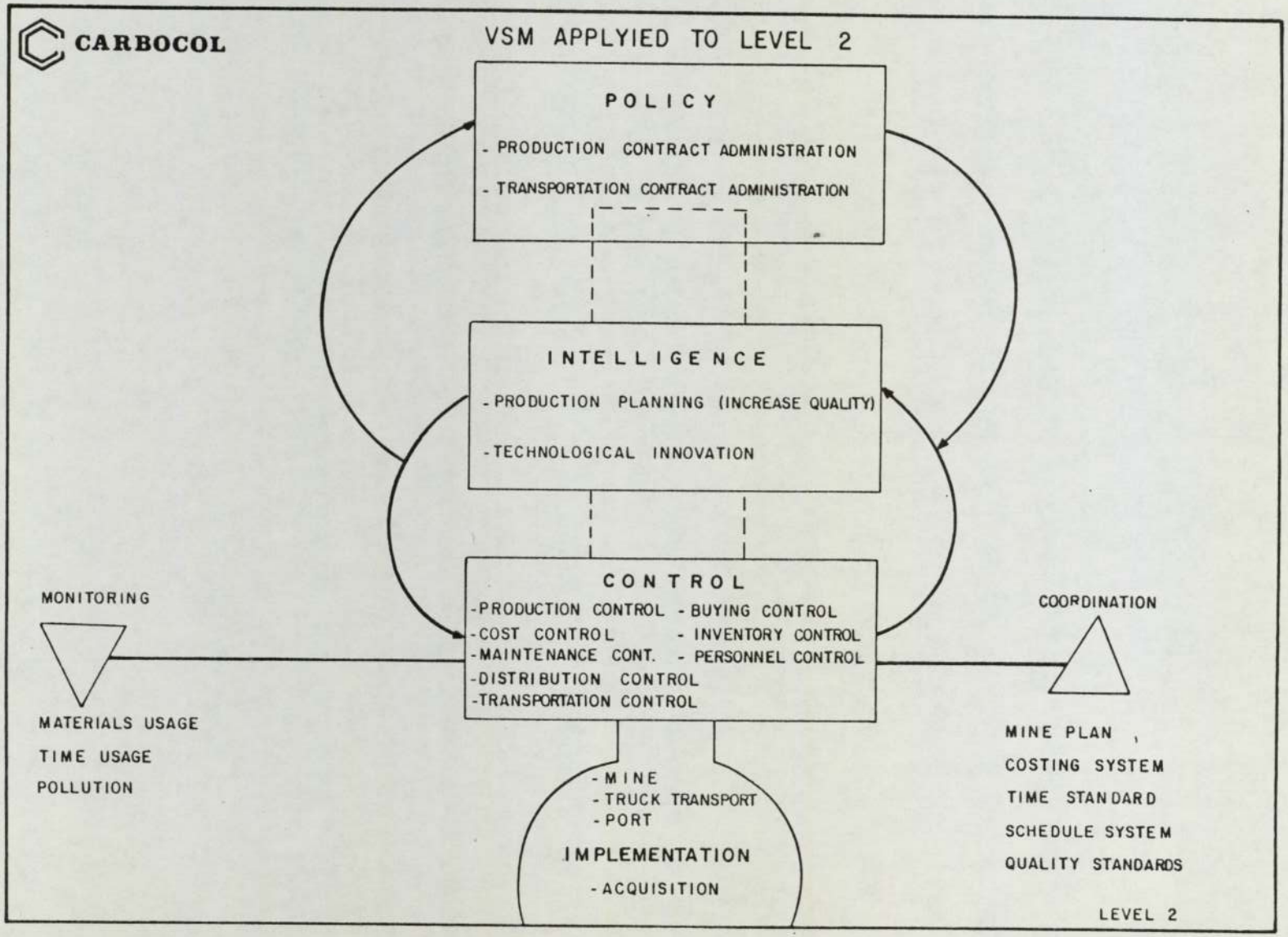

CARBOCOL
VSM APPLYIED TO LEVEL 2
POLICY
- PRODUCTION CONTRACT ADMINISTRATION
- TRANSPORTATION CONTRACT ADMINISTRATION
INTELLIGENCE
- PRODUCTION PLANNING (INCREASE QUALITY)
- TECHNOLOGICAL INNOVATION
CONTROL
-PRODUCTION CONTROL - BUYING CONTROL
-COST CONTROL - INVENTORY CONTROL
-MAINTENANCE CONT. - PERSONNEL CONTROL
-DISTRIBUTION CONTROL
-TRANSPORTATION CONTROL
MONITORING
MATERIALS USAGE
TIME USAGE
POLLUTION
COORDINATION
MINE PLAN
COSTING SYSTEM
TIME STANDARD
SCHEDULE SYSTEM
QUALITY STANDARDS
- MINE
- TRUCK TRANSPORT
- PORT
IMPLEMENTATION
- ACQUISITION
LEVEL 2

FIG. 18

policy function is centred in defining the project development and in defining the type of contracts, at the second level of recursion, corresponding to the Central Zone as Project, the important thing is to define the necessary policies to manage these production association-contract.

The way the VSM could be used to analyze the mechanisms of discretion and autonomy, used by Carbocol, are shown in Fig.19. The mechanisms are helpful in identifying the supporting functions necessary to fulfil primary tasks.

By carefully defining the purpose of "black box", Carbocol could be integrated into a corporation. This concept has been described by Espejo and, in the present context, is related to a recursion level compared to a Russian doll.

Due to a great variety of mining projects, each one with its particular phases, stages, dimensions, etc., their adequate commercialization contracts for different geographical distributions, markets, etc. included, besides a diversity of sponsoring programs for different deposits located in distinct locations in the country, etc., it is necessary to analyze all the possible alternatives to solve the problems connected with each recursion level.

If it is necessary, Carbocol's plans should be reformulated in accordance with the systemic approach comprising the organization as a whole (Fig.16). Such an approach analyzes three sub-systems:

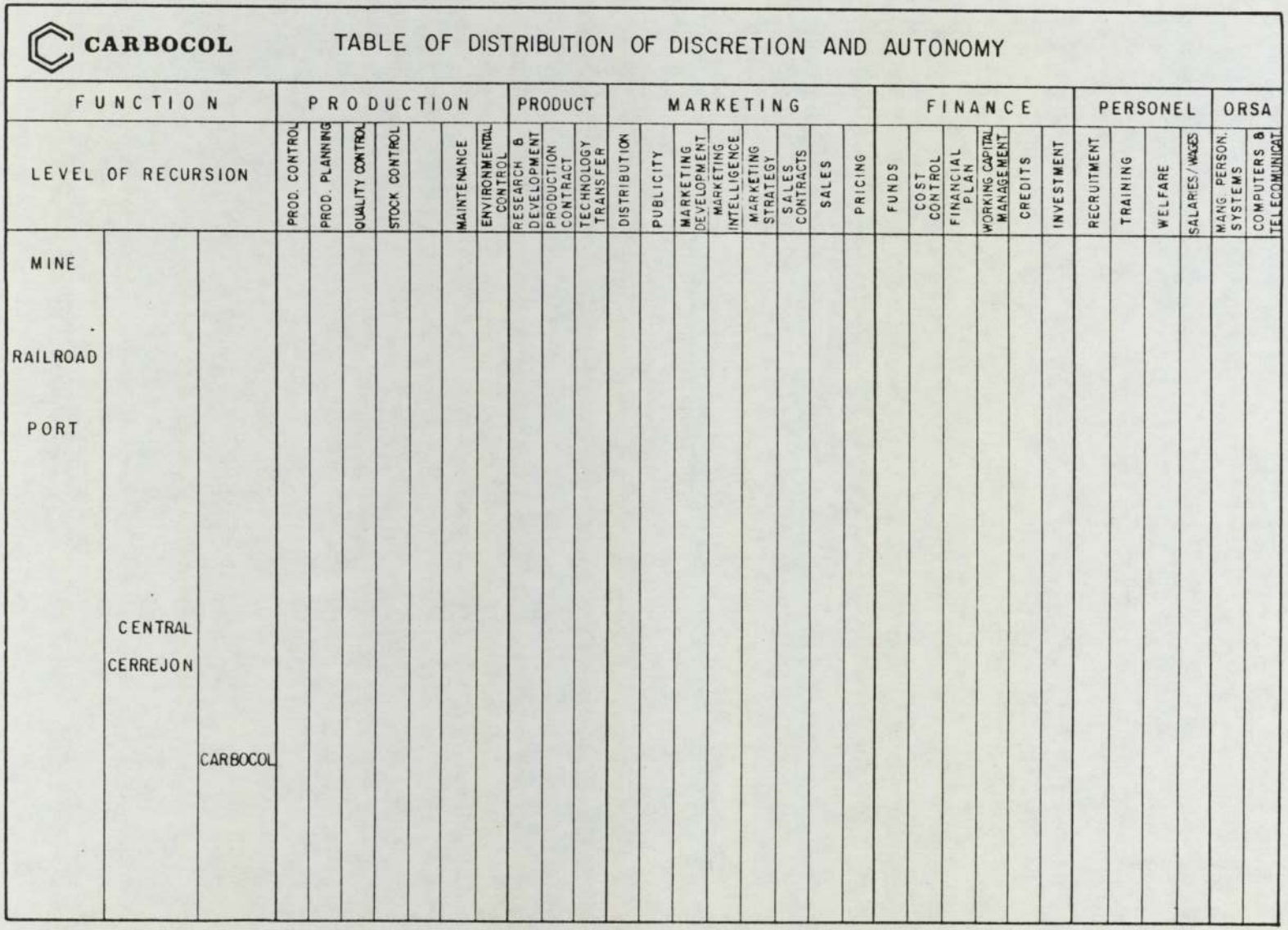

CARBOCOL
TABLE OF DISTRIBUTION OF DISCRETION AND AUTONOMY
FUNCTION
LEVEL OF RECURSION
MINE
RAILROAD
PORT
CENTRAL CERREJON
CARBOCOL
PRODUCTION
PROD. CONTROL
PROD. PLANNING
QUALITY CONTROL
STOCK CONTROL
MAINTENANCE
ENVIRONMENTAL CONTROL
PRODUCT
RESEARCH & DEVELOPMENT
PRODUCTION CONTRACT
TECHNOLOGY TRANSFER
MARKETING
DISTRIBUTION
PUBLICITY
MARKETING DEVELOPMENT
MARKETING INTELLIGENCE
MARKETING STRATEGY
SALES CONTRACTS
SALES
PRICING
FINANCE
FUNDS
COST CONTROL
FINANCIAL PLAN
WORKING CAPITAL MANAGEMENT
CREDITS
INVESTMENT
PERSONEL
RECRUITMENT
TRAINING
WELFARE
SALARIES/WAGES
ORSA
MANG. PERSON. SYSTEMS
COMPUTERS & TELECOMUNICAT.

FIG. 19

production, commercialization and miners sponsoring for Carbocol. Each sub-system is composed of "sub-systems" with own discretion and with the capacity of amplifying the operational complexity inherent to every sub-system they belong to. The different phases and stages required by each of the mining projects, since they greatly differ the ones from the others, should be identified for each production primary task.

From the point of view of Carbocol, the differentiation among projects is due, specially to the type of contract that has been stipulated for the operator of the mines because he participates directly in the planning and control mechanisms necessary to define.

b) Process Definition

First of all, it is important to understand the different production processes that take place in Carbocol to better identify the indicators. It is worthwhile to stress the way SBU's, comprising production, commercialization, and miners sponsoring, are closely connected to the next recursion level through their outputs if they are considered black boxes.

In accordance with Fig.16, phases and stages of viable production processes are SBU's supervised by the enterprise. There are lots of variations regarding quantity, quality and technology for the two projects (North and Central Cerrejon). These variations could be easy to observe at the different stages of the exploitation phase of the aforementioned projects, and they are stipulated in the coal production

contracts to be signed. Fig.20 and 21 depict two flow charts, for the two projects, that show the boundaries for the autonomy of control exerted by Carbocol. For instance, in the association contract signed for North Cerrejon, Carbocol-control and Intercor-operator manage the Joint Operation, but the day to day management is the sole responsibility of Intercor-operator.

Carbocol-owner is indirectly involved in the production processes (mine, railway to port and port facilities) and commercializes its own coal from the projects dealt with already, various market strata and the different customers and may share them with Intercor-owner as stipulated by a clause of mutual respect in the association contract.

Maintenance of all necessary infrastructure and the mining operation itself are Pinsky-Operator responsibilities in Central Cerrejon. According to their contract, Carbocol must receive the coal, on trucks, in the mine, and then take care of the land transport to the railway. Then, Intercor gets in charge of the railway transport and handles the coal in port until it is shipped. Commercialization is also one of Carbocol's duties.

Regarding the Drummond's contract, the situation is rather different because it is based on a government agreement, and Carbocol, although able to oversee the whole operation, has no control whatsoever over the project. Its sole concern are royalties per coal production at mine lode.

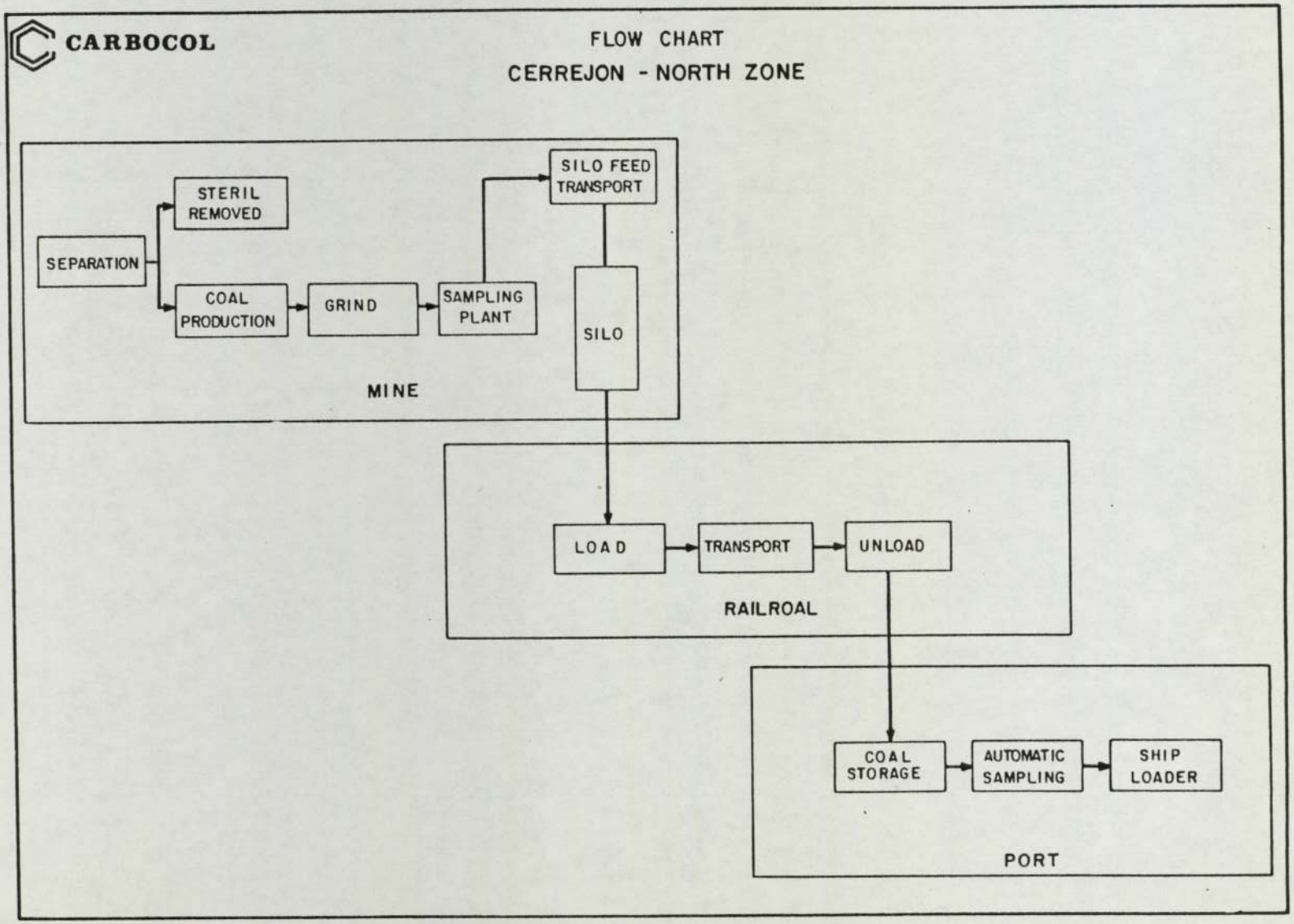

CARBOCOL
FLOW CHART
CERREJON - NORTH ZONE
SILO FEED TRANSPORT
STERIL REMOVED
SEPARATION
COAL PRODUCTION
GRIND
SAMPLING PLANT
SILO
MINE
LOAD
TRANSPORT
UNLOAD
RAILROAL
COAL STORAGE
AUTOMATIC SAMPLING
SHIP LOADER
PORT

FIG. 20

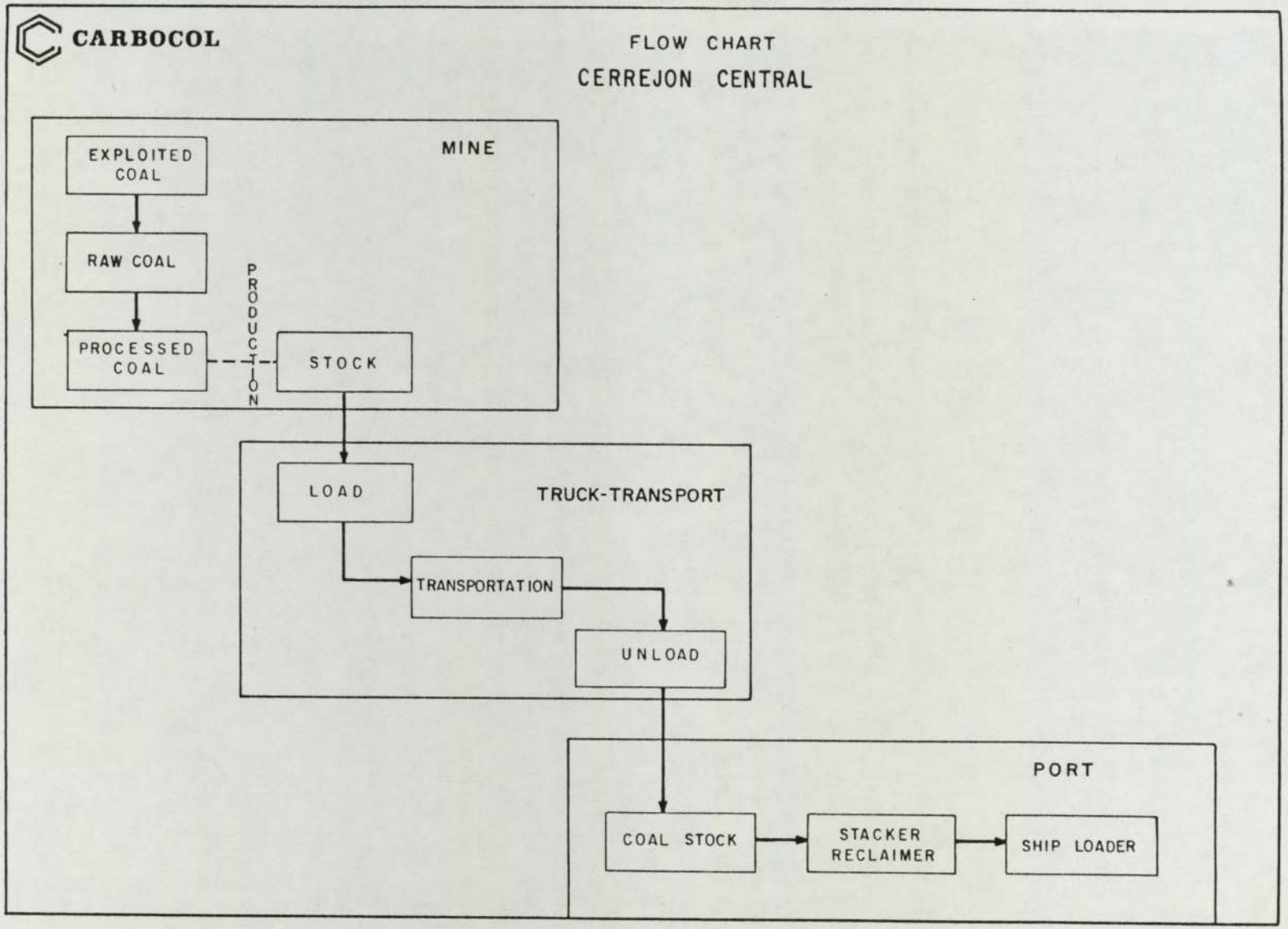

CARBOCOL
FLOW CHART
CERREJON CENTRAL
MINE
EXPLOITED COAL
RAW COAL
PROCESSED COAL
PRODUCTION
STOCK
LOAD
TRUCK-TRANSPORT
TRANSPORTATION
UNLOAD
PORT
COAL STOCK
STACKER RECLAIMER
SHIP LOADER

FIG. 21

Through these three examples, it is possible to observe how the kind of contract signed with the Mine Operator influences directly the mechanism of planning and control necessary to make the project operational. The mechanisms are directly related to the way Stability Indicators have been identified.

Carbocol's commercializing function defined by the organization, implies coordination of coal exports, from its own mines, and from other private and state-owned mines. Carbocol carries out and supervises each negotiation, sales and freights contracts. The function also includes relevant loading and unloading processes. (Fig.22). There should be an integral exporting infrastructure and sales agents to help make sales profitable while providing customers with valuable information of the offers in far competitive regions for the commercializing function to fulfil its mission.

From the point of view of the miners sponsoring programs and with the purpose of helping to develop the small miners technical capacity, Carbocol has created six different supporting stations: Jamundi, Zulia, Sogamoso, Amagá, Ubaté and Valledupar, each of them working independently and using resources from the Financial Coal Fund. The objective of these supporting stations is to identify the community's physical and social needs.

The sponsoring small and medium miners SBU must recognize all sort of new projects, connected with it, maintain a Projects Bank for the small miners that could be used as support decisions taking necessary in the

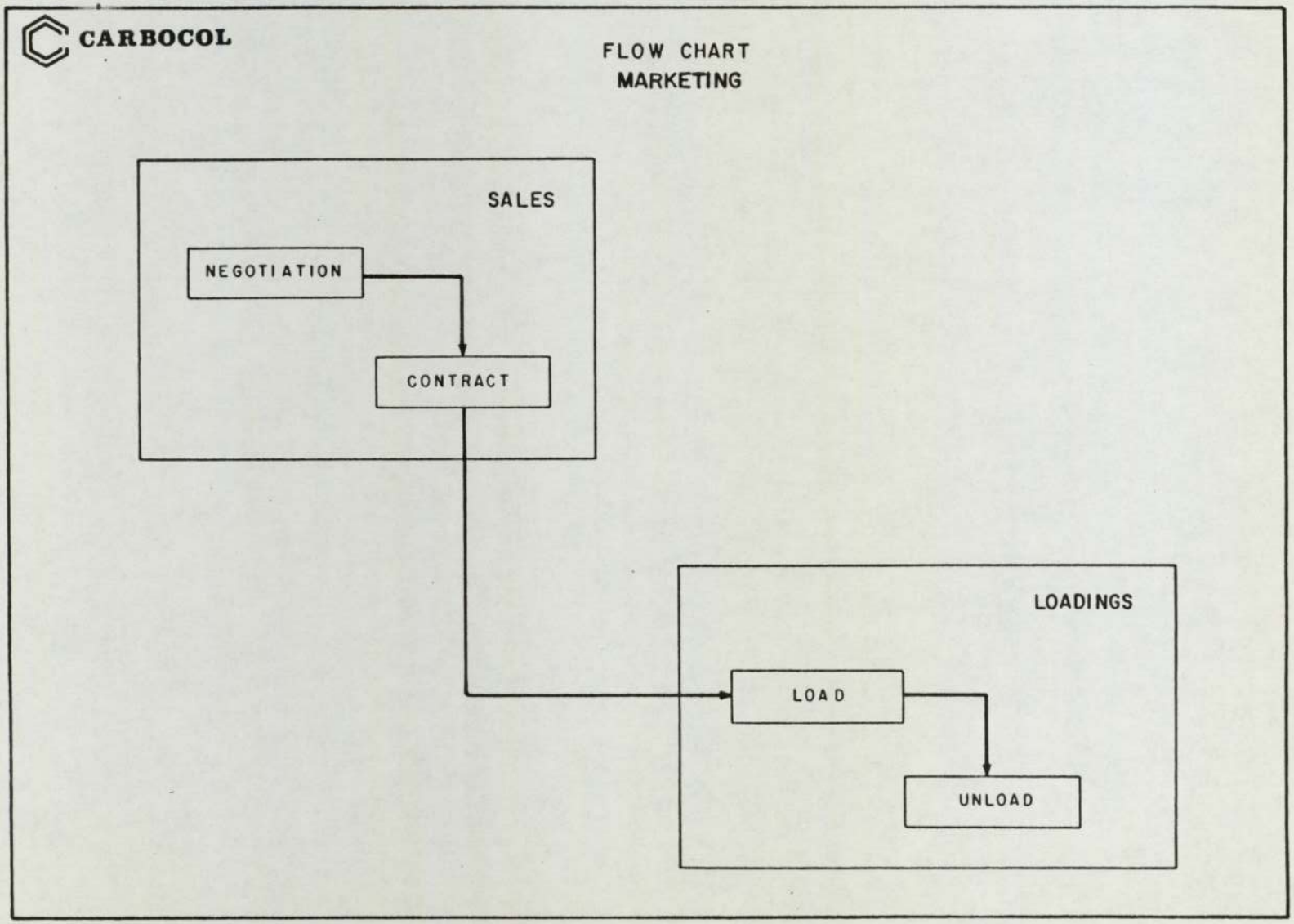

CARBOCOL
FLOW CHART
MARKETING
SALES
NEGOTIATION
CONTRACT
LOADINGS
LOAD
UNLOAD

FIG. 22

internal and external development of the market. This SBU should also create and manage reliable systems to collect tax income on coal production and supervise allocation from tax resources to maximize the ratio benefit/cost measured in socio-economical terms for the country. (Fig.23).

c) Identifying technical processes at the third recursion level

- **analysis of processes at Cerrejon Central Zone**

Cerrejon Central Zone project is the main issue at the second recursion level. One of the objectives of the present research is to verify how efficient the processes and how rationalized the resources for this mining project, that has been identified as pilot for designing, validating, and evaluating the methodology.

Managing the Central Cerrejon project is the sole responsibility of Carbocol's Operation Vicepresidency. The Vicepresidency must guarantee that production, from every operational coal project is carried out in accordance with quantity and quality required, and at a competitive price regarding other coal producing countries.

Opencast coal mining can be defined as the method of winning coal from an open deposit: firstly, the steril is removed (steril is considered the earth and material that covers the coal in the deposit), then, the steril is piled along the trench and the coal extracted from it.

There are three basic phases for each coal project. They are:

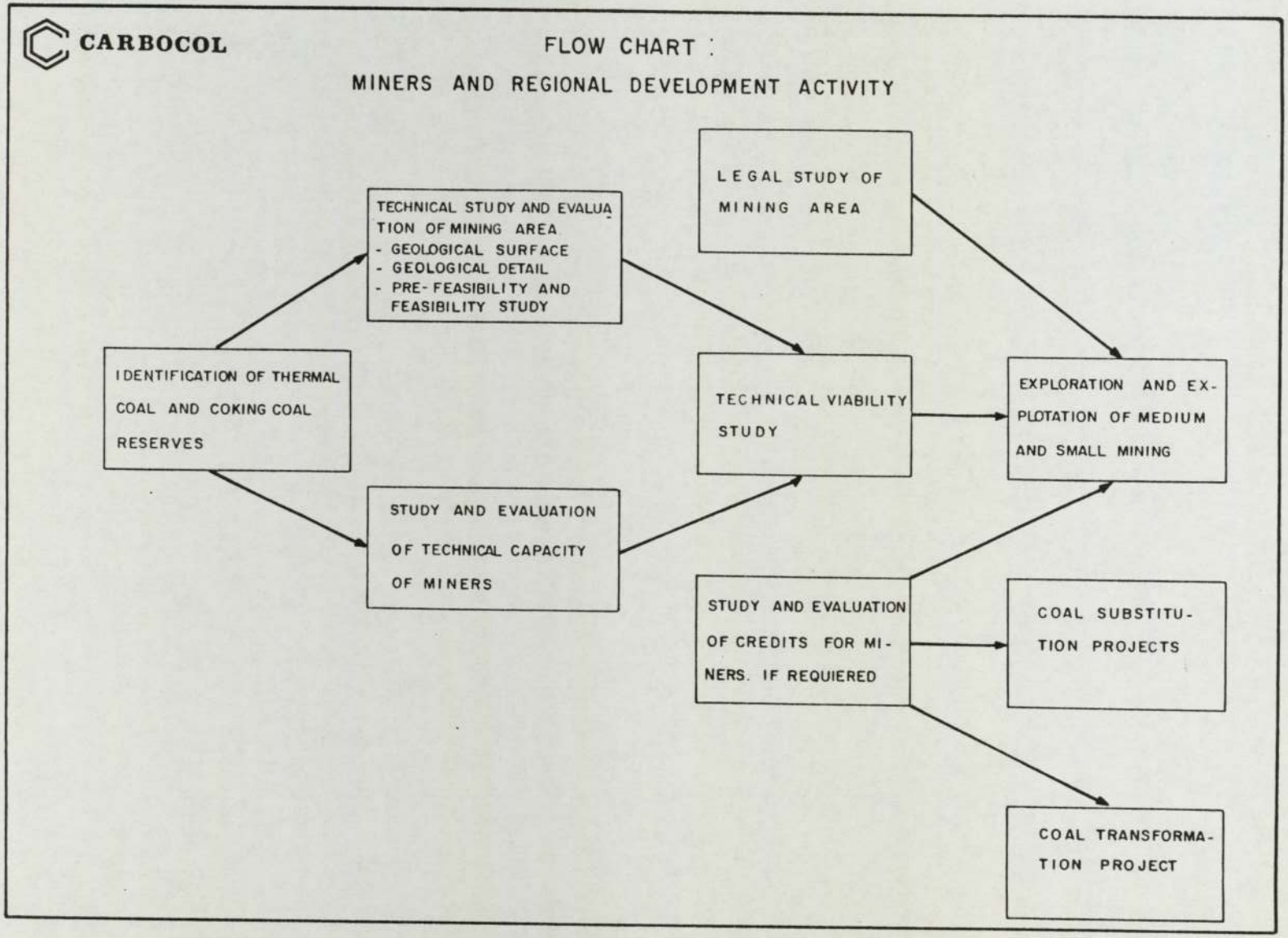

CARBOCOL
FLOW CHART :
MINERS AND REGIONAL DEVELOPMENT ACTIVITY
LEGAL STUDY OF MINING AREA
TECHNICAL STUDY AND EVALUATION OF MINING AREA
- GEOLOGICAL SURFACE
- GEOLOGICAL DETAIL
- PRE-FEASIBILITY AND FEASIBILITY STUDY
IDENTIFICATION OF THERMAL COAL AND COKING COAL RESERVES
TECHNICAL VIABILITY STUDY
EXPLORATION AND EXPLOTATION OF MEDIUM AND SMALL MINING
STUDY AND EVALUATION OF TECHNICAL CAPACITY OF MINERS
STUDY AND EVALUATION OF CREDITS FOR MINERS. IF REQUIERED
COAL SUBSTITUTION PROJECTS
COAL TRANSFORMATION PROJECT

FIG. 23

Exploration, Preparation, and Exploitation.(the study of Central Cerrejon Zone will take into consideration only the Exploitation phase).

Each phase goes through different stages in the opencast mining technology. Refer to Fig.24 for a better understanding. It plays a vital role in low cost recovering of shallow coal reserves that cannot be extracted by deep mine methods. A right equilibrium should be established when developing opencast coal reserves in order to protect the environment. Production costs per ton of coal extracted by this method are significantly less than those from deep mining. Besides, the coal extracted by this method is supposedly better than the one produced by the other system. When the open cast mining processes where analyzed to be used in the Cerrejon Central Zone project the mine, trucking and railway transportation, and harbouring facilities were identified as a third level of recursion (Fig.25).

The exploitation phase for the Central Cerrejon Zone project (Fig.26) is considered a whole system that integrates the commercializing and production functions. Nevertheless, the diagram should be only regarded as a model if it is intended for other similar coal projects. It contains all the necessary steps, altogether, to be considered from mine lode until the coal reaches the final customer. Production includes mining, trucking and stocking at Central Cerrejon. railway transport, stocking and harbouring at North Zone (Albania).

Commercialization includes sales and their after control. Nevertheless, for modelling the coal project under the Pinsky contract, it should be

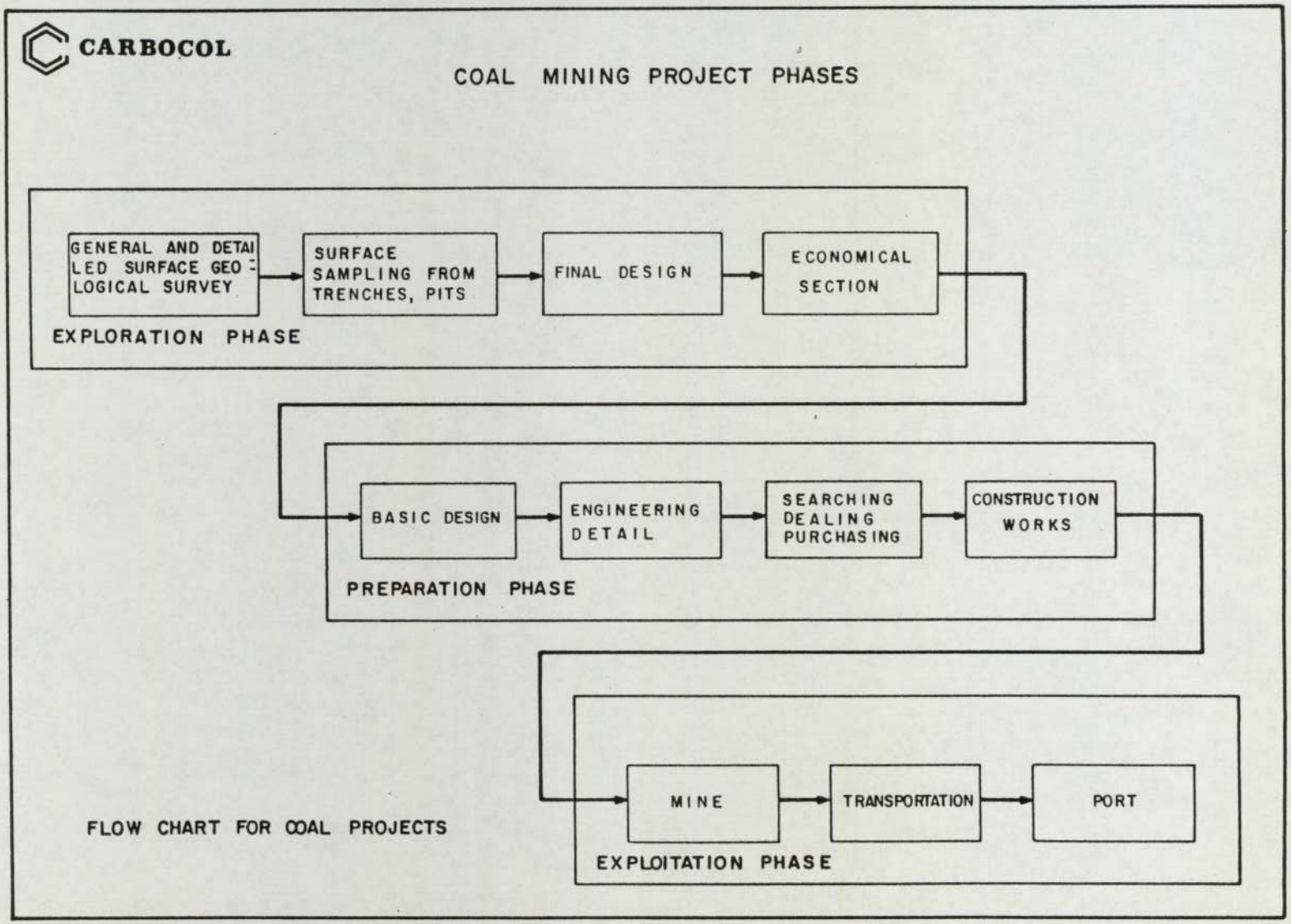

CARBOCOL
COAL MINING PROJECT PHASES
GENERAL AND DETAI LED SURFACE GEO - LOGICAL SURVEY
SURFACE SAMPLING FROM TRENCHES, PITS
FINAL DESIGN
ECONOMICAL SECTION
EXPLORATION PHASE
BASIC DESIGN
ENGINEERING DETAIL
SEARCHING DEALING PURCHASING
CONSTRUCTION WORKS
PREPARATION PHASE
MINE
TRANSPORTATION
PORT
EXPLOITATION PHASE
FLOW CHART FOR COAL PROJECTS

FIG. 24

COAL MOVEMENT

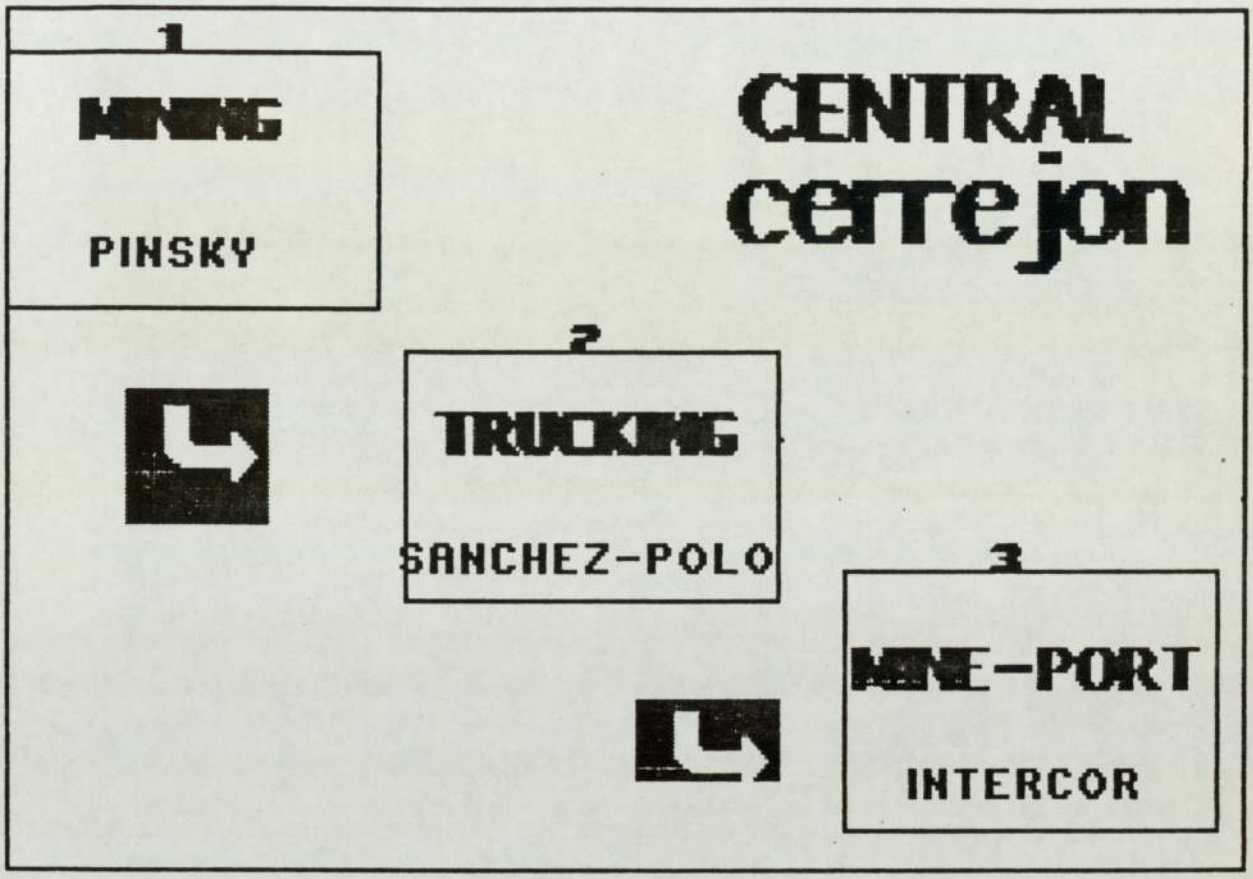


FIG. 25

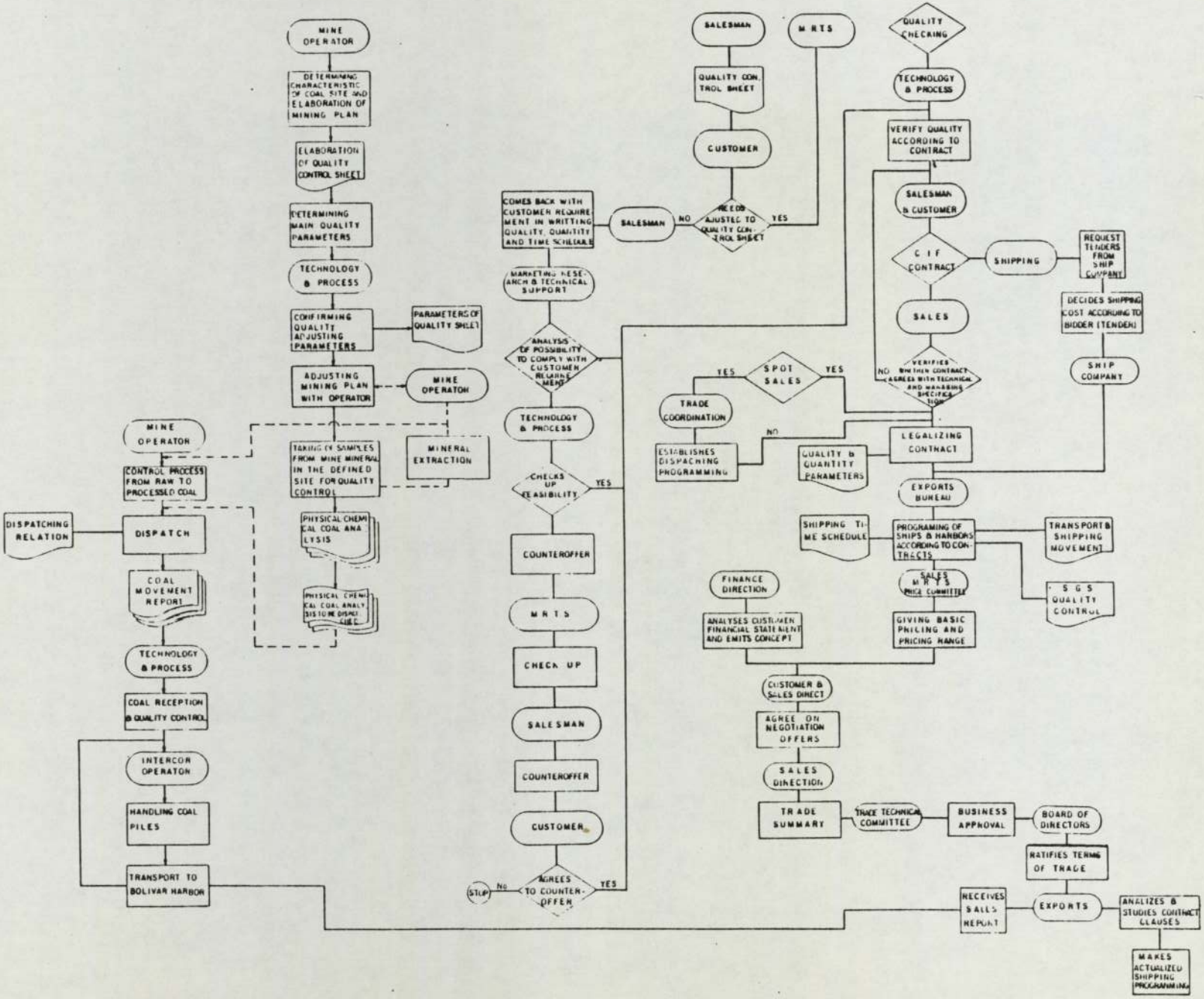

MINE OPERATOR
DETERMINING CHARACTERISTIC OF COAL SITE AND ELABORATION OF MINING PLAN
ELABORATION OF QUALITY CONTROL SHEET
DETERMINING MAIN QUALITY PARAMETERS
TECHNOLOGY & PROCESS
CONFIRMING QUALITY ADJUSTING PARAMETERS
PARAMETERS OF QUALITY SHEET
ADJUSTING MINING PLAN WITH OPERATOR
MINE OPERATOR
MINE OPERATOR
CONTROL PROCESS FROM RAW TO PROCESSED COAL
TAKING OF SAMPLES FROM MINE MINERAL IN THE DEFINED SITE FOR QUALITY CONTROL
MINERAL EXTRACTION
DISPATCHING RELATION
DISPATCH
PHYSICAL CHEMICAL COAL ANALYSIS
COAL MOVEMENT REPORT
PHYSICAL CHEMICAL COAL ANALYSIS FROM MINE DISPATCH SITE
TECHNOLOGY & PROCESS
COAL RECEPTION & QUALITY CONTROL
INTERCOR OPERATOR
HANDLING COAL PILES
TRANSPORT TO BOLIVAR HARBOR
SALESMAN
MRTS
QUALITY CONTROL SHEET
CUSTOMER
NEEDS AJUSTED TO QUALITY CONTROL SHEET
NO
YES
COMES BACK WITH CUSTOMER REQUIREMENT IN WRITTING QUALITY, QUANTITY AND TIME SCHEDULE
SALESMAN
MARKETING RESEARCH & TECHNICAL SUPPORT
ANALYSIS OF POSSIBILITY TO COMPLY WITH CUSTOMER REQUIREMENT
TECHNOLOGY & PROCESS
CHECKS UP FEASIBILITY
YES
COUNTEROFFER
MRTS
CHECK UP
SALESMAN
COUNTEROFFER
CUSTOMER
AGREES TO COUNTER-OFFER
NO
STOP
YES
QUALITY CHECKING
TECHNOLOGY & PROCESS
VERIFY QUALITY ACCORDING TO CONTRACT
SALESMAN & CUSTOMER
C I F CONTRACT
SHIPPING
REQUEST TENDERS FROM SHIP COMPANY
DECIDES SHIPPING COST ACCORDING TO BIDDER (TENDER)
SALES
SHIP COMPANY
VERIFIES IF IN THIS CONTRACT AGREES WITH TECHNICAL AND MARKETING SPECIFICATION
NO
YES
SPOT SALES
YES
TRADE COORDINATION
ESTABLISHES DISPACHING PROGRAMMING
NO
QUALITY & QUANTITY PARAMETERS
LEGALIZING CONTRACT
EXPORTS BUREAU
SHIPPING TIME SCHEDULE
PROGRAMING OF SHIPS & HARBORS ACCORDING TO CONTRACTS
TRANSPORT & SHIPPING MOVEMENT
SALES MRTS PRICE COMMITTEE
S G S QUALITY CONTROL
FINANCE DIRECTION
ANALYSES CUSTUMER FINANCIAL STATEMENT AND EMITS CONCEPT
GIVING BASIC PRICING AND PRICING RANGE
CUSTOMER & SALES DIRECT
AGREE ON NEGOTIATION OFFERS
SALES DIRECTION
TRADE SUMMARY
TRADE TECHNICAL COMMITTEE
BUSINESS APPROVAL
BOARD OF DIRECTORS
RATIFIES TERMS OF TRADE
EXPORTS
RECEIVES SALES REPORT
ANALIZES & STUDIES CONTRACT CLAUSES
MAKES ACTUALIZED SHIPPING PROGRAMMING

FIG. 26

advisable to concentrate mainly on those specific variables Carbocol controls which are mine, truck and railway transport and harbouring.

1) Mining

The geological structure of Central Cerrejon is ideal for an open pit mine with a truck and shovel operation. The original contract with Pinsky was to produce 500,000 tons in 15 months, 3 of them were pre-operational, and the remaining 12 dedicated to production as it is. However, this production level could not be reached and it was necessary to extend it until March 1990 demanding Pinsky to average a peek of 750.000 tons.

Pinsky was responsible of producing, processing, and loading the coal, Fig.27. To carry out this operation, Carbocol supplies Pinsky with the needed infrastructure, that is machinery and equipment. It also sells Pinsky spare parts as well as accessories from its warehouses.

Carbocol receives the coal on trucks and pays the Operator $2.070 per coal produced ton (base fare). This amount will be readjusted monthly according to increments corresponding to cost of labour, equipment, fuel, tires and spare parts.

Pinsky is entitled to premiums if quality reaches above pre-established BTU's or penalties (liabilities) if it is under this value.

MINE COAL MOVEMENT

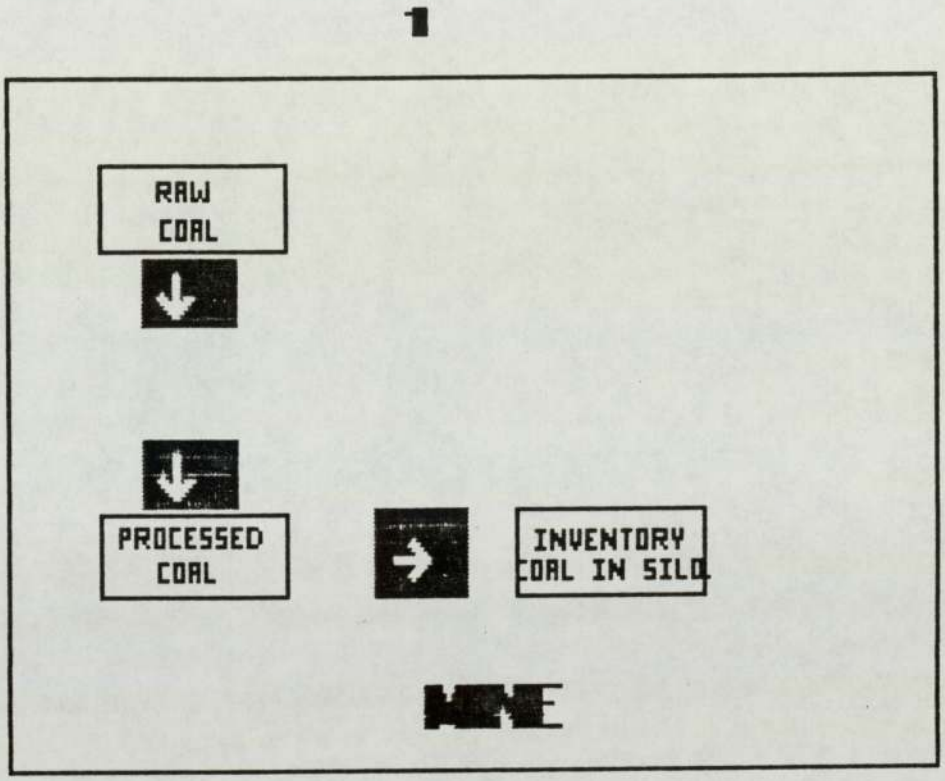


FIG. 27

2) Land transport

"Sanchéz Polo & Administración de Transporte" are subject, by a legalized contract, to transport coal from Central Zone Mine to a yard the North Zone project has in Albania Fig.28.

The transport contract, was agreed upon and signed in May 1988 for 500.000 tons, 15 months duration, for a total value of $685.000.000. Due to the extension of the Pinsky production contract, the date was extended to March 1990 and Sanchez Polo was bound to carry 750.000 tons, total production.

3) Port

Carbocol uses and controls both the railway and harbouring facilities from North Cerrejon for shipping the coal deposited in yard number 1 in Albania. Intercor behaves as operator and it is its responsibility to handle and pile the coal in Albania, then load it in railway wagons and transport it to Puerto Bolivar, and finally ship it on line boats.

There are two basic operations for the coal that must be carried out in the harbour: railway transport and whatever is involved in harbouring (Fig.29).

3a) Railway.

There is a 150 kilometre one-way railway which is used for both, coal

LAND TRANSPORT COAL MOVEMENT

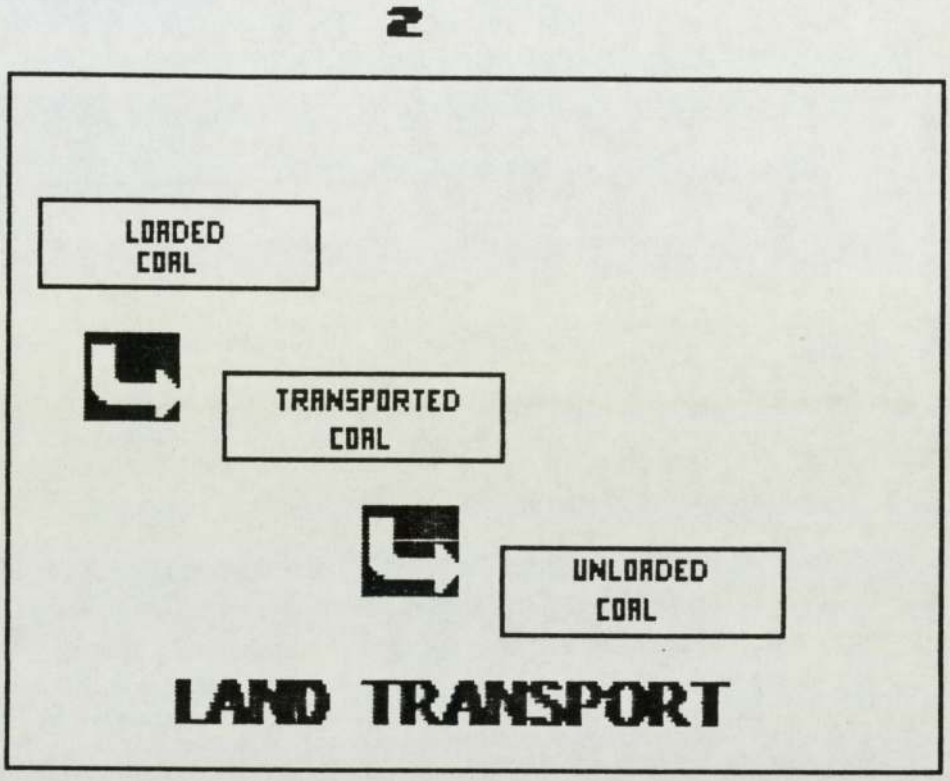


FIG. 28

PORT COAL MOVEMENT

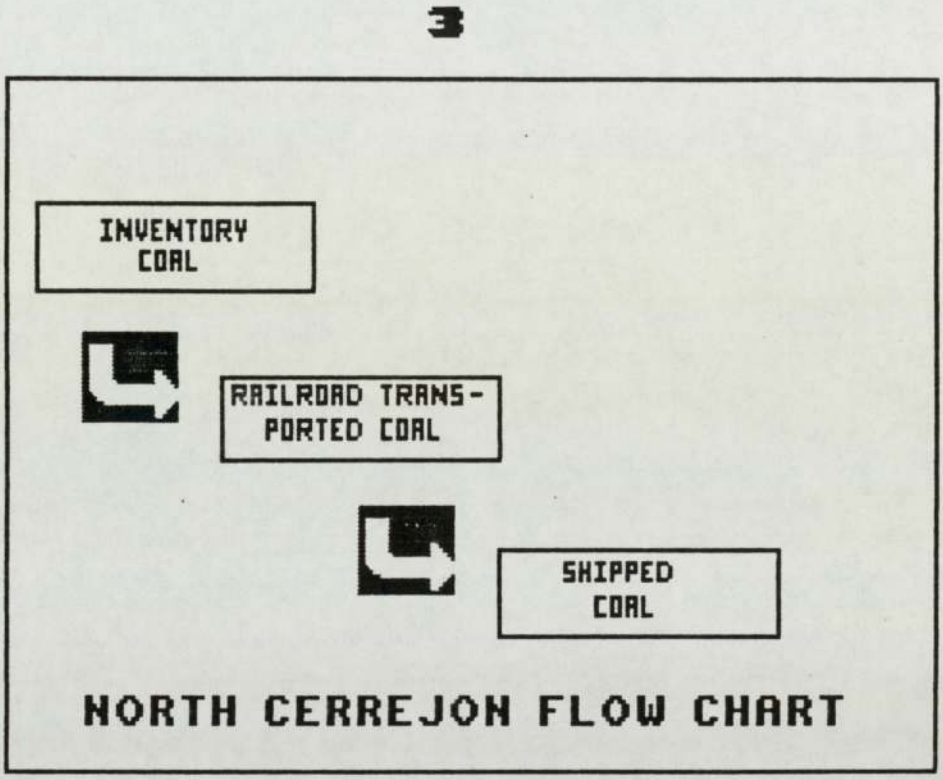


FIG. 29

and raw material transport, and other products the mine needs.

At present, two 3.600 horsepower locomotives and 93 botton dump cars with a total capacity of 8.000 tons per car, are used. The capacity of the unloading station is 6.000 tons per hour.

3b) Storing and other harbouring activities.

Puerto Bolivar is located at the entrance of the Portete Bay in the Guajira Departament, north-east Colombia. The port may serve ships of up to 150.000 tons, DWT (dead weight).

The coal available facilities for handling it consist of an unloading station, a stockpilining area with three stacker reclaimers, as well as a linear shiploader that deposits the coal on board. This facilities include a dust suppression and recollection system at every point of transfer, storage, automatic sampling and weighing areas.

Every operation in the port has been designed for 24 hours a day, 365 days a year.

3a. Strategic Plan

Identification of strategies is characterized by a progressing knowledge process of institutional apprenticeship programs, in such a way that, in the end, this knowledge turns into a heuristic process continuously searching for political and psychological variables. Stafford Beer defines "heuristic methods" as a set of instructions looking for strategies and unknown objectives through continuous search and the repeated evaluations of such progress according to a well known criterion. The identified Stability Indicators expedite this process because it permits to evaluate, follow up and redefine the best strategies.

Once strategies, objectives and priorities have been clearly stated it would be more expedite to take decisions. On the other hand, as far as more knowledge and relevant information about the organization and its environment have been gathered, the Strategical Plan to be proposed would be better and the identification of Stability Indicators to evaluate the Plan easier. Therefore, the decisions to be taken will have to be the best and more appropriate for an adequate recursion level.

Strategical planning approach has a tremendous importance in the definition and evaluation of the Strategic Plan according to results. Strategic Plan includes two major steps: 1) An analysis of the business environment that considers the structure of the industry the enterprise

belongs to and the environmental conditions that may influence the organization; and 2) the enterprise's positioning where various aspects are considered. They are formulation of strategies, objectives, policies and goals of the business; definition of Stability Indicators to evaluate and control results; assignment and allocation of resources, according to priorities and estimates of benefits and costs; and measurement and evaluation of indicators used to control the Plan. These aspects are essential to design the Strategic Plan for the enterprise are summarized in Fig.30. For the time being, the focus will be centred in defining strategies, objectives and policies as well as fractionating, aggregating, and segregating objectives by using the systemic approach. Measuring and adjustment of results is attained by means of Stability Indicators, that is why, the strategic management system must be flexible enough to facilitate such an adjustment.

An effective planning system that determines qualitative strategies must focus on two relevant dimensions: firstly, it should respond to the external environmental changes and secondly provide an analysis of the internal environment as stated by Fig.31. A consolidation of internal and external forces helps to set aside not only the opportunities and threats awaiting in the environment but also the strengths and weaknesses of the enterprise. Top level executives, when facing these two dimensions, develop their strategies by searching and analyzing the opportunities and threats immersed in the environment on the one hand, and on the other by identifying the internal strengths and weaknesses of the enterprise.

COMPONENTS OF STRATEGIG PLANNING

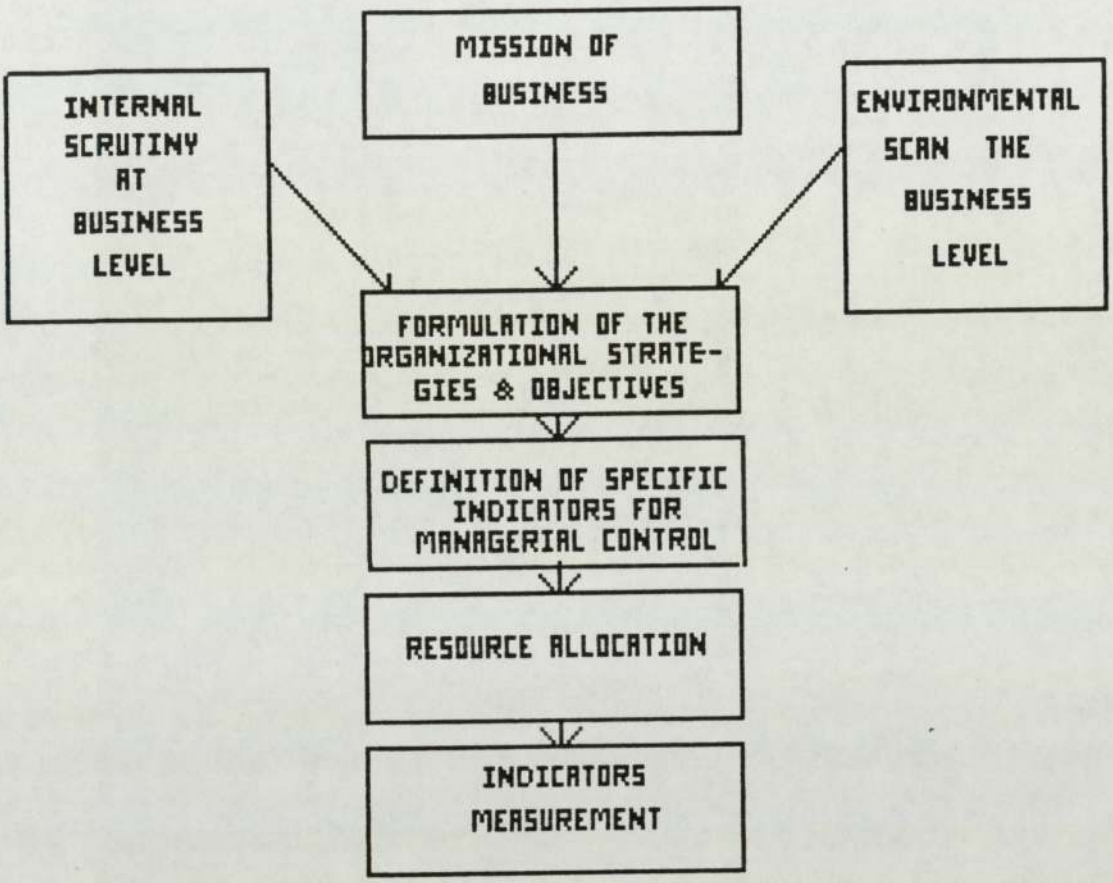


FIG. 30

FORMULATION OF STRATEGY

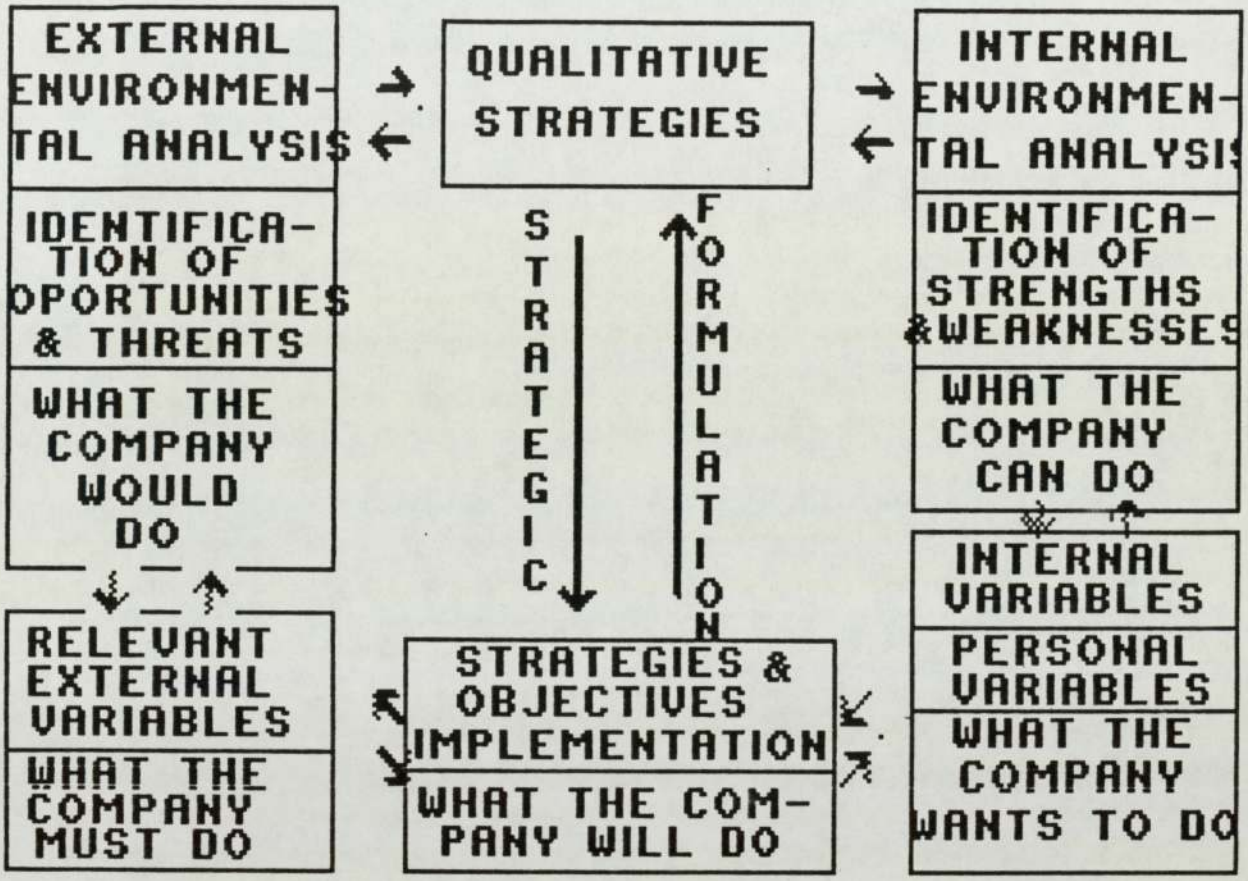


FIG. 31

An external analysis is of great assistance in determining what the company should do with regards to the external variables that are relevant to the environment but affect the organization. The analyst should concentrate strongly on those variables if he wants to be able to better respond to the changes in the environment. It is also important to determine which are the essential conditions in which the enterprise may take opportunities, and which constitute threats if the resources of the enterprise are used to make the best out of the opportunities or to counterattack the threats.

On the other hand, an internal analysis of both business and the relevant variables help to determine the possibilities of the company. However the existing resources and the variables for the personal capacity of each executive should be taken into consideration because, in the end, it is the executives who are going to decide the objectives according to the possibilities of the company. A historical background of enterprises coping with potential producers, suppliers, clients and direct competitors, permits the present competitive strengths and weaknesses of the company. This is learning from past experiences.

The two aforementioned analyses are a great help, in the formulation of strategies for the enterprise because they permit to grasp the real possibilities or capabilities of the enterprise, and, thus formulate objectives and policies necessary it strategically. The above paragraph outlines the strategic profile in accordance with the way the enterprise fixes the boundaries of the business, defines competitive positioning and enunciates the positioning based on the environmental conditions. "

The strategic profile stipulates the variables the enterprise considers essential to face competitiveness, on the one hand, and environmental conditions, on the other." Rueda (1991).

The next subject considers the organization from the inside and outside. The external analysis includes the surrounding environment, the industry the enterprise belongs to, and the inherent environmental conditions for it. The internal analysis define strategies, objectives and policies and both are used to expedite the setting up of the Strategic Plan.

a) Analysis of the environment

As it has been pointed out, lots of opportunities and threats lie in the environment. If they could be timely recognized, the organization would make better use of them. Opportunities and threats are easily identified or developed once the industry and the environmental structure influencing conditions have been thoroughly analyzed. Finally, a strategy real value is to permit the enterprise to face threats, and identify and use opportunities to advantage.

1) Analysis of the Industry

An industry is made up of a group of enterprises competing in the production or selling of products or services. According to Arthur D'Little, "the corporate analysis must be based on the opportunities offered by the industry to all participants and the threats they have to cope with. This is possible through the portfolio models which intend

to measure concentration, maturity, and attractiveness of the industry." A summary of these analysis is shown in Fig.32.

The analysis of concentration determines the degree of difficulty to compete in the industry. Some of the factors to be considered are: the accessing barriers to the market of that industry, relationships with suppliers of raw materials, and the industry customers or clients, direct competitiveness of enterprises member of the industry, economies of scale, transportation costs, market needs, product exclusiveness, existing trade marks, cycle of inventories and their costs, market share, kinds of management and channels for distribution.

The **analysis of maturity** helps to determine the positioning of the industry. Some aspects worth considering are growth of the industry through time, grow rate, potentiality, lines of established products, alternation of members belonging to that specific industry, stability of market share, fair trade, easement of access to industry, and role and maturity of the technology employed by the industry.

Finally, the analysis of attractiveness determines the potentiality for profits obtained in that particular industry. This analysis comprehends the industry relative size present and future, the tendencies towards concentration of the market, external forces, and rivalry among its different members.

INDUSTRY ANALYSIS

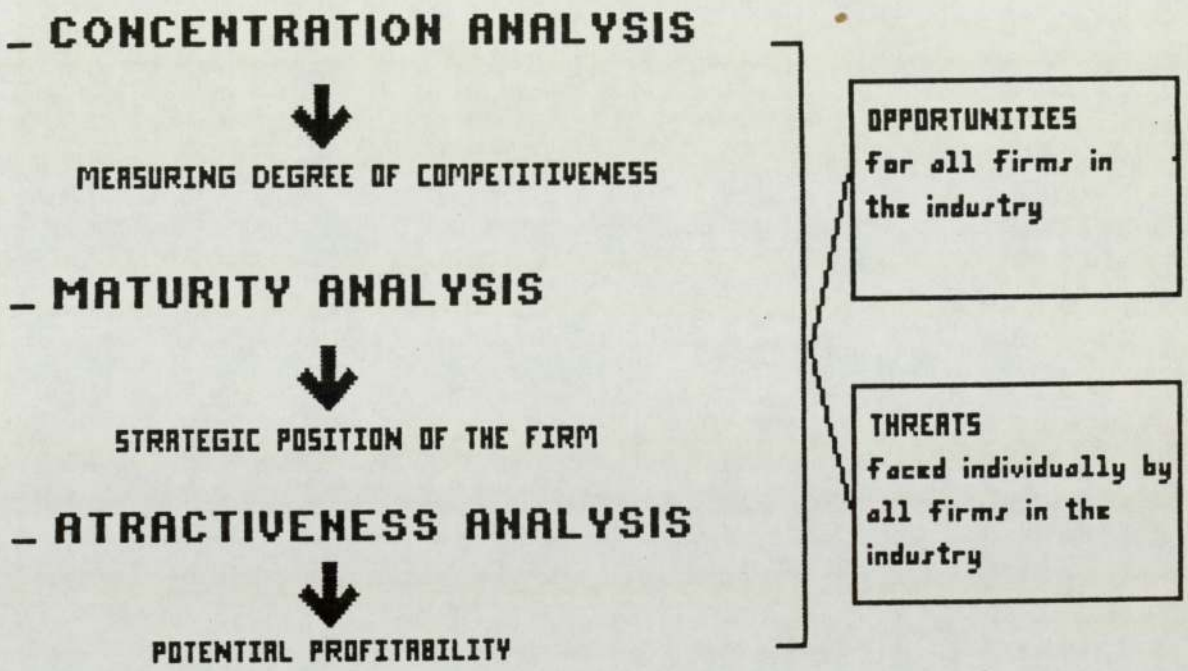


FIG. 32

2) Environmental conditions

The characteristics of the environment that may have strongly influenced the industry in a positive or negative way (opportunities and threats) may have been the national and international economic events (rise and fall of supply and demand, economic growth, economic cyclic activity, price fluctuations of national products in external markets affecting the economic cycle); political and social events (different attitudes and priorities taken up by society improving the protection of the ecological system, the consumer, schooling and health system, etc.), business regulations steps taken by the government (to decrease economic concentration, control pricing, protect the consumer, regulate tax income, etc.), and technological conditions (developments in electronics, materials, sources of energy, physical activities mechanization, better understanding and control of life, mechanization of processes, etc).

b) Internal analysis of the organization

A clear definition of a Plan by the executives should be taken for granted before analyzing the situation of the company. The Plan must specify and consider accomplishment of the enterprise in a predetermined extent of time, through prioritizing products or services, markets to be looked for and, finally, allocation of resources plus all necessary and specific plans to make the Strategic Plan workable.

The general context of strategic management has been enriched by such a

category of concepts necessary to consolidate the terms used so far. The developed managerial language (jargon) is not very accurate. Each author, analyst, or executive adopts his/her own definitions of strategies, objectives, and policies to be used in the enterprise. Therefore, everybody should speak the same language to expedite communication. This research will consider the following meaning for each term employed in the definition of strategic planning.

STRATEGY: An orderly or systematic unit of objectives, policies and programs of action that, starting from the reality of the enterprises today, determines what it could be like in a specific future. The word strategy has a competitive connotation.

A relevant question to identify strategies would be: What alternative should be chosen to accomplish or fulfil the mission?

OBJECTIVE: Goals the enterprise must fulfil. Objectives are not always explicit since, due to a permanent evolution, they become rapidly obsolete.

Understanding the full extent of the enterprise provides a reliable framework used as a guideline to think and behave while a decision is being taken. Therefore, in obtaining objectives, the important question is to determine: What should be accomplished in the organization?

POLICIES: They are made up of values, criteria, and necessary constrains to carry out objectives. Policies are also an understanding or

guideline that permits thinking and behaving when a decision is being taken. Policies generally are defined so that an area could attain objectives. The relevant question is: Which rules would be operating in their accomplishment?

PLAN: The whole program of actions and development of resources to reach objectives. It is defined as the final results that must be accomplished. They can be reached by using Stability Indicators as measuring pattern. The obvious question would be: How much and how far should resources be developed to be at one's disposal and ready to make one's will?

After this definition of terms, to be used throughout this paper, the organization will be analyzed from an internal point of view.
At this point, it is important to analyze internal **strengths** and **weaknesses** the enterprise has.

For the Plan to be developed, it is a pre-requisite that strategies, objectives and policies at corporate level are fulfilled. Although, this demands the corporation to be segmented in Strategical Business Units at different levels of recursion. Therefore, each SBU's should develop, autonomously, strategies and objectives to be a part of an integrated system in attained strategies and corporate objectives.

The organizational behaviour is the function of an effective transformation of strategies, objectives and policies in accordance with the operational capacity of each recursion level. "An objective

independent from a plan, a control system, or an executor is not an objective but an intention. An operative objective must therefore depend on plan, control and executor". Rueda (1991).

The objectives decomposition principle has important implications in the process of monitoring and control process. In the organization, objectives are formulated according to available resources, then adjusted through different recursion levels by means of a continuous feedback process. Objectives segregate or decompose in sub-objectives depending on the level of complexity they have been formulated Fig.33. It is obvious that objectives at a certain level of recursion are the function of objectives at a lower level of recursion and vice versa, thus providing an aggregation-segregation tool. A plan for a specific level of the organization could be an objective for a lower level.

Once strategies and objectives are established, at corporate level, into different Business Units, they could not be simply added in a mechanical way to obtain the strategies and objectives for the corporation. Therefore, correct identification of completely autonomous recursion levels helps to develop a better Strategic Plan at corporate level. The whole idea in formulating corporate objectives is to determine those whose sole purpose is to guarantee survival and growth for the enterprise. As soon as they are defined, they must be segregated from the other SBU's and recursion levels.

The Plan should be formulated so that its evaluation would permit a strategical formulation of it for the next few years. The evaluation

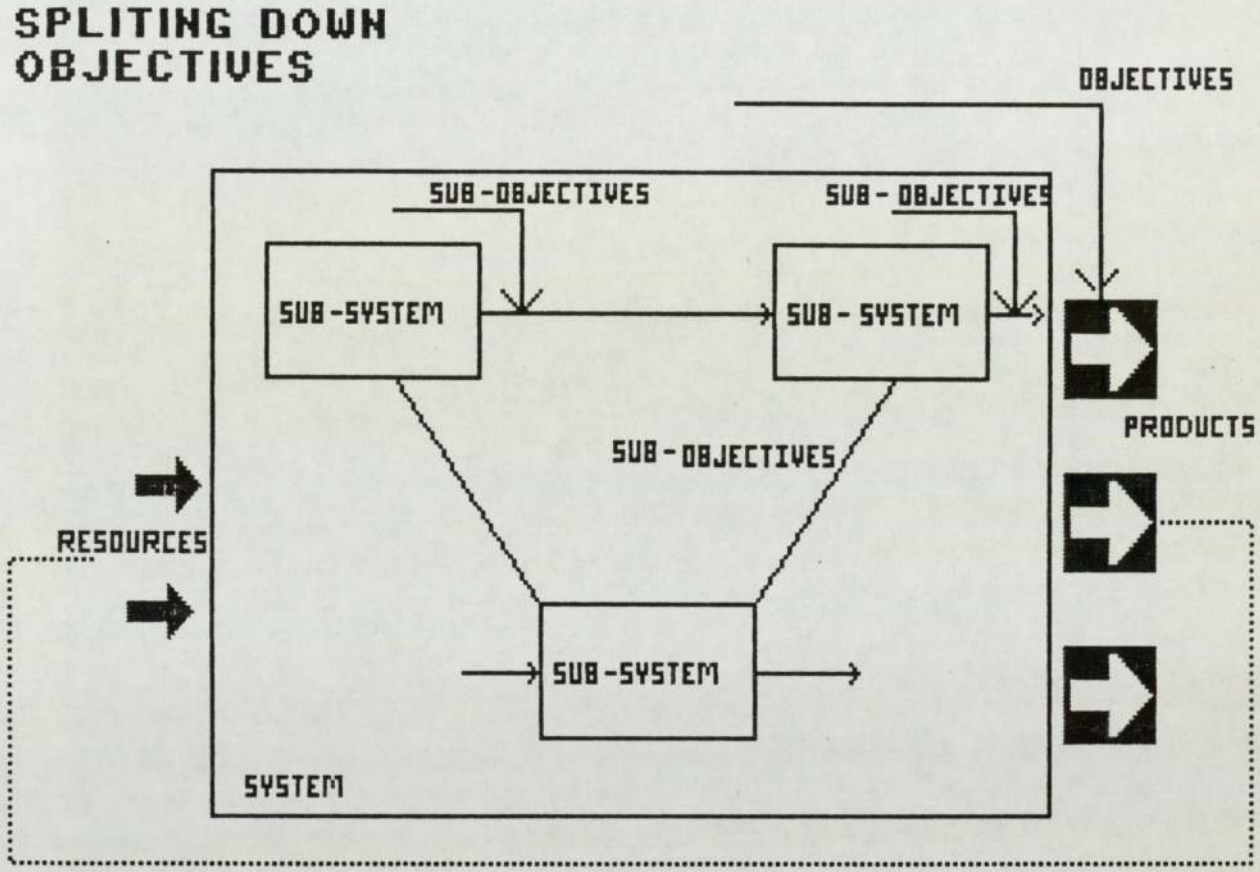

SPLITING DOWN
OBJECTIVES
OBJECTIVES
SUB-OBJECTIVES
SUB-OBJECTIVES
SUB-SYSTEM
SUB-SYSTEM
PRODUCTS
SUB-OBJECTIVES
RESOURCES
SUB-SYSTEM
SYSTEM

FIG. 33

facilitates a strategic forecast, formulates strategic options to obtain a strategic decision and designs a new profile as soon as internal and external analysis are compatible.

3b. Carbocol: Practical Case

The purpose of this item is to offer a detailed discussion of the applicability of the Strategic Planning Methodology to Carbocol as practical case, the focus will be firstly centred on an external and then an internal analysis of the organization as a complete entity.

a) Analysis of the environment

This title will outline factors comprised by the coal industry or sector Carbocol belongs to.

1) Analysis of world coal industry

The forces in the energy market are diverse in origin. The future movement of some is calculable, except for judgments about interactions between demand and supply.

"The real revolution has been the relentless growth in using electricity, intensively, in all the economies of the underdeveloped, in the process of being developed and over developed countries in the world. The applicability of electricity to industry in the lapse of 20 years has been 2.5% cumulative yearly and shows no sign of slackening.

About 75% of all the steam coal produced in the world is now burnt at power stations and this combustible is the biggest source of electricity - 40 % of the world's total. Power stations now dominate the energy business in the whole world - they process nearly 40% of the primary energy. Coal is 70% of the cost of running a coalfired power station and 30% the cost of producing cement. Let's contrast this with the metallurgic industry where steel is only 10%.

There is indeed a great deal to be done in the market for steam coal to reach its potential in the future. The world's coal industries need to act quickly, robustly and publicly. If they do not and they concentrate on doing what comes naturally- pushing each other around but still in the same bed, their case will go by default and with it the prospect of a stable, healthy and expanding future for steam coal which if they act promptly and decisively will be our future." Edwards M.J. (1989).

It is believed that in the medium term, nuclear energy will be too expensive both economically and socially to compete with coal. There are very attractive markets both in Europe as well as in Eastern Canada for coal. Using coal from North Cerrejon Coal Project in high furnaces (kilns) would mean the opening of markets in the Far East and Europe in steel and iron metallurgy.

The better a market is understood, the more effective the resources employed to win it will be. For the industrial market, this means splitting fuel use according to site and appliance; analyzing the economics of having to switch to coal, and also bearing in mind how coal

is approached by potential users.

1a.) Growth of Coal Industry

The following is an analysis of coal growth starting in 1986 covering the present as well as the near future.

The coal export supply grew 26.9 million tons between 1986-1987 (An increment of 21% a year) and was expected to increase 15 million tons more in 1988 if the present difficulties were surmounted, miners strikes in Australia, and the need for a washing plant as well as an improved domestic transport in China.

The expansion of the exportable supply from 1988 to 1992 will be 44.3 million tons: Australia with 11.5 million tons, China with 11 million tons, and Colombia with 5.2 million tons. Poland, on the other hand, will see its possibilities of enlarging its share in the international market quite limited due to internal consumption, the treaties with the Soviet block, and difficulties for mining expansions.

Although South Africa will continue as the number two supplier in 1992 (22.2% share) in the world, the allocation of its volumes will depend on the attitude of importing countries vis-a-vis Apartheid. China has become an important coal exporter and has been increasing its volume with more aggressive exporting. Nevertheless, its percentage

share during the coming years will depend on the capability to develop its export infra- structure and its capacity to fulfil coal deliveries to final consumers.

The U.S. will surely maintain and likely increase its base supply position in steam coal. " Our national coal association's economics committee has recently forecast export gains from 1987 actual levels to the year 2000 of 27% for metallurgical and 150% for steam coal, both of which equal a 62% total increase.

Like many U. S. industries, Colombian coal industry became aware during this decade, that its competition is no longer only among the American producers. This competition is global and must be faced as such head on. Although late in coming, this realization is clear now and should tend to support continuing productivity gains." Morton J. (1989)

Colombia will continue supplying the international steam coal market and will increase its share from 1987 to 1992 from 6.8% to 8%, thus becoming little by little a stronger exporter. Australia is the major producer country competing with Colombia for the Far East market and its competitiveness as a supplier in Europe will rely basically on the future development of freights, as well as the improvement of internal labour relationships.

As new suppliers for the international markets in 1992 and depending on their ability to create an export infrastructure we find Venezuela with

a volume of 2.5 million tons (Carbozulia project) and Indonesia with a volume of 1.5 million tons (Kaltim Prima and Parambaham projects). Both producers offer excellent quality, low cost coals, the political will to export, and a long term view of the attractiveness of international coal supply.

The new exporters could be shipping about 65 million tons of steam coal by 1995 and, in addition, there will continue to be increasing investment in areas with an already established infrastructure. This is a considerable amount of coal to be absorbed by the market in a relatively short period of time, so although substantial demand growth is expected, new supply capability is joining existing production at a similar rate.

1b.) Perspectives for present and future steam coal demand

Present demands following actual needs for the coal industry, mainly in Europe and the Far East are as follows:

Steam coal world imports increased in 26.9 million tons between 1986-87, representing an increase of 21.8% per year, with a total of 150 million tons during 1987. During 1988, exports almost reached 10 million tons worldwide. For 1989 an important increase of 18.5 million tons in the import world market was foreseen. Europe will show an increasing of 9 million tons while the Far East only 7.9 million tons.

A major increment, between 1990-1992, in coal imports in both the

Mediterranean and Far East, in relation to North and Central Europe, is expected due to the concentration of new power plants which will become active during that period.

The Mediterranean shows an ever increasing demand of steam coal because of the expansion in the generation of electric power mainly in Italy, Portugal, and Spain.

The Far East has shown an ever accelerating industrial development, mainly in Japan, Hong Kong, Korea, and Taiwan, forcing them to a larger consumption of energy and particularly coal for obvious reasons. This situation is expected to be, if not growing, at least stable.

Additionally, the market has been experimenting new consumption due to the substitution of iron and steel metallurgy coal for semi-coke coals (cheaper prices) up to permissible technical limits. This simple fact represents a tremendous additional demand for steam coal worldwide. Also, other industries have adjusted to hyper-capacity: such as the tanker and chemical industries and oil refiners have tackled problems not dissimilar to those faced by the coal activity.

2) Analysis of the Coal Sector in Colombia

2a.) Mining projects.

There are reserves of excellent thermic and metallurgical coal in Colombia. As the country is strategically located, in relation to the world export market, these reserves are economically viable and can be developed by private investors as far as markets accept new addition to world supply.

Deposits are characterized by their multiple seams and are located both in plains and mountainous terrains. Most of it in basins of less than 30 degrees, and part in vertical mountain ridges.

Carbocol, in order to expedite evolution of coal projects, has divided the country into four regions:

-The **Atlantic Coast Region** includes all the departments along this coast, but excludes the Cerrejon area. In this zone, two areas are being studied:

-La Loma, El Paso and El Descanso, in the department of El Cesar.

-Alto San Jorge and San Pedro Ure, in the department of Cordoba.

-The **Central Region** includes the following departments: Cundinamarca, Boyacá, Santander and Norte de Santander. The studies being developed in this zone are:

-Tasajero, in Norte de Santander.

-Suesca, Villapinzon, and Ventaquemada in Boyaca-Cundinamarca area.

-San Vicente de Chuquri in Santander.

-The **Western Region** includes the Departments of Antioquia, Valle, and

Cauca. The following projects are being developed there:

-Amaga, Venecia-Bolombolo, in Antioquia.

-Inguito, and El Tambo, in Cauca.

-The **Cerrejon Region** is located in the department of La Guajira, in northern Colombia. It is a long and narrow depression, enclosed by the Sierra Nevada of Santa Marta on the west and the Serrania del Perija on the east. The deposit extends approximately 50 kms along the Rancheria River and for purposes of exploration and exploitation it was divided into three areas: North, Central, and South Zones.

- Signed contracts

The most important contracts which have been signed by Carbocol for the exploitation stage are Central, North Cerrejon, La Loma and Calenturitas Coal Projects. These projects, as well as other less important ones, are being promoted for the twin goals of increasing production of coal and rationalizing domestic consumption of both steam and metallurgic (coking) coal.

Until 1982, the annual coal production was 4.7 million tons and came from small and medium underground mines intended only for internal consumption. In that same year, the exploitation of open coal mines began in Central Cerrejon Zone (followed sometime later by North Cerrejon Zone).

There are other projects under study for feasibility that include El Descanso, La Jagua, San Luis, San Jorge and Antracita. Carbocol is

currently trying to encourage private investors to perform the exploration and exploitation on these projects. It was in the decade of the 80's, with mass coal production and the discovery of important deposits, that large investments were made to create transport and harbouring facilities to export coal.

2b.) Colombian coal market situation

The decade of the 80's marked an accelerated change in the processes of coal production in Colombia, by making the country growing and trustworthy in the international market. For this reason, lots of new projects were developed, increasing their productivity according to modern mining technology because it changed from traditional mining to a transitional technological stage.

Colombia, with an export of 1.3 millions tons, entered the international market in 1982. The other 80% of total production was consumed internally. However, the domestic market for solid fuel (steam coal) has declined in recent years in the face of intense competition from alternative fuels, e.g. natural gas.

In 1988, production reached 15.0 million tons, 9.0 million of which came from El Cerrejon mines and 6.0 million tons from approximately 1.200 small and medium size mines from other mines currently in exploitation in other parts of the country. At present, a larger percentage of the coal is being exported. The goal for the year 2000 is to reach a production of 40 to 60 million tons, 80% will be exportable. This is

how the country basing its domestic consumption on gas is increasing coal export competing for the world market.

Up to the present, Intercor and Carbocol have sold 50.9 million tons for the time between 1982 and 1992. Carbocol has supplied 25.1 million tons which is 49.3% of the total. Intercor has sold 25.7 million tons of which 52.3% (that is, 13.5 million) belongs to the contract signed by Intercor and Elsam (Denmark).

From the beginning, the exploitation of Cerrejon in 1982, up to May 31 1988, Carbocol (from Central and North Cerrejon), exported 19.9 million tons in 310 shipments. Of this total 10.7 belonged to Carbocol alone, that is about 67.7% of the shipments. The production for 1989 was 6.3 million tons for Carbocol alone.

The financing effort made by the country to structure a modern coal sector was rewarded by foreign exchange and regional development. "From the 80's decade, Colombia gets the satisfaction of having being able to capitalize the great opportunities coal offered to improve its economic structure. This means that the country has not only a new pushing sector but it has also involved it in a real long term promising perspective. This success obtained under stressing conditions, being new in a market competing with low prices, is encouraging to look forward to the 90's decade optimistically." quoted from The Colombian Coal Sector : Statistics 1980-1990.

For 1990-92 North Cerrejon expects to sell 45 million tons in the

international market. Carbocol plans to export 5.5 million tons, 65% for the European market and 24% for both Latin America and U.S.A. and the remaining 11% would be allocated in the Far East.

3) Analysis of the Coal Industry

Reliability and quality in dispatching coal made Colombia number four in the international steam coal trade. Coal is sold in all major energy market sectors although the characteristics and problems posed by the different markets may vary greatly.

Studies of market planning concern the match between both supply and demand for the different markets. The present assessments of what to do are based on a cautious view of the future. Carbocol has to assure its customers enough provision to cover all their conceivable needs.

An analysis of concentration, maturity and attractiveness of the coal sector comes below:

3a.) Analysis of concentration

This is an analysis of the main factors the industry concentrates and make competitiveness difficult in the coal sector:

-Market accessing barriers:

A colombian major related participation has been observed in analyzing

competitiveness although market accessing barriers have been present all the time. The main limitation of expanding the Colombian supply has been the internal infrastructure. Therefore, it is very important for Carbocol and Colombia to re- examine all necessary expansions to ease competition in the market.

-Economies of Scale:

Depending on a recent market growth and the mine production, it is important to take advantages from economies of scale in the installed infrastructure which minimizes costs concerning mines expansion, production and sales. Hill (1990) says: "Immediate gradual increments in the production capacity in both Cerrejons would be fast return investments to improve the cash flow."

-Transport Costs:

Colombia is advantageously located in relation to Europe, The U.S.A., other Latinamerican Countries and Japan. This location makes it possible to compete with sea freights.

Another advantage is the excellent location of coal mines regarding docks because it minimizes land transport costs. Nevertheless, the land transport for small miners is high. Besides, there is no infrastructure for railway and river transport. Any infrastructure of the kind would definitively lower costs.

-Market Needs:

"The present level of market development guarantees not only placing one

hundred percent of the planned production but also new exporting volumes." from Carbocol. Manual de Planeacion Estrategica (1990).

A deficit in supply for the international thermic coal market could be expected even with the foreseen production increments of exporting capacity. The future for metallurgic coal (coke) is uncertain in the international market in the medium and long term.

-Product Exclusiveness:

Carbocol is one of the main world coal suppliers of high quality thermic coal. Besides the growing importance of coking coal market, Carbocol has also been accepted as a highly qualified supplier.

-Inventory Cycles and Costs

"It has been found that the equilibrium point for the price of thermic coal in the market is $ U.S. 34 a ton." Hill (1990).

That Carbocol makes profits under the present levels of production and costs is not likely, the only way of making profits would be by reducing costs. This could be done through improving maintenance, keeping on with Central Cerrejón production, either by hiring miners operators or by means of sub-lease with North Cerrejon.

At present, costs for the North Zone Cerrejon Mine show an outstanding decrease because of a program for operating efficiency. If production in every mine could be improved, more coal is bound to be sold at more attractive prices.

3b.) Analysis of Maturity

Through this analysis, the position of the industry could be understood:

-Grow Rate:

"It is assumed that thermic coal international industry has come into maturity." Oficina de Planeación (1990).

M.J.Edwards comments (1989), "Everybody connected with thermic coal in the last 15 years ought to have made a good deal. This is the activity of coal enterprise that has experimented a complete growth that started the real revolution of energy business everywhere.

Revolutionary has been the inexorable growth of the electricity sector within every economy in the world, even if it is the underdeveloped, the one being developed or the most developed one."

-Industrial Potential:

By the year 2000 the participation of Colombia in the international thermic coal could reach 13%. The present operation rate comprehends only a 5% therefore, it is necessary to continue with an exploration program permitting to measure reserves in 20 years term.

-Established Product Lines:

Almost 91% of thermic shipped tons are "standard compliance", this standard includes, in general categories, a variation of high and low ashes.

At the beginning, when the exploitation phase began, it was possible to sell to every customer the product with the quality he wanted but this fact generated stocks of nearly 10 different products.

As coking coal is becoming one of the most attractive products in the U.S.A. market, Colombia has a great potential for it in the future.

-Easiness of Accessing the Market:

Carbocol has a good standing as a high quality coal supplier, and is likely to maintain this positioning, therefore its accessing the market has been eased.

-Role of Maturity and Technology:

There is a great difference in the technology used by the different mines in the country. Small and medium miners generate production without any technical or managerial developments, whilst North Zone Cerrejon uses the highest technology in the world obtained through technology transfer.

3c.) Analysis of attractiveness

The potential for profitability of coal industry could be determined through this analysis:

-Relative Size of Industry:

By 1991, an exporting production of 15 million tons per year from Central Cerrejon Zone is expected and by the year 2000 one of 40 to 60

million tons. Of this total, 25 million tons would be supplied by North Cerrejon Zone alone.

-Market Concentration Tendencies:

In recent years, risk was reduced through the strategy of having a great amount of customers although, due to the opportunities of placing a tremendous quantity of coal into just a few customers, has changed the strategy by concentrating every sale effort towards their satisfaction. At present only three major customers purchase 50% of sales and six the 75%. This strategy is not regarded as a problem since sales patterns are very slow, other producers have taken up the same strategies without incurring in major risks, besides Carbocol has sale contracts shared with Intercor.

Since most customers concentrate in the mediterranean and atlantic zones, it is advisable to attract more clients, in those zones, to guarantee market price competitiveness. Although in the short term the Colombian coal could seen attractive for the Japanese market, those customers would prefer U.S. coals due to the commercial balance if demand is increased.

The mexican pacific growing demand could be easily supplied by Panamaxes. Argentina and Brazil are attractive because of their need for high quality metallurgic coal and there low freights.
The market for the Caribbean and Central America zone, although small, is also interesting for Colombia.

-Rivalry:

Because of different costs for coal producers, Carbocol's projects are more favourable due to lower costs. Colombian coal with a low ash contain is advantageously competitive in Europe. Although it rivals with natural gas, there is a stable and ever growing demand of coal in the market.

4) Environmental conditions

There are lots of opportunities and threats in the environmental conditions worthwhile keeping in mind for the production and commercialization of coal:

4a.) Opportunities

1.- Advantageous location of Colombia: Nearness to Europe, México, the Caribbean, Brazil, and Argentina. Eventually, it could take away from the U.S.A. some of the Japanese market due to the Plan for Opening the Pacific Ocean.

2.- Government to government agreement facility.

3.- Great standing negotiations due to product excellent quality.

4b.) Threats

1.- Colombia is relatively new in the coal market

2.- Carbocol does not control North Cerrejón mine

3.- High financing costs

4.- Threat of substitute products

5.- New competitors threat

6.- Fear of investing in the country

7.- Difficulty in defining coal harbours because of ecological and political problems

8.- Both guerilla and drug traffic hinder foreign investment

9.- No infrastructure for railway and trucking

b) Internal Analysis of Carbocol

1) Strategies, Objectives and Policies

Determining strategies, objectives, and policies have become one ofthe most important items of external and internal relationships in the short, mid, and long term. The Plan is outlined in the framework for the methodology being proposed and the most interesting step for the methodology is identification and measurement of indicators. explained in detail in numerals d.) and e.) respectively.

Since objectives, strategies, policies, and goals are dynamic in time, it is vital to identify the most advantageous indicators in the evaluation of the Strategic Plan. In the end, stability or instability of indicators permits the adjustment and formulation of a new and dynamic Plan to better support whatever decision. Therefore it is essential to concentrate on measuring the organizational performance by determining the Stability Indicators to be gauged. Definition of objectives, strategies and policies for Carbocol as corporation and

Central Cerrejon as sample pilot are prior to determining Indicators.

1a.) Strategies and Objectives

1.- Secure immediate survival for Carbocol by:

a) creating a positive image of the company in the country

b) restructuring debt and capital

c) keeping a project data base of mining projects for taking decisions based on internal and external coal market

2.- Improve Investment Revenue by:

a) reaching a production rhythm of 15 million of tons per year in North Cerrejon Zone, minimal investment, starting 1991 (to attain this rhythm Carbocol ought to expand North Cerrejon production to 25 m.t.per y.

b) reducing production costs for the Operator and Carbocol

c) Employing to maximum the infrastructure both Cerrejons and whichever other projects

d) Keeping a portfolio of customers--five year term-- with high potential growth

e) Exporting coal from small miners to maintain a minimum 10% of penetration in the world market and conquer the mexican market

f) supplying reliable coal with stable quality, at competitive price an excellent service to customer according to market regulations.

An attainment of 40 to 60 million tons for the year 2000 is expected, 80% would be sold at long term contract in the international market --to chosen customers. An amount of 25 million tons of this total would come out of the North Cerrejon Zone.

3- Maximize the ratio Benefit/Cost in the allocation of resources by:

a) creating and managing reliable systems for collecting taxes on coal production

b) legalizing mines with high potential growth to cover 70% of the medium and small miners production and by also trying to improve managerial development for such mines.

1b.) Policies

- Commercial policy

The strategy for marketing and commercialization must be developed by the following policies:

1. Maximize return by:

-developing markets to guarantee better prices.

-competing with producers at lower prices whenever necessary.

-keeping diversification in all different areas of the market.

2.- Control the market by:

-directing negotiation with final consumers.

-using intermediaries only when there is no other alternative and whenever the final destiny of coal is known.

-providing after-sale services at a technical-commercial level.

-evaluating and restructuring the present network of Carbocol agents abroad that could be used as a basis for certain market areas.

-establishing Carbocol Commercial Offices abroad to guarantee presence and control of the market.

3.- Minimize commercial risks and diversify markets by:

-allocating an amount not exceeding more than 10% of production to any given country.

-covering the different market segments to enlarge participation by selling coal to the whole industrial sector.

-keeping defensively the different areas of the market it already has and furthering development in both Latin America and the Far East.

-orienting efforts toward customers who present no technical, logistical, or financial disturbances.

4.-Attain commercial and financing stability by:

-negotiating long-term contracts with pre-established customers.

-committing, itself, in delivering volumes not reaching over

500.000 tons a year per customer, unless special circumstances are present.

-keeping an adequate coverage of the market.

5.-Offer customers a better service by:

-carrying out technical sales.

-offering Post-sales services at a technical-commercial level.

- Coal mining policy

The Colombian government has designed policies to develop coal mining by:

-encouraging private investors to perform the exploration and exploitation of mining projects.

-bidding and granting contracts directly, without any interference, to private investors, either from the country or abroad, to explore and produce coal.

-fulfilling direct contracts stipulations and acquired commitment as a guarantee for those intending to invest in the country.

- Accountable policies

For accounting purposes, the following situation should be understood:

-Carbocol exploits all the coal extracted from both Cerrejons and could, additionally, sell to or buy from Intercor to fulfil sales agreements

-the coal is billed in U.S. currency at FOB otherwise, the bill

must include freights and insurances.

-payment should not exceed 30 days upon receive

-the "OPERATOR" is in charge of processing the coal in Puerto Bolivar until shipment. Nevertheless any delays, assigned for whatever causes are assumed by Carbocol (owner of shipment) as sale expenses. Premiums for fast shipping are entered as non operational income.

2) Strengths and Weaknesses

2a) Strengths

- excellent coal quality
- advantageous price to compete in the market
- excellent coastal mine location
- variety of products: thermic and metallurgic (coke)

2b) Weaknesses

- high cost of mine preparation and development stage
- most exporting mines due not participate actively in exports
- lack of transport
- insufficiency of yards to store coal in the harbours
- no facilities to load ships
- no capital to define reserves, develop mine and washing plants
- lack of marketing programs
- aggressive unions

d. Identification of stability indicators

1d. The identification

The most appropriate stability indicators (SI) could be easily identified after having structured the organization. The SI are defined as quotient that filter information and then compare it with the specific characteristics of a pre-established process. They can express relationships of cause and effect among the raw materials participating in the process, in its transformation and in its results (end-product).

As far as the nature of interrelations of organizational processes is understood, the most appropriate indicators could be selected.

These SI's are of great help to evaluate the Strategic Plan becausethey detect what should be measured in a pre-established situation. Success or failure could be measured through Stability Indicators and the result of such measurement permit to improve the Plan through correctly actions and foster, among executives, a dialogue to set it off. On the other hand, if each organizational process could be guaranteed an optimum of resources and rationalization of internal transformation, as well as their final result, the identified indicators will help to obtain a better measuring of the organization's dynamic. (By using the survey described in appendix C, the identification of indicators would be expedite.)

The success of the Plan depends, basically, on an exhaustive study of

the internal and external Stability Indicators of the enterprise. The study furnishes accurate measurement of the Plan at any given moment that may influence in the structuring aspects of behaviour and, finally, facilitate the creation of a much better future for the enterprise.

In the process of definition, the important thing is to only detect the essential ones and select the most appropriate for an optimum definition of Cost/Bene. A constant evaluation of Indicators permit to identify critical areas, activities or operations, without neglecting that organizational behaviour is a direct function of effective transformation of strategies, objectives and policies having place at each recursion level.

The mechanisms of control, to follow up the plans, could be successful only if the Stability Indicators, used for measuring strategies, have been correctly evaluated. For this reason, executives should be alert in the compilation of facts that could cause an impact in attaining the pre-set plans and whatever analysis that may be necessary.

The behaviour of indicators in time permits to have an overview of present and future health of the organization as well as to modify strategies and objectives in the light of recent information for the indicators to plan through tendencies and control by exceptions according to the needs of their behaviour.

A System of Indicators is necessary to re-evaluate not only the Plan but also the indicators themselves as soon as any result has been obtained.

In this way indicators could be used in the diagnosis of future plans. It is also possible, through simulation, to adjust the stability criteria that more closely fit the real situation.

This Indicator System permits to manage strategies, objectives, policies and plans for the organization because they have criteria of stability. Formulation of Strategic Plan is based on the behaviour of indicators, considered stable by the organization. Instabilities would make impossible the outlining of a good strategic plan because of the difficulty for designing and evaluating excellent indicators that may provide a good result of measurements to be used by managers.

To evaluate a strategy in isolation is relatively easy, but to evaluate its contribution to success or failure, in accordance with their impact on the organization as a complete entity, is quite difficult.

For the implementation of each strategy, there is a strong need for resources in order to make operative the required processes. People, materials, machinery, and money are meant as resources necessary to develop strategies. The defined indicators must furnish an evaluation system to detect instabilities and stabilities emerging from the behaviour of resources used. This is the reason why every indicator, good for reducing risk and cost, increase income, detect problems, protect assets, quantify and correct mistakes, should be identified.

Identification of indicators must follow some well structure steps permitting to recognize why some indicators are more important than

others for a given type of organization at a given moment. The systemic approach and the Viable System Model facilitate the identification of essential filters and amplifiers that guarantee to be the most important of all those related to a given situation.

Indicators are classified, according to their degree of importance, in terms of **efficiency, efficacy and effectiveness.** By importance is meant the risk their omission could cost the enterprise, either internally or in relation to the environment it is located. An inaccuracy in the definition of indicators could mean problems difficult to control in their interrelation.

A description of the importance of having filters and amplifiers to permit a correct definition of indicators, together with the criteria used for classifying them in terms of efficiency, efficacy, and effectiveness and other aspects related to their interrelation comes next.

a) Need for filters and amplifiers in the definition of Stability Indicators

Each executive must solve the emerging problems, either in detail or globally, from the medium and low level of the organization. The executives in charge need an indicator showing the day to day information for their decision taking (detail); those in charge of the organization as a whole entity, need a continuous response from all over the organization (globally) to expedite their decision taking. This

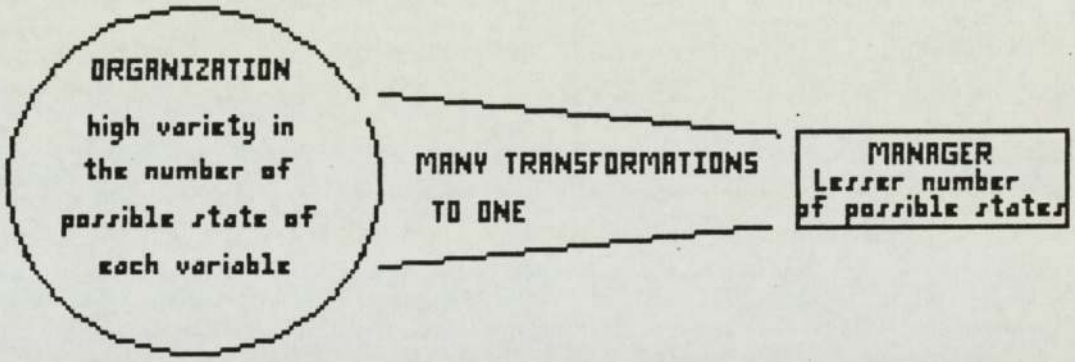
means, there is an enormous amount of event that do not have to reach the high level for solution.

It is inconceivable that every instability, present in the organizational situation, be transmitted directly to the policy function. As it was observed at the moment of discussing the Viable System Model, the intelligence function demands acknowledging external changes and the control function the internal ones. The use of the Viable System Model is a paramount step towards identification of indicators. The VSM provides each level of recursion a tremendous help for filtering and amplifying information from one level to the other.

The identification of filters and amplifiers expedite definition of Stability Indicators. For this reason, those that better reflect organizational complexity, stressing variables that could be monitored and controlled by filters and amplifiers, should be first defined.

Because of a tremendous quantity of reports that go over the capacity of the executives to analyze information, it is nigh impossible for them to take decisions in a short and limited time. The analysts should, therefore, provide executives with detail analysis of information, they have previously examined, so, only the basic relevant facts will be known by high level executives.

Consequently, an information filtering process is necessary to obtain the identification of Stability Indicators (Fig.34). This filtering process should be done within the organization to better plan and



FILTERING PROCESS

FIG. 34

control it in order to obtain effective and adequate policies. The identification and design of the best Stability Indicators must permit filtering the information of processes by transforming many variables into one. The effectiveness of such filters depend on the relationships of the enterprises inherent complexity and the richness of variable interactions they are filtering.

Executives may not know everything taking place in the system they are responsible for because the complexity of the situation is sometimes too big to be grasped. This is why they must develop a mental model of such situation and strive constantly towards full comprehension.

The process demands information and it is obtained from the filters. The filtering process allows the variety of complexity to be rapidly recognized and interpreted by the executive. The Planning and Control functions must be well balanced so, none would be more complex than the other. These two functions verify the problems arising within the boundaries of the organization in such a way that, only those aspects having passed the filtering process, could reach a higher level.

The executive will be completely sure that he has taken the best decision only if the enterprise disposes of an adapting mechanism that could be used by every executive. A consensus on common objectives is difficult for any organization. An amplifying process is required to implant decision (Fig.35). Such process demands executives to be capable to respond, autonomously, to the variety of problems that may emerge from mid and low levels within the organization. Once they have

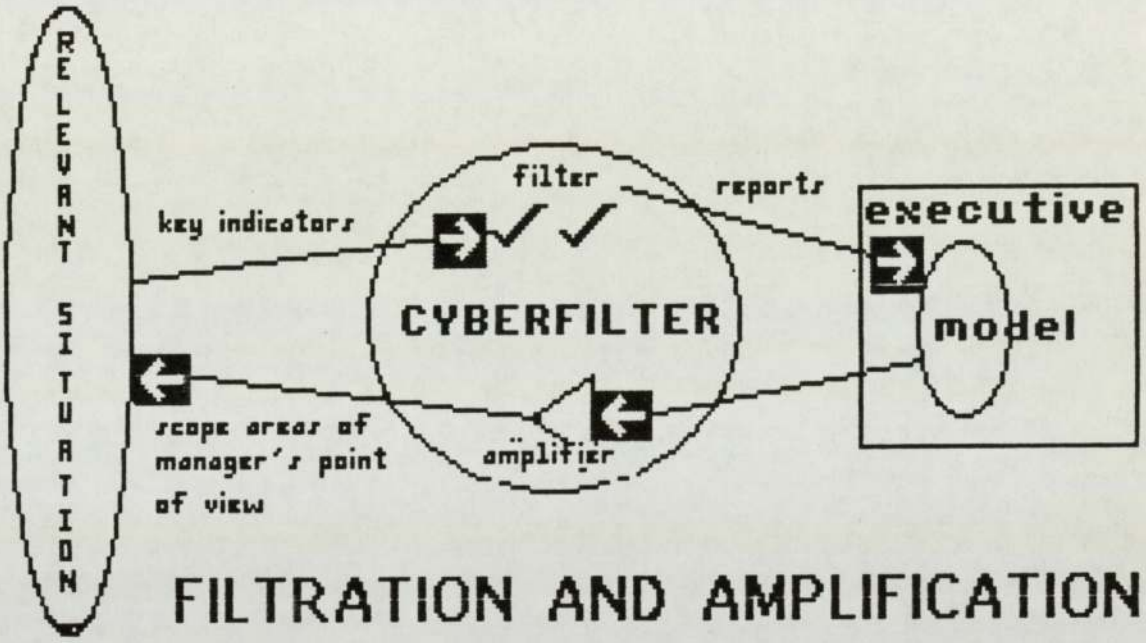

RELEVANT SITUATION
key indicators
filter
reports
executive
CYBERFILTER
model
scope areas of manager's point of view
amplifier
FILTRATION AND AMPLIFICATION

FIG. 35

decided upon organizational policies improvements, they could transmit their decisions to places or levels where the problems originated. There, they would be analyzed in greater detail and then re-transmitted to a lower level to be implemented (the executive in charge of implementation will be responsible of the whole process). The environmental complexity could be handled with the greater flexibility in the control of uncertainty, ever present in the implementation process of organization's policies.

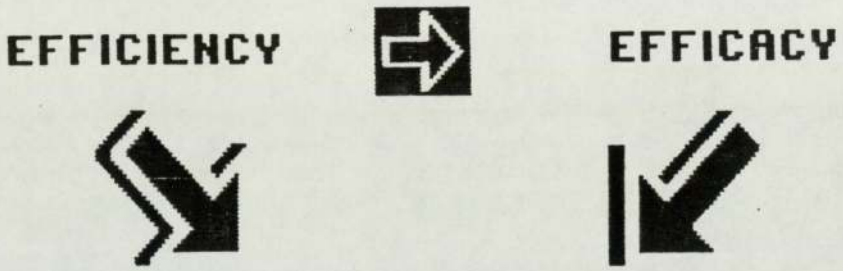
Through information filtering and amplifying processes, the VSM identifies Stability Indicators and, according to the way such an information is used, the organizational effectiveness could be attained.

b) Classification of Indicators in terms of Efficiency, Efficacy and Effectiveness

By measuring their quality, the productivity of processes could be increased. The use of resources, rationality of processes, and attainment of results, in accordance with relevant factors, should be verified for this purpose. The dynamic behaviour of the organization as a whole, and consequently the continuous evaluation of Stability Indicators are based on the criteria of efficiency, efficacy, and effectiveness (Fig.36).

Efficiency is used to analyze performance within the enterprise and depends on how well resources (human, financing, technological, information, etc.) are being employed in the organization. It gives

INTEGRATION OF EFFICIENCY, EFFICACY AND EFFECTIVENESS



TOTAL EFFECTIVENESS

FIG.36

analysis criteria about quality of the different internal processes while observing the organizational behaviour. The organization must be considered as a group of independent processes whose sole objective is to attain maximum efficiency in their results. Efficiency is indicative of whether what is been done is correct and at lower cost. The link between opportunities and means becomes the operational managerial responsibility through its resources and comes to be the major determiner of organizational efficiency. Consequently, the relationships between the internal process and the necessary resources to carry out such a process are very important and constitute a prime measuring factor to be always kept in mind.

It is important that any existing bottleneck will be removed to attain a maximum of efficiency. Therefore, it can conclude that indicators of efficiency evaluate important characteristics of the operational work in the areas that are parts of the lower recursion levels of the organization.

To make management efficient at this level of recursion, it is necessary to think of plans, their enforcement, and the analysis of their results in an integrated, efficient, and coherent manner. All the organizational units must be integrated in a continuous and permanent action allowing them to maintain an internal stability and adapt to a changing environment. The best way to do this, would be through an "Open dialogue" among executives on strategies defining priorities to adapt and react in front of future changes. If there is a correspondence between opportunities and necessary resources to carry it

out, it would be the sole responsibility of the operational executives, who, through their functions and actions, constitute a prime determiner to analyze the efficiency of the organization.

If executives happen to have the slightest idea of how their organizational units work, they ought to have a monitoring system to allow them to know the behaviour of the variables as soon as something important shows up.

Efficacy is a measurement used to analyze the behaviour of the organization in relation to the environment and shows whether the organization is doing what is expected with its environment. In other words if the expected results are being achieved with the desired accuracy in the most suitable time.

The organization is represented as an open system looking for effective goals to adapt to the ever changing environment. This research studies the organization as a system trying to reach equilibrium or stability. Any disturbance that may attempt to make the system lose balance will be offset by forces that try to re-establish it.

Efficacy is related directly to both corporate integration and operational coordination, therefore, it is understandable that it has respectively directional and functional characteristics. The way a company adapts itself to a complex environment and then manages it, may result in an increasing or lowering of performance efficacy. Indicators of efficacy are those indicating the result of all the organization

managerial action regarding what the environment would be demanding from it.

Effectiveness depends especially on the relationship between objectives and opportunities resulting from a strategical management characterized by the use of entrepreneurial tactics. This effectiveness criterion encloses efficiency and efficacy criteria to measure the corporate productivity. A successful evolution of the organization depends, simultaneously, on efficiency and efficacy.

The interrelation of efficiency and efficacy indicators could be understood through indicators of effectiveness, every organizational unit must show up both. The more these indicators help to achieve organizational objectives, the more effective they would be. Besides, these effectiveness indicators show how any variation of efficiency indicators affect those of efficacy.

If the final results help to fulfil the organizational goals, the enterprise is considered to be effective. Basically, effectiveness depends on the relationship that must exist between objectives and the opportunities offered so that the corporate strategies are carried out completely. Although participant members will have to share their points of view to reach, with own criteria, expected results in consensus.

As far as organizational results are attained, according to pre-set objectives, adapted to the requirements of the environment, the

enterprise could be consider effective. First of all, the level of efficiency and optimum efficacy prevailing in the enterprise should be systematically identified to achieve total effectiveness (Fig.37). Organizational effectiveness depends on its feasibility to maintain its viability in fulfilling its organizational objectives in the different recursion levels.

c) Interrelation of Indicators

As it was pointed out before, Indicators must be designed for different organizational activities at different stages of aggregation. Establishing relationships, for each indicator with the others, implies an orientation towards measuring efficiency, efficacy, and effectiveness. The consequence of the behaviour of not only one specific indicator but also the relationships between the one and the other or others (Synergy) are present in the performance of organization. Such segregation makes possible a natural design of behaviour measurement at different levels since an organization could be defined as a close circuit of indicators relationship.

Indicators should be identified for the different organizational activities, at different levels of recursion, and for different sub-systems at a pre-established recursion level. It is obvious that its design must include the diverse levels of aggregation.

Aggregation is a function depending on every level the organization may have. Indicators of efficiency, efficacy, and effectiveness have

EFFICIENCY, EFFICACY AND EFFECTIVENESS IN THE ORGANIZATIONS

GENERAL CONTEXT

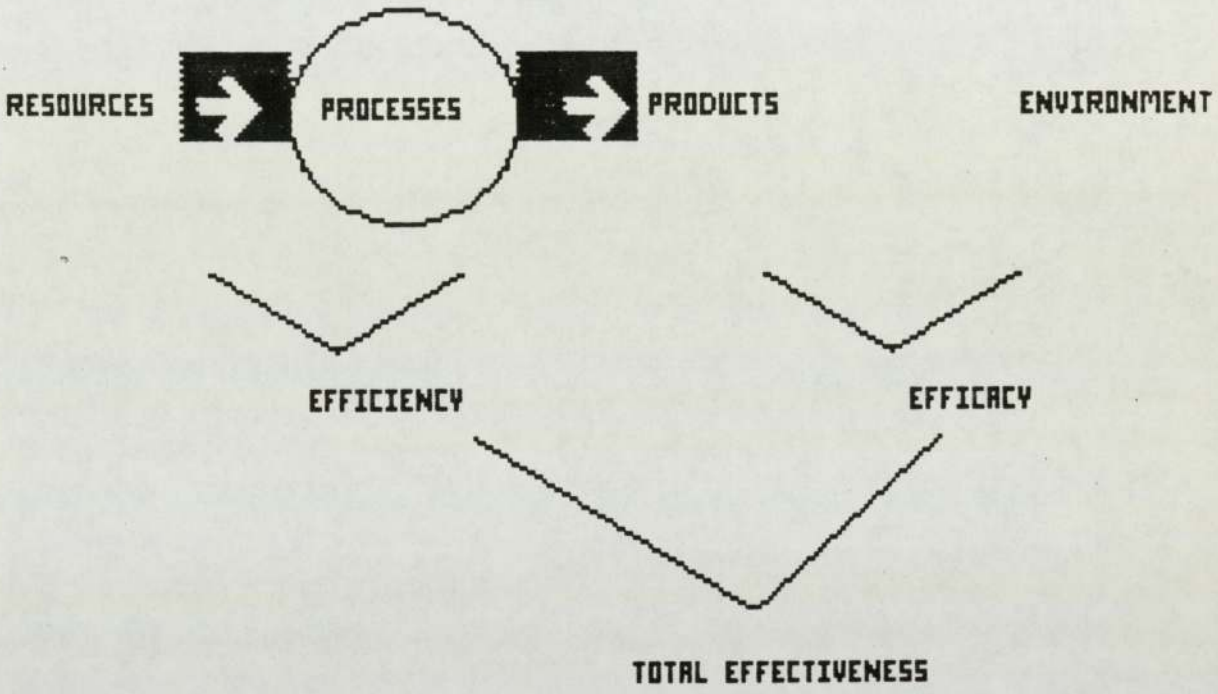


FIG. 37

different components of aggregation, they belong to different recursion levels in the organization.

While efficiency indicators belong to different cycles and in the internal processes of the enterprise in charge of operational managers, efficacy indicators relate to processes interconnected, at the medium level of recursion, with the environment are in charge of medium management, and top management is in charge of effectiveness indicators.

Organization must step from an emphasis on efficiency (rationalization of resources) to an emphasis in efficacy (timely achievement of results) keeping a dynamic relationship between products and the needs of the environment. Nowadays, this processing requires more efficient managerial methods to help maintain underhand the number of variables participating in the organization dynamics.

In applying techniques for measuring, periodically, the organizational dynamic, it should be analyzed whether products behave in accordance with the requirements of the environment.

After having obtained an identification for each specific Indicator, they could be measured integrally (further explanation under numeral e.). Together they furnish the measure of the state of the organizational units in time.

Measurements used to identify critical flows and bottlenecks provide executives with planning and control actions to improve the behaviour of

any managerial situation by means of follow up and control mechanisms.

Measuring indicators at corporate level follows a logic of systemic interrelations permitting each sub-system to know the exceptional changes connected with its behaviour and the changes that may have taken place in the behaviour of others sub- systems that could affect its own activity.

2d. Carbocol: Practical case

This process was carried out with a group of officers representing Central Cerrejon and every area in Carbocol, related to the project, under the direction of the researcher, who behave as a facilitating agent in the identification of Indicators and their measuring patterns. The survey in Appendix C was used throughout the process.

As it was explained before, there is a number of Indicators used to measure efficiency, others could be weighed only in relation to efficacy and others with total effectiveness. Every managerial unit must, nevertheless, be evaluated in terms of efficiency, efficacy and effectiveness.

a) Identification of Stability Indicators for Central Zone

Definition of significative indicators for the Central Zone Project is something closely connected with identification of areas likely to present mistakes or irregularities. This makes it necessary to have

Indicators permitting to predict, prevent or detect such mistakes.

Carbocol's operational results as well as its financing situation at a given time are the consequence of a managing task that influences, directly, the results attained by Central Zone. This is why Carbocol should be studied integrally as a corporation and Central Zone as a Business Unit to justify most of the necessary internal and external Stability Indicators, that otherwise will have no logical explanation.

At present, the identified indicators cover a wide gamut of functions either in the company or the project, and are related to production, marketing, financing, socii-economic impact, etc,.

It could not be stated that the organization relies only on budgetary and financing indicators, nevertheless, being the financing area one of the outstanding problems in Carbocol, it is necessary to keep handy those indicators that permit to analyze continuously the financing situation of the company.

The Central Zone project is directly affected by, from the financing point of view, what happens in Carbocol as a corporation. The identification of adequate indicators requires a thorough analysis of the enterprise. The compilation, interpreting, comparing and studying financing states plus the operational data of Carbocol are basic for such an identification. Nevertheless, this research will deal merely with the final result of the analysis leading to calculation and interpretation of indicators, such as, percentages, rates and

tendencies, since they are used to evaluate the financing and operational performance of the company, and help executives, investors and debtors to take their relevant decisions.

The identification of Stability Indicators, in the financing context, is closely connected to identification of financing ratios. These ratios are quotients comparing the giving characteristics of a process (process is a financing analysis of the enterprise).

These indicators are useful to make sensibility analysis, examine relations of cause and effect among the different accounts of the financing analysis, their activities and their accrues. When dealing with measuring financing ratios in Carbocol, it is necessary to carry out a historic-statistical comparison of each ratio and the value of such a ratio with the values of other enterprises in the sector. In other words, such a comparison means that one sole financing ratio is no a sufficiently valid base for it to be applied.

The financing ratios that could be taken from financing statements could be varied, but here, the important thing is not the number of ratios,but a reduced amount that,once conveniently applied to the type of business the enterprise is carrying out, could furnish a thorough and meaningful analysis. Financing indicators of liquidity, leverage, activity and profitability will be the basic objects of concentration for the present study.

1) Efficiency measuring Stability Indicators

Stability Indicators for measuring the efficiency of the project furnish the criteria used to analyze the performance of Carbocol because they permit to determine whether the organization is doing correctly what should be done. The relationship between internal process and resources is very important in measuring efficiency. This indicators link opportunities and means through resources and products and become a factor that better determines the organization's efficiency.

Most of these indicators belong to the processes identified at the third level of recursion. Fig.38, depicts a summary of these indicators, related to each of the project operational phase. The Indicators, that have been identified for the exploitation phase of Central Cerrejon provide useful measurements to evaluate results regarding the mine operation, land transport, and harbouring that have been as stages of the exploitation phase.

PRODUCTIVITY

This indicator is used in mining activities and compares the mine real operation against the theoretical operation that could be affected by external factors. It would be quite convenient for the productivity measurement to be applied to every machine, required either by the mine for extraction of the mineral, land transport (trucks and railway including their maintenance), and others machines necessary to stack and ship the coal at the port, machinery maintenance including.

EFFICIENCY INDICATORS

MINE VARIABLES	INDICATOR (PER MACHINE)
PRODUCTIVITY	OPERATIONAL PRODUCTIVITY/ENVIRONMENTAL CONDITIONS FCTR.
AVAILABILITY	1 - MAINTENANCE FACTOR (FABRICATION REQUIREMENTS)
VULNERABILITY	AVAILABILITY / PRODUCTIVITY (WORK SITE)
NET CAPACITY	THEORETICAL CAPACITY / USEFULNESS INDEX
MACHINERY NEED	WORKING VOLUME/ NET CAPACITY
MACHINARY OPERATING COST	(FUEL, LUBRICANT, SPARE PART, TIRE TREADING SPEND PER HOUR)* COMMERCIAL PRICE
RAILROAD	365 OPERATION DAYS: 24 HOURS A DAY RETURN CYCLE 148 KM. WEIGHT PER WAGON 97 TONS. COAL MOVEMENTS 103 TONS PER WAGON LOAD RATE 8255 TON/HOUR. UNLOAD RATE 6000 TONS/HOUR.
PRODUCTIVITY	RAILROAD(TRANSPORT ROAD AND RAIL MAINTENANCE) LOCOMOTIVES (EXPORT TONS/ROUND TRIP HOUR)
AVAILABILITY	RAILROAD LOCOMOTIVES
PORT	365 OPERATION DAYS: 24 HOURS A DAY MAXIMUM SIZE OF SHIPS: SUPPLY MOORING 5 COAL MOORING 150 SHIP LOAD RATE 1000 TONS/HOUR
PRODUCTIVITY	STACKER RECLAIMER SHIP LOADER MOORING
SHIPPING DELAY	FORECAST SHIPPING TIME/ REAL SHIPPING TIME
LOADING RATE	CONTRACT LOADING RATE/ACTUAL LOADING RATE

FIG. 38

EFFICIENCY INDICATORS

LIQUIDITY RATIOS:	
CURRENT RATIO	TOTAL CURRENT ASSETS/TOTAL CURRENT LIABILITIES
WORKING CAPITAL	CURRENT ASSETS - CURRENT LIABILITIES
QUICK RATIO	(CASH & EQUIVALENT & MARKETABLE SECURITIES & ACCOUNTS RECEIVABLES)/ CURRENT LIABILITIES
SALES/NET WORKING CAPITAL	NET SALES/ NET WORKING CAPITAL
LEVERAGE RATIOS	
TOTAL LIABILITIES/ NET WORTH	TOTAL LIABILITIES/ (TOTAL NET WORTH - INTAGIBLES)
INTEREST COVERAGE	(NET INCOME BEFORE TAX + TOTAL INTEREST EXPENSE)/ TOTAL INTEREST EXPENSE
TOTAL SENIOR DEBT/ (NET WORTH & SUBORDINATED DEB)	TOTAL SENIOR DEBT/ (TOTAL NET WORTH - INTANGIBLES & SUBORDINATED DEBT
LONG TERM DEBT/ FIXED ASSETS	(TOTAL LIABILITIES - CURRENT LIABILITIES) /FIXED ASSETS - NET

FIG. 38

Mooring must also be taken into consideration when performing the above evaluation.

AVAILABILITY

This indicator furnishes the necessary evaluation to measure the availability of each machine that depends on the theoretical production minus the maintenance factor. This measure must be taken simultaneously with productivity since it is, essentially, a factor connected directly with machinery.

VULNERABILITY

This indicator shows the proportion that must exist between availability and productivity and must be measured right at the working site.

NET CAPACITY

This indicator reaffirms usefulness and productivity of each machine and it is measured as: THEORETICAL CAPACITY / USEFULNESS.

MACHINERY NEEDS

This indicator defines the quantity of machines required to carry out the whole production process and it is measured as: WORKING VOLUME/ NET CAPACITY

MACHINERY OPERATING COST

This indicator includes every operational cost of working machinery consumption along the production line. It is measured in terms of: (FUEL, LUBRICANT, SPARE PARTS, TIRE TREAD WORN PER HOUR) * COMMERCIAL

PRICE

LIQUIDITY INDICATORS

These indicators emerge from the need to measure the capability Carbocol has to meet its short term obligations. They are used in the degree of facility or difficulty that may be encountered to honour the current liabilities and transform into cash the current assets. The chosen indicators are current ratio, working capital and quick ratio.

LEVERAGE INDICATORS

These indicators measure up to what degree and how debtors participate in financing the enterprise, establish the kind of risk they and the owners could be exposed to and the convenience or inconvenience for the enterprise to reach a pre- determined level of leverage. A summary of leverage indicators could be seen in Fig.38 .

2) Efficacy measuring Stability Indicators

These indicators depend on the relationship that made exist between objectives and strategies, either in Carbocol and Central Zone, to fulfil opportunities and counterattack threats inherent to the environment, consequently these indicators are directly linked to strategical management. The more these indicators help achieve the organization objectives, the more effective it would be.

The indicators furnish useful criteria to analyze the organizational performance in relation to the environment, through the existing

relationships between the obtained results, either by Carbocol or Central Zone, and those demanded by the environment from the organization and evaluate whether what is being done is the correct thing.

The facility to identify efficacy indicators is widely ruled by the integration and coordination of Carbocol as a company and Central Zone as a business unit. A summary of the indicators at the second level of recursion is described in Fig.39.

COAL PRODUCTION

This indicator refers to the total volume of coal extracted. The mining production plan for Central Zone defines the quantity to be produced, for the present situation the contract granted to Pinsky stipulates the total amount.

INVENTORY CONTROL

Inventory control is an indicator that evaluates the existence of coal stock rotation in the yards of Central Cerrejon mine, Albania and Puerto Bolivar. The ratio is: STOCK ROTATION= SALES ($)/ AVERAGE INVENTORY ($)

ESTIMATING INVENTORY OF REAL STOCK

The real stock is estimated in cubic meters through a topographical measurement. A pile of coal must be levelled or flattened prior to measuring. This calculation is valid for the yards of Central Cerrejon, Albania and Puerto Bolivar. The real stock, although included in the extension, was not considered in the first operation contract.

EFFICACY INDICATORS

VARIABLE	INDICATOR
COAL PRODUCTION	LOADED COAL
STERILE REMOVED	STERIL REMOVED
COAL RECOVERY	RATIO= STERIL REMOVED/ COAL PRODUCTION
INVENTORY CONTROL (ALBANIA & PTO. BOLIVAR)	STOCK ROTATION= SALES ($)/ AVERAGE INVENTORY ($)
COAL PRODUCTION COST	CARBOCOL-PRODUCTION COST PER TON PINSKY-PRODUCTION COST PER TON
In terms of variation curves:	
PREMIUMS OR DELAYS	CONTRACT FREIGHT, SALE PRICE, SALE, QUANTITY AGREED TIME / REAL FREIGHT, SALE PRICE, SALE QUANTITY OR ACTUAL TIME CONTRACT
ACTIVITY RATIOS	
PAYABLES IN DAYS	ACCOUNTS PAYABLE/ COST OF GOODS SOLD (OR SALES IF THERE IS NO CGS) * 365
INVENTORY IN DAYS	INVENTORY/ COST OF GOODS SOLD (OR SALES IF THERE IS NO CGS) * 365
RECEIVABLE IN DAYS	ACCOUNTS RECEIVABLE NET/ NET SALES
TOTAL ASSETS/NET ASSETS	TOTAL ASSETS/NET ASSETS

FIG. 39

DENSITY ESTIMATE

To determine the real volume, the degree of density coal has must be measured.

QUALITY

Coal quality is essential to obtain a competitive advantage in the market and it is determined in terms of ashes, moisture, sulphur, fixed-coal and volatile matter. Pinsky will be awarded either a premium or a penalty (liability) depending on the quality of coal extracted.

STERILE

This indicator is constantly evaluated in relation to dirt removed while extracting the coal.

COAL RECOVERY

This indicator shows the ratio between sterile removed and coal extracted. When measuring the behaviour of this indicator the ratio should be 4 m3 sterile to 1 ton of coal.

COAL PRODUCTION COST

This indicator is defined as the production cost per ton as stipulated by the contract signed between Carbocol and Pinsky & Associates. It is also important to consider the real Pinsky production cost spent per ton because of the fixed or non-variable nature of some of the expense items.

ACTIVITY INDICATORS

These indicators, known as rotation indicators too, attempt to measure the efficacy an enterprise deploys in using its assets in accordance with the speed involved in the return of its investment (gain back). The financing activity indicators are connected with payable in days, inventory in days, receivable in days, etc.

3) Effectiveness measuring Stability Indicators

These indicators includes the efficiency and efficacy of Carbocol and Central Zone, as a complete entity, in trying to attain objectives in accordance with environmental opportunities and threats. With these indicators, it is necessary not only what is going to be measured but also the way such measurements interrelate to gauge managerial productivity.

Fig.40 shows the effectiveness indicators that have been defined for the first recursion considered as corporate productivity. That figure contains certain formulas used for measuring the behaviour of each indicator.

MARKET POSITIONING

This indicator is measured in terms of market share over a given period of time. The measurement is stated as the available clients percentage that must be attracted or captured by the company.

EFFECTIVENESS INDICATORS

VARIABLE	INDICATOR
MARKET POSITION	MARKET SHARE
MAKET SUCCESS	CHANGE IN MARKET SHARE GROWTH RATES OF COMPANY MARKETS
PRICING	MEAN SALES PRICE
COST	MEAN PRODUCTION COST
CUSTOMER SATISFACTION	TOTAL NUMBER SHIPPING WITH RIGHT QUALITY/TOTAL SHIPPING
PROFITABILITY RATIOS	
NET MARGIN %	NET INCOME/ NET SALES * 100
RETURN ON AVERAGE ASSETS %	NET INCOME/ TOTAL ASSETS * 100
RETURN ON AVERAGE EQUITY %	NET INCOME/ TOTAL NET WORTH * 100
GROSS MARGIN %	GROSS PROFIT/ NET SALES * 100
S G & A %	(SALES, GENERAL & ADMINISTRATION EXPENSE) / NET SALES * 100
CUSHION (GROSS - S G & A) %	GROSS MARGIN - S G & A

FIG. 40

PRICING

Pricing does not merely depends on internal factors such as quality, transport costs, and value of coal extracted, but also on market external factors dealing with competitiveness.

COST

Cost is directly associated with one coal ton produced during a given lapse of time. At the end of that period, the cost of coal produced will be determined by an average (cost) per ton over that period.

CUSTOMER SATISFACTION

This indicator gives the measure of customer's satisfaction with quality of coal shipped over, so that he would never consider the possibility of rejecting it or switch to another supplier.

PROFITABILITY INDICATORS

Indicators of profitability are used to measure the effectiveness management has to control costs and expenses to turn sales into profit. It is important that these indicators may analyze the return (gain back) of capital invested by the company.

Profits are, generally, a profitability measure in proportion to Carbocol's disbursement or investment. A good indicator would be net margin, return on average assets, return on average equity, gross margin.

b) Relationship among indicators

No indicator could have any meaning isolated from the entrepreneurial context it is located in, nevertheless, each one is useful for management decisions taken. Their reciprocal relations must be considered to better understand how the diverse areas of Carbocol interrelate and observe how, when such relations are modify, executives are able to take much better decisions.

A tool permitting to interrelate indicators for them to reflect the relative influence of the one on the other is paramount here.

As an example, it could be observed how a simple modification in the production of coal at Central Zone affects the land and sea transport, deliveries to customers, inventory levels, etc. That is why the day-to-day and the mid term production plan should be adjusted.

Some indicators imply long term planning -- over five years-- investments, changes in the managerial structure, increment in production capacity, and development of new qualities and technologies, for instance; some others -- mid term-- such as personnel, motivation, correction of bottlenecks and those required by daily planning.

Comparing various groups of indicators is important, for instance financing ones. The analysis of each indicator should not be carried out independently from the other financing statements. Quite the contrary, the correlating indicators must be studied in group to find

the effect the ones may exert on the others and, thus, obtain global conclusions that permit the enterprise to have an exact idea of its real financing situation.

Coming back to the financing indicators example, there are indicators such as profits, an effectiveness measure, for they are simultaneously related to efficiency and efficacy (Fig.41). There are other financing indicators, connected exclusively to efficacy, e.g. incomes and others to efficiency e.g. expenses. Some indicators must correspond with the different cycles of processing in the organization.

Each enterprise and economic sector have their own conditions and characteristics. Therefore, only when extracting and comparing indicators of an enterprise against another of the same sector, they become meaningful.

Carbocol needs standard indicators calculated for the energetic sector it belongs to. Standard indicators and their values must not be considered "ideal" but as representing the whole sector, they are used to compare each specific enterprise. This is the best way to situate the company in terms of competitiveness and draw the biggest profit out of this comparison.

1) Relationship among production indicators

Production and commercialization of Central Zone coal belong to a cycle

EXAMPLE OF INDICATORS FOR EFFICIENCY, EFICACY AND EFFECTIVENESS INDICATORS

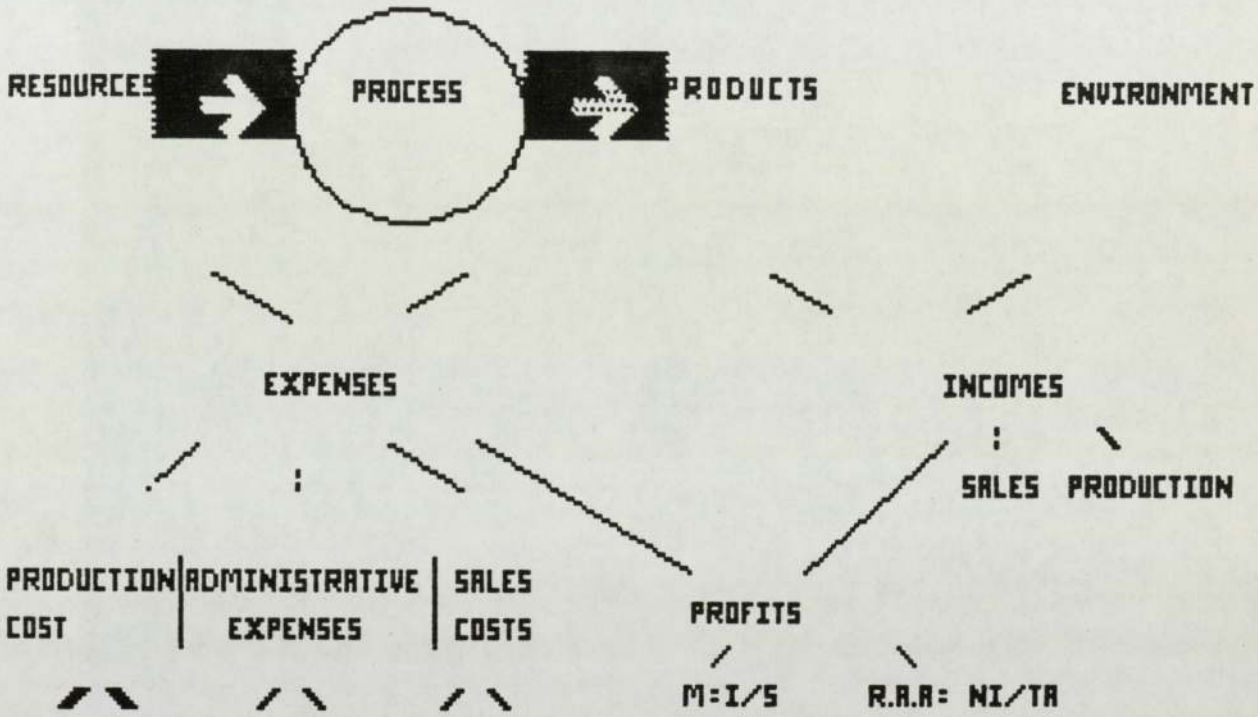


FIG. 41

and as such the identified indicators, in it, depend the ones on the others. The first step is receiving,from Pinsky, the Central Cerrejon coal production on trucks. The second, transporting the coal on the Sanchez-Polo's trucks to North Cerrejón where the movements of the mineral from the railway and the port or harbour are checked, compared and confirmed by Intercor. The third step is shipping the coal at Puerto Bolivar, where not only the stock-piles movements but also those from production are fixed by taking into account the number of shipments or deliveries carried out, either by trucking or railway, including the relevant loading factors.

This way all the information flowing about this cycle depend on some logical steps that could be converted into mathematical equations. Thus, the exact production volume could be determined by considering inventory of real stock that, once done, could be used to adjust the estimate of such existences with the corresponding data. This adjustment provides the volume of real production. Therefore, the daily production is based on calculations that take into account the real stock inventory estimated according to different coal movements, for the corresponding month, if it is compared with the previous one, and so on and so forth until a new inventory is taken.

From the above information, it can be deduced that obtaining one indicator is not an easy task, besides a crass mistake could be made if it is considered isolated from the context it emerges from, since the relationships among indicators could be overlooked.

2) Relationship among financing indicators

There is a series of interrelationships among some financing indicators to be taken into account if an integral study of the enterprise is to be made. Financing indicators expressed in terms of ratios have little significance by themselves. There is a close relationship among liquidity and activity indicators, especially when it concerns rotation of accounts receivable and rotation of inventories. The current ratio, main indicator of liquidity, could be either supported or deteriorated by good or bad rotation of either accounts receivable or inventories. The current ratio, in their analysis, present a great dependency on the rotation of accounts receivable and inventories. Another relationship worth studying is the one existing between debts incurred and the net profit margin of the enterprise.

Thus, the absolute number, represented by an indicator numeric relationship, has no meaning outside the economic- financing context. The found value starts making sense once it is placed within an economic-financing environment and when it originates in some statistical listing that gather economical history of Carbocol. Therefore, there is no way to determine whether it indicates favourable or unfavourable situations, or whether there is at least a way to compare it to any other thing.

When defining these financing indicators, it is essential to observe how the world economic situation affects directly or indirectly Colombia and Carbocol. Some of the external world variables influencing the

effectiveness indicators, that must be considered, are inflation, devaluation, change rates, prime rates, external debt, economical and political power of the oil producing countries, etc.

Some internal variables (Colombia) may influence directly the efficacy indicators i.e. the national economic situation in its variations lead to a constant preoccupation about the government's general economic policies, monetary measurements, the attitude or decisions of unions, the national development plans, the problems concerning the balance of change, the development of imports and exports, the subsidized credit policies, etc.

If the internal situation of Carbocol is analyzed, some variables that may influence efficiency indicators must be considered. They deal with policies related to the fiscal regime treatment, production cost, inventories, depreciation, amortization and the expenses associated with sales, among others.

The analysis of these indicators points out the strong and weak points of both Central Zone and Carbocol at a given time indicating probabilities and tendencies. At the same time it focuses on certain indicators and their relationships with others, but they need later and deeper investigation.

e. Measure Stability Indicators

1e. Measuring Stability Indicators

After the identification of relevant indicators, the next decisive step is pondering them. " What was done today, the real thing, is compared to what could have been done as if every thing had been optimally organized under present level of resources and operational hurdles. If hurdles are reduced and resources allocated, a better value has to be attained". Espejo (1986)

When the definition of process was studied, it was understood that it could offer executives criteria based on the analysis of productivity improvement to measure indicators. To accomplish this, executives must focus their attention on result producing processes, either by increasing or reducing the input resources, varying the efficiency of the transformation process, or varying the efficacy of results according to what is expected from the organization.

For measuring purposes, the indicator is considered as a reason or quotient, which events or numbers, depending on a set of pre-established rules are assigned to. In order to quantify indicators, a series of relationships must be established so as to facilitate the reduction and measurement of a great variety of indicators into a simple ratio.

Measuring of Stability Indicators demands a great deal of criteria directly connected to a suitable moment, production, quality, security,

wastage, leisure hours, personnel replacement, overtime, etc. Since this kind of measuring changes constantly to meet the requirements of environmental interferences, it requires a continuous feedback for a better monitoring of indicators by means of information loops. The loops integrate the executives' apprenticeship process, past experience, present action, and future behaviour for each indicator.

A sophisticated measuring performance derives from a careful analysis of indicators beginning with the whole organizational system and goes down segregating until it has been thoroughly measured the performance of all lower levels.

Executives, based on stability criterium, emerging from experiences, theirs, their organization or their competitors, measure indicators. They also measure and define those that could be necessary to evaluate the organizational performance and behaviour and negotiate stability criteria for each indicator by changing their needs of information adjusting the information systems their decisions are based on.

Measuring indicators also influence the implementation of organizational adjustment by improving problem solving, and apprenticeship processes, adaptability or development of new indicators.

a) Indicators measuring criteria in terms of actuality, capability and potentiality

When measuring indicators, it is important to keep their behaviour

measurements in terms of actuality, capability and potentiality. Because this permits to add latent resources to improve the situation of each indicator, thus providing a powerful supporting tool for decision making. Correctly managed, it permits to simulate to maximum what the organization can do in the short, mid and long term. These measurements affect the organization directly since they allow organizational behaviour to be observed in terms of efficiency, efficacy, and effectiveness, once resources are thoroughly used and constraints altogether removed.

Actuality: A fluctuating value based on measuring the possibilities of the present with existing resources and constraints.

Capability: The maximum that could be accomplished with present resources under existing constraints. It is a fixed value that provides a reference on how to reach present productivity. The annotations in strategical planning for productivity must be explained in accordance with differences of optimal values. To determine capability, it is important to clearly state resources and constraints that are connected to maximum capability.

Potentiality: The maximum to be attained once resources have been fully developed and bottlenecks removed to improve capacity. In other words, potentiality permits, once bottlenecks are removed and resources improved, to reach superior values for such capability. It means it is possible to create better conditions than those already defined in capability to develop activities.

Potentiality is a normative value connected to setting up production, marketing, or financing policies. The values from the competitiveness stability indicators must be considered to measure potentiality. With a such value, it is expected to answer questions like: How much could be produced? Which is the company's potential market? etc. To answer them, the real meaning of potentiality should be understood.

Determining capability is a fundamental concept at measuring indicators. While potentiality is basically a normative value and actuality a fluctuating one, capability is a stable measure depending on stable patterns for present organizational resources. Most of the time to determine capability, it is necessary to have at one's disposal series of time or simulate the behaviour of every indicator. This value can only be defined after the values for the other activities have been standardized, since they could affect the measurement of a specific activity.

b) Productivity, Latency and Performance Indices

Analyzing the indices is a method that helps executives to observe the behaviour of the organization in the short, mid, and long term by means of a permanent evaluation of their behaviour in time.

An index is defined as a measuring instrument that allows detecting variations from the indicators standard measurements. Indices provide relevant measurements for any organizational operation and facilitate,

through them, observing the behaviour of an indicator in time and follow it up. Besides, the absolute value of indices provide not only a measurement of the evolution of each indicator in time, but also helps executives to adjust to the organizational complexity in accordance with the inherent dynamics, thus it becomes a powerful tool in decision making.

A definition of Indices of productivity, latency, and performance as the reason of measuring actuality, capability, and potentiality follows: (Fig. 42)

Index of Achievement or productivity- This is the quotient between actuality and capability if "better" means more (e.g. production per day) or between capability and actuality if "better" means less (e.g hours necessary to perform a job). This index measures the possible organizational developments with present, although inactive, resources. What is done today, the actual present value, is compared with what could have been done as if everything had been optimally organized with present resources and constraints. The value can vary only from 0 to 1

the closer to 1, the higher the achievement.

$$0 <= Act/Cap <= 1$$

-Index of Latency- It is the quotient between capability and potentiality, or the other way round depending on the scalar order

DEFINITION OF INDICES

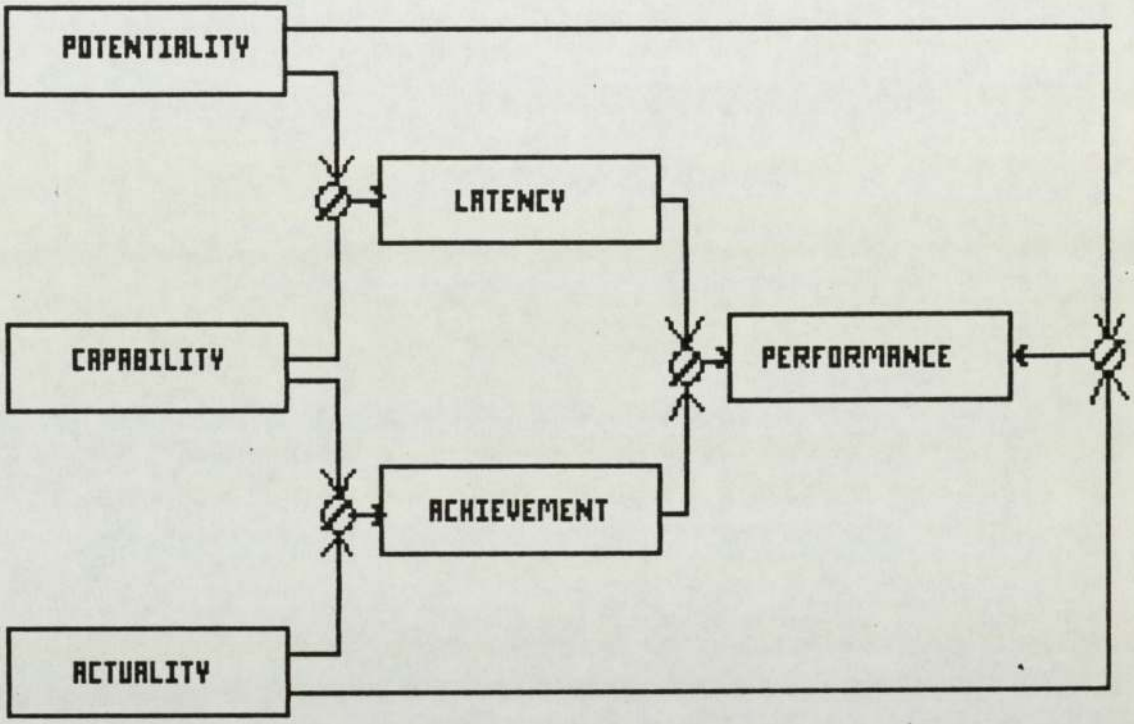


FIG. 42

between these two measuring factors. It measures how much could the system accomplish in one, two or three years with present although inactive, resources. In other words, latency is something potentially present that has not been attained. The annotations to latency are defined for all the activities in accordance with conditions of potentiality that can be obtained. The closer to 1 the index, the better it will be using latent resources. This index is connected to a measurement that could be only reached in the long term.

$$0 <= Cap/Pot <= 1$$

-Index of Performance- It is defined as the quotient between actuality and potentiality (or the other way round depending on the scalar order). It could also be defined as the product of the indices of achievement and latency.

$$0 <= Act/Pot <= 1$$

The significance of this index lies in the fact that it is related to both present and future, since it balances organizational achievements in the short term and a need to develop resources to maintain or increase productivity in the future.

The system of indices is a measuring instrument permitting the detection of any variation from some pre-established standards. The executives have to grasp the importance of these indices in order to understand what happens, should, in some given circumstances, the behaviour of the

indicator be improved under certain and specific constraints. This system allows executives to measure the present performance of any organizational operation and, at the same time, helps them to create the future.

To observe the behaviour of indices and their relationship in time is primal. For example, any manager could improve performance of an area that shows increasing values for actuality or decreasing values for capability either way, by improving productivity or reducing costs. If costs are reduced, productivity is improved, but, in the long term, the future of the organization might be destroyed. On the other hand, if potentiality is kept constant, when it should be increased, performance would grow better, although in the long term, this could be harmful for the organization because achievement will be reduced.

c) Planning concepts related to Indices

The term planning is related to the concept of time in the short, medium, and long term. Different concepts of planning, are closely related to indices such as tactical, strategical and normative planning.

-Tactical Planning: relates to short term in the extent of which planning is based on actuality. To know actuality, what is being done now, is important if this value will serve as reference for what is expected to do later. If this value is used, a plan sufficiently realistic and rational should be elaborated based on what ought to have been done before the brief existence of the present. Therefore, it is

important to be highly sensible of the here and now to plan for the morrow.

As each executive is aware of both his top capability and actuality, he will understand what he is going to do tomorrow if he refers to what could be done with the present levels of productivity today.

For this kind of planning to exist in a continuous process, it is necessary to be extremely aware of today's changes to plan for the near future, considering essentially, what could be accomplished if present levels of productivity are kept under control.

-Strategic Planning- That is planning by objectives in the mid term. Some organizational negotiations are necessary to design new objectives and appropriate continuous process to attain them. This planning operates on the basis of top capability and allots the best existing resources to be used in the coming years.

It is the relation of many plans supported by a continuous process to reach top capability. Strategical planning is a systematic process that looks into the future to identify how much could be accomplished and the best way to do so. Once resources and constraints are fully known, executives, within the organizations, can use as point of reference the interactions and evaluation of behaviour.

-Normative Planning- Planning based on potentiality. Generally

investment planning, structural changes, technological innovations and expansions are directly related to long term planning. It refers to what should be done for each activity once constraints have been taken away and resources developed. This kind of planning brings along lots of risks and penalties but offers better and perhaps decisive benefits in the long term. Analyzing the conditions of potentiality that could be reached or not and why, is important when defining normative planning.

It is essential to plan with enough autonomy in the long, mid and short term at each recursion level of the organization for each task to be developed in its most appropriate level. There will be imbalances if there is not clarity in the definitions corresponding to each level of recursion.

Handled by executives, this planning system permits a continuous check up of the consistency of such plans with reality. As plans emerge, they are fed with new information so, by the time they reach the executives, the latter would be ready to face, at any moment, the apparition of possible inconsistencies.

2e. Carbocol: Practical Case

Each indicator is measured after having been identified. The measurement would take as base Indicator coal Production, such an Indicator was selected because it is one of the most important ones, interrelated with others in the integral system.

a) Coal Production

The "production" indicator, for the Central Zone Project, is directly related to tons produced, delivered, transported and shipped. For an accurate measure of the coal produced by Central Zone, it is necessary to refer to the production process described previously because it permits to understand not only the volume losses but also the inventories of existence.

To determine the amount of coal exploited at Central Zone project, the amounts of coal extracted and the sterile displaced to obtain that particular coal are measured at the pit. Physical inventories are continually carried out at the storing points and the estimated value is adjusted accordingly. Most of the time, the value of the physical inventory does not match the estimated one because of a series of variables that could altered either the final value or the factors related to quality. Such variables could be moisture, rain, etc.

Both at the mine and at the shipping harbour, a quality control is carried out. Coal quality depends on moisture, ashes contents, sulphur, volatile matter, fix coal, and BTU or units of energy produced per coal ton.

The total-real production is obtained by the following equation:

Total production = Final stock inventory (A+B+C) - Initial stock

inventory (A+B+C) + Delivered tons +

Transported Tons + Shipped tons +

Volume losses (A+B+C)

The following partial equation must be considered:

- (A) Central Cerrejon mine.

Final stock inventory (A) = Initial stock Inventory (A) +

Production (A)- Delivered Tons

- (B) North Cerrejon mine.

Final stock inventory (B) = Initial stock Inventory (B)

+Delivered Tons - Transported Tons

- (C) Puerto Bolivar at the North Cerrejon port.

Final stock inventory (C) = Initial stock Inventory (C) +

Transported tons - Shipped tons

The total coal production arriving at the port should be the same dispatched from the mines although natural losses (moisture, dust coal falling of trucks, etc.).

b) Calculating actuality, capability, and potentiality.

Fig.43, Index of Production Indicator, is an analysis of behaviour for three weeks-working days (from June 3, June 19, 1988) and calculates the values of actuality, capability and potentiality and the indices of productivity, latency and performance as it is produced by the computer model.

The values of the indicator for June 6, 1988 (Fig.44) were taken to illustrate the example and the behaviour was defined in terms of actuality, capability and potentiality.

-Actuality-

The value of actuality for the production, under existing resources and restrictions, was 5824 tons for that day.

-Capability-

It is the top level Pinsky could reach with existing resources and restrictions. The capability value for that day was 7000 tons defined based on the historical behaviour of Pinsky's production values. Capacity value was determined after understanding the way other activities could affect production.

The executive in charge of the production indicator at Central Cerrejon Zone must take into consideration not only the value of capability, but

INDEX OF PRODUCTION INDICATOR

DATE	ACTUAL.	CAPA.	POTEN.	PROD.	LAT.	PERF.	
03.06.88	2919	7000	8000	0.42	0.87	0.36	
04.06.88	1524	7000	8000	0.22	0.87	0.19	
05.06.88	6859	7000	8000	0.98	0.87	0.86	
06.06.88	5824	7000	8000	0.83	0.87	0.73	<--
07.06.88	4070	7000	8000	0.58	0.87	0.51	
08.06.88	3501	7000	8000	0.50	0.87	0.44	
09.06.88	4500	7000	8000	0.64	0.87	0.56	
10.06.88	3800	7000	8000	0.54	0.87	0.47	
11.06.88	3700	7000	8000	0.53	0.87	0.46	
12.06.88	3600	7000	8000	0.51	0.87	0.45	
13.06.88	3800	7000	8000	0.54	0.87	0.47	
14.06.88	3900	7000	8000	0.56	0.87	0.49	
15.06.88	3750	7000	8000	0.54	0.87	0.47	
16.06.88	4000	7000	8000	0.57	0.87	0.50	
17.06.88	4100	7000	8000	0.59	0.87	0.51	
18.06.88	3800	7000	8000	0.54	0.87	0.47	
19.06.88	3300	7000	8000	0.47	0.87	0.41	

FIG. 43

INDEX VALUES FOR JUNE 6 - 1988

POTENTIALITY: 8000

LATENCY: 0.87

CAPABILITY: 7000

PERFORMANCE: 0.7

PRODUCTIVITY: 0.83

ACTUALITY: 5824

FIG. 44

also resources and restrictions associated with it.

-Potentiality-

The potentiality of Central Zone is the highest daily production capability projected for that Zone. This value considers as developed all the resources and suppresses all restrictions, within the boundaries of feasibility, independently from Pinsky's top daily production capability relying on the stipulation of the contract signed.

The estimated value was 8000 a day. It was obtained by means of studying what other similar mines in identical situations could get to produce. As values, North Cerrejon and other coal projects abroad were taken into consideration.

c) Indices of productivity, latency and performance

The indices furnished by previously established measurement are calculated in terms of productivity, latency and performance. The following are previously established values:

-Index of achievement or productivity-

The relation of actuality and capability is called index of productivity and its value 0.83. If the relative amount of that day (6 June 1988) Fig.44 is analyzed, a descent of 17% could be observed. The important relevant thing in this situation is to find out its causes.

- Index of Latency-

The relation of capability and potentiality is the index of latency and its value 0.87. This index measures, realistically, the development the organizational may attain in one, two or three years.

-Index of Performance-

The relation of actuality and potentiality is the index of performance and its value 0.73.

Analyzing these indices in time constitute a method helping Carbocol's management to observe the behaviour of the organization in the short, mid and long terms. Considering the meaning of such relationships is important to attempt controlling what could happen, under some given circumstances, if the present performance is improved under particular restrictions.

The 7000 daily tons, calculated as capacity for the production indicator were obtained in relation to the following indicators:

90% Availability of equipment

95% Availability of spare parts

95% Availability of maintenance of working capacity

10% Index of absenteeism

1% Inability caused by accidents

10% Environmental moisture (rain,etc)

Capability may be affected by the change of any of the aforementioned values. If the productivity descent of 17 % for the (jun-6-1988) is investigated, it is found that the actuality value for availability of equipment was 83%. By a deeper analysis of the situation, it could be ascertained that 24 trucks produce 7000 daily tons, as each one has a net capacity for 300 tons a day (24 * 300 = 7200).

The 17% equals four trucks production (1200 daily tons), therefore, the descent in the index of productivity was cause by the absence of 4 drivers on union leave on that day .

The above analysis allows to see how the attained results by equipment and human resources depend not only on the characteristic of the mineral, the expected production, environmental conditions, etc.

When production, as an efficacy indicator, is analyzed it can be concluded that any variations in the measured results could be explained in relation to other indicators in the system. Therefore, it is important to dispose of an information system to find the causes.

After having studied the aforementioned indicators, it comes out that an effective system of tactical, strategical and normative planning is indispensable in the organization since executives have to verify, through the system, the consistency of plans with reality. The

information system must be fed as soon as new information has been produced for the executives to be alerted at the moment or even before inconsistencies arise. Planning in the short, mid and long term would, therefore, be only possible through an information indicator system supporting decisions taking.

f. How to handle the problem-solving process

Once stability indicators have been established and measured, it must be guaranteed that the Stability Indicators System could be implemented. This System must, essentially, allow the identification, measuring and handling of Stability Indicators for them to be adjusted and actualized. It is on this that lies the importance of continuously generating debates among the executives and disposing of a systematized information system since, briefly, it permits to obtain the best Indicator System.

Creating permanently consensus and internal debates, in the organization, are important factors in the production of structural changes, that is why the debates on Stability Indicators have to generate a constant feedback of what is happening inside and outside the organization since, in the end, permits to identify and measure the best indicators to guarantee that strategies and plans adhere wholly to the organization.

The participants' rotating interaction of ideas, the discussions to clarify them, voting, hierarchy, and additional discussion to arrive to a consensus are essential throughout the debate. It is interesting to observe how the executives perceive or visualize indicators and the way they have to measure them.

It is possible that this visualization and measurement generate an exact list of exceptions and weaknesses in the enterprise to be detected

through the instability of indicators, that must be adjusted by means of a coordinating effort into administering the recommendations suggested and already accepted.

The exception reports are used to generate the alerting signals that will help the executive to launch a specific action towards avoiding danger even before this becomes really harmful for the enterprise.

This requires an Information System capable to produce line reports whenever somebody in the organization may ask for any kind of information.

Detecting problems, as the aforementioned ones, makes it feasible to improve the organizational performance and to include corrective actions in the relevant managerial process.

A much more significative Indicators System could be generated if all the executives participate in a perfectly structured process to identify and measure Indicators. For this reason, the participation of executives from Central Zone, and the others areas, in direct relationship with the project, have been considered to be so important. "The most relevant of all the methodological activities is handling the problem solving process. It is at this stage when technical and political considerations must permit to establish improvements either desirable or feasible." Espejo (1986).

To make a correct implementation of the system possible, both an

efficient working team and the necessary resources are necessary. The same way, the information produced in the enterprise must be every day more reliable and timely. It is also indispensable that, from the policies of mine operators, commercial or any other kind of contracts, Carbocol could obtain all the information needed to feed the Indicator System. It is important to bear in mind the experience accumulated by other organizations working in the same sector, competitiveness especially when determining potentiality should this point be emphasized.

The debates could be expedite if some well structured steps are followed. In Fig.45, all the necessary steps to keep the Indicators System fed are synthetized and intertwined. Once the indicators have been identified, it is possible to adjust or re-define them. Measuring could be also adjusted or redefine. As soon as capacities, potentialities and actualities are determined for each indicator (step A), they are introduced in the data base of the system (step B), then, the system calculates the indices of achievement, latency and behaviour (step C). Finally, these indices permit the best decisions to be taken (Step D, E, and F) about the organizational behaviour. In this way, and based on the indicators behaviour, it would be possible to decide on the best action to improve organizational performance if such improvements should be necessary. The whole sequence has a monitoring mechanism to be used as permanent feedback (step G), and permits to improve the obtained results to fulfil effectively every managerial situation.

Depending on the organizational behaviour, capabilities or

STABILITY INDICATORS SYSTEM

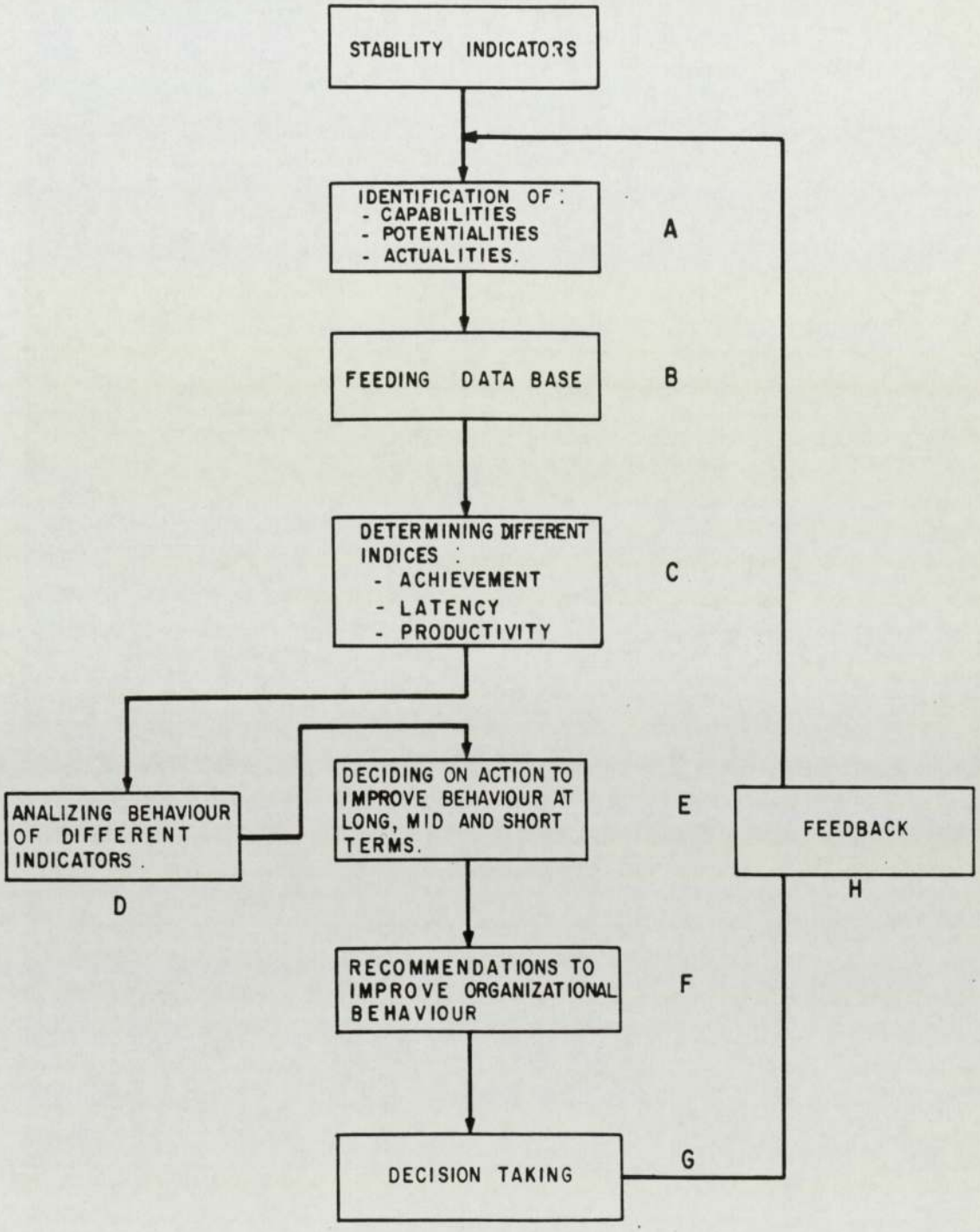


Fig45

potentialities for each indicator could be adjusted as to reflect the real situation. They should also allow the whole organization to make an effort towards attaining such values. If a measurement does not gauge what it is intended to do, a stable behaviour of the system could not be expected since, most of the time, measuring standards, in terms of capacities and potentialities, have not been altogether defined.

The Indicators System permits a continuously checking up of the consistency of plans, regarding reality, and this process should be handled by executives. The indicators are fed with information as soon as it is produced so that, when management gets it, they could be alert, at any moment, for the arrival of inconsistencies.

There is a certain kind of information that requires a statistical analysis before it is entered in the Data Bases, this implies a permanent check up of the information gathered.

1. Managerial reports system

The design of the present Information System, should study the way the different organizational decisions are taken at different recursion levels and how they are continually debated and analyzed by the executives. It should be also analyzed how the efficient and timely flow of information allows a better handling of the different opportunities that come to the executives to make the best decision.

Before taking a decision, lots of information has been previously

analyzed so that the organization could adapt better to the prevailing circumstances inside or outside the company. Top level executives carry out the analysis using as tools the technical reports that were sent to him by the analysts. Since they, the analysts, are in charge of selecting the best alternatives for a good decision taking, it could be said that, the final decision has been the object of a general consensus from everybody participating, as the alternatives carry implicit the criteria of the analysts.

Fig.9 provides a general view of the continuous decision taking process. Strategies, objectives, policies, and plans are modified and controlled by measuring and actualizing Stability Indicators. The complete cycle of decisions taking must include not only the results of previous definition and measuring of indicators, the analysis of the information that may have been generated by such indicators, the presence of stabilities or exceptions in the aforementioned analysis, the debate or debates originated by exceptions or stabilities, the possible course of action that executives in charge of exceptions or stabilities must follow, but also the instructions formulated to rapidly carry out the decisions taken. If the new decision requires a re-definition of the indicators previously defined, it could be done by means of an adjusting-continuous close loop either in defining or valuing indicators.

A generation of reports is the obvious result of the steps followed from the analysis of indicators up to the necessary instruction to fulfil the relevant corrections. This series of steps is summarized in Fig.46 (Steps to be followed in the analysis of Indicators).

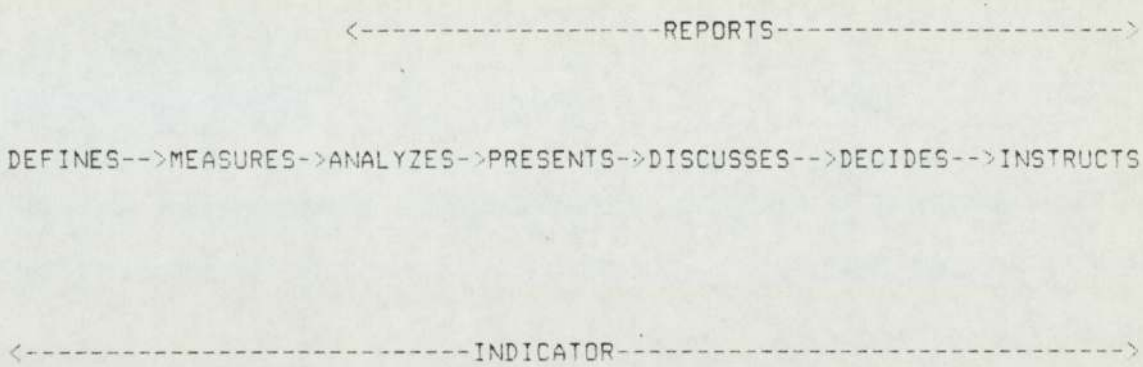


FIG.46

The usage of indicators provides the executives with a powerful tool to analyze the organizational behaviour, since the system of managerial reports permits to simplify, anticipate, and aggregate information originated from the analysis of indicators by means of reports either graphic or written. There are two kinds of reports: some of them dealing with stabilities and the others with instabilities of the organizational behaviour.

For Beer (1987), the reports are in accordance with two important kinds of signals that must be acknowledged, the important and the algedonic ones.

An important signal is produced as a result of the stability of indicators and comprehends the behaviour of means, tendencies, capabilities, and potentialities. A stable indicators behaviour

constitute a Eudemonic Regulator. According to Beer, this regulator encompasses all the signals consigned in an Important Report. The signals are defined as positive if the measuring of indicators behave within the defined ranges for the industry or sector the organization belongs to. These signals furnish the stable or calm values, of the indicator without any kind of alarms. The new strategies, objectives and organizational policies originate at the Important Reports since they contain the values of the stable behaviour of indicators.

An algedonic signal is the one that could be pleasant and/or painful for the executive in charge because of the exceptions it has reported. An exception is produced when the measuring of the indicator and, consequently, its behaviour are away from those defined as standard. Some processes may have no defined indicators and in the event they do, the indicators are being misused or perhaps the defined measuring standards have not been the most appropriate ones. In case there are no indicators or if it is necessary to re-evaluate the existing ones, a deficiency is produced and whenever indicators are misapplied, exceptions would be produced. These symptoms of abnormality in the behaviour of the system are sent to the executives through Algedonic Reports that should be generated timely and at the same place the exceptions occurred. They contain suggestions concerning the exception and deficiencies produced by deviations from standard values in behaviour. The Algedonic Reports generate alarm signals that cause the executive to start some kind of action to avoid danger before this turns into a real harm for the enterprise.

The flow of generated reports is closely connected to the way exceptions are handled within the organization, that is why it is so important to verify whether exceptions go to the right person at the correct level of recursion and at the right time. If this is the case, the algedonic signals will be sent directly to the person in charge of taking the suggested action.

As soon as an exception has been detected and an algedonic signal, including the relevant recommendations, generated, it is important to carry out an action that will permit to implement the suggested recommendations. This action must be analyzed with the executive in charge of fulfilling it.

A commitment to make all relevant corrections within a pre-established amount of time must have been previously established with this executive.

Suggestions are important since their accomplishment sets the stability of the system, therefore, it is important to send the suggestions in writing to take corrective actions as well as follow up and monitor the implementation of such solutions.

For example, either an algedonic signal is produced or tendencies redefined should the latter change from that is expected. Naturally, redefinition must be carried out by or with the executive in charge within the relevant recursion level.

If the executives local autonomy is limited, he will have to ask for help when the automatic algedonic signal is produced; on the other hand, in the event of full local autonomy, he will have to consider whatever relations he may have with other recursion levels in the corporation for the organization, under any situation, must be always taken as a whole.

A contingency plan permitting to take alternative actions should be included at the moment of making recommendations since, most of the time, problems arise when trying to accomplish the action chosen in the first place. This is the reason to demand more than one answer for the same set of questions in relation to the opportunities present in the business environment.

In the end, handling of reports is what makes up the computer model. The whole set of reports produced by the organization needs the implementation of a flowing and following up mechanism and the chain process that takes place in the managerial handling of the system of reports must be analyzed.

The design of such a system could be as sophisticated as necessary and the degree of sophistication will depend exclusively on how indicators are being used at the different levels of recursion in the organization.

B. MODEL

A model is defined as a description, simplification, simulation or abstraction of reality. The model identifies the principal components of reality and shows the way they interrelate. As every organization has to elaborate its systems according to expectations, culture and managerial processes regarding its optimal structure, the production of flexible models is very important.

A model is an aid to understand the system being model that could be used to describe, explain or control the system.

By generating Stability Indicators that help to control Carbocol's behaviour, instabilities to be detected, this is why, it is so interesting to analyze the general tendencies and perspectives of the whole industry. The global dimension of these systems of control underlines the importance of designing adequate information systems. The identification of the most advantageous indicators provides a system that better supports every decision taking, therefore weighing the organizational stability or instability through measuring established Stability Indicators is vital.

Through a monitoring and control system that allows the executives to know the changes of any variable connected to the indicators, the executives grasp the way the units of their organization operate.

a. Information system for handling stability indicators

The business environment is every day more complex. Nevertheless, this complexity could be acknowledged by observing the emergence of a tremendous amount of unexpected events to deal with decisions that must be taken. Every new situation has to be analyzed through tools, that permit handling the unlimited number of variables, in which decisions must be taken, almost immediately. This is why, an information system, responding, in real time, to the critical points of the enterprise, on which planning and control must be based, becomes unavoidable.

With the information system, offered here, the different organizational areas will be able to design and actualize their Stability Indicators since it furnishes relevant and timely information that could detect instabilities in the organizational behaviour. Identifying the most advantageous indicators brings along, as a result, a system that is used to support every decision that could be taken in such a way that, once, the principal indicators are identified and measured an improved information system could be put together.

A consolidated Stability Indicators System gives the executives a greater understanding of the enterprise's behaviour, because it offers them the opportunity to develop a faster adapting and learning capability. It also helps them to be prepared to cope with organizational deficiencies even before they take place.

The Indicators Information System permits to know, in real time and by

exception, all the changes that take place in the health of the organization by constantly monitoring and controlling indicators that are going to help Management to take timely decisions. It may be observed that most of the organizational problems emerge from poor control loops. Since this control is distributed throughout the organization, instabilities multiply as indicators interrelate.

The complete Stability Indicators System make up an Information System that permits a better control on the essential processes carried out through the organization.

The important thing in developing this kind of information systems, is the definition of criteria that could make possible the best effective design. For an information system (MIS), to be effective, it must have enough flexibility to respond, continually, to changes in the areas of information and technology. The organization must be modelled to better identify Stability Indicators "vital signs detectors". This information system will furnish answers in real time, and thus, executives will take pertinent timely decisions, without being overburdened with un-necessary or inadequate data but rather with alerting signals when something comes out wrong.

Clear criteria about the definition of filters and amplifiers must be established, to have a flexible information system. The criteria must expedite the identification of Stability Indicators that define the kind of information that must be transmitted not only to the different recursion levels, but also to the different executives that are going to

receive it.

It is, therefore, necessary to find criteria to aggregate relevant and useful, data and transactions for the executive in charge because it is an extremely important step in the designing of Information Systems. There are lots of ways to produce aggregation although not equally effective. That is why the philosophy of the Viable System Model is so useful.

The main objective of such an information system is to provide the organization only with necessary information, in the best place, at the best moment, with the right quality and cost, to develop normally organizational activities. This information system will support fulfilment, follow up, and monitoring of objectives and strategies for the organizational mission to be duly attained.

b. Management Centre

Beer (1987) calls **Management Centre** the suitable environment for the group of executives to take their decisions: "The Management Centre, as he defines it, is the environment of decision, in which the board, or college of managers advance into the process of decision taking they are directly responsible for. The Centre is like a corporate brain that extends the nervous system of the whole organization into the real world, thus integrating the results of its findings, and taking motor action in which all the sensory input that originated the action is sinthetized. Everything takes place in real time". The setting up of a

management centre assumes the pre-existence of one or various Information Systems.

The "Decision Environment" or "Decision Centre" is really a "Centre of Information Systems. In other words, D.C. could be described as a room full of electronic screens controlled by computers. "The idea is to improve this room in accordance with new ideas supplied by creative executives." Beer Staford (1987). The author's main idea is to set aside a place where top level executives could meet and take important decisions for the enterprise based on information furnished by the system. The information that finally reaches them comes from the definition filtering and amplification process, monitoring, analysis of results, suggestions discoveries, comments and risks.

The process implies a decentralized organization structure, in accordance with the Viable System Model, and a group of highly prepared executives able to interpret results and whose analysis can flow, through filters, to the next level of recursion in the organization. The computer model is designed with Cybernetic criteria that produce outputs generated in accordance with the philosophy of the VSM as described before. The outputs are helpful tools to make predictions by means of special feedback and apprenticeship methods at different recursion levels in the organization.

The cybernetic design permits, each executive connected in line within the system, to receive signals coming from relevant indicators. This makes him aware of different questions that he may want to ask from a

particular indicator, which must be related to his own responsibility or that of his lower level of recursion. If the model is considered within the context of the Viable System, it could be observed that the executive may be located at either one of two particular levels of the organization's system. Should he belong to the operational level, he would use efficiency indicators but, in the event he belongs to the managerial level, he would be employing indicators of either efficacy or effectiveness.

The information coming from different indicators flows from one level to another in accordance with reference points that identify the responsible for a given indicator or for a given recursion level. The generated information is then revised by the following recursion level in accordance with the quantified processing diagrams defined by the Viable System. These indicators are adjusted depending on the changes that may take place in Strategic or Normative Plans.

c. Computer model

The flow and data structure in the computer model must follow the same kind of logic as that in the Viable System Model. The scheme has been thought to handle complexity by using uniform models that follow standard techniques for diagrams of quantified flow and language programming of the fourth generation. All terminals are connected to a room that continuously receives and generates information.

The computer model that has been developed is a support system for

decision making that brings close to the executives the possibility of keeping a permanent control on indicators and critical processes indispensable in the successful performance of the enterprise. The systems that have been developed so far to support the decision making process are interactive. This kind of software is quite different if it is compared with the one designed to handle transactions. In it, a constant analysis based on different judgements, not necessarily following normal programming patterns, prevails. The mental process used by this kind of software can not be programmed as it is in constant evolution.

Since planning and control for each plan require one or more indicators, the system must be sufficiently flexible to allow the effective interrelation of all the indicators so that they could adjust more freely to the changes the organization undergoes in time. In the end, instead of one strategy or one plan, there will be as many as indicators have been defined within and without the enterprise and this is, in essence, what really constitutes the organization's strategic plan. The indicators system is designed to facilitate following up and monitoring each indicator and, at the same time, allow its measuring to be made at the very moment any change takes place so that it should be possible to observe the interrelation each indicator may have with all those affected by change.

The model tries to handle all the information necessary to carry out the steps dealt with in Fig.47 and has been so developed as to permit making all kinds of simulations with the information, each time more different,

SYSTEM IN REAL TIME

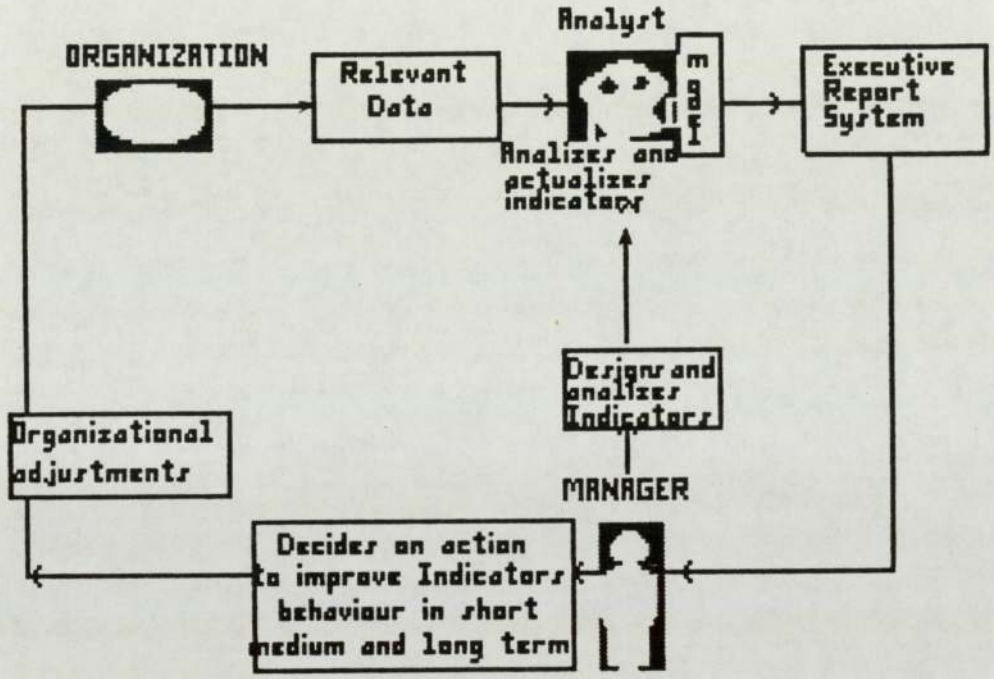


FIG. 47

that has been generated by indicators and the reports produced after analyzing them. The analysts, besides feeding the data bases as soon as they have received the information, produce the exception reports based on the information gathered which is analyzed in accordance with the engineering criterion for variety. In other words, experience will teach the analysts what is most important for each recursion level when they issue such reports. Therefore, a system capable to produce interactive reports is necessary whenever somebody in the organization requests information from the decision taking indicators.

The first set of modifications or organizational adjustments displayed on the screen is reported as exception by the analysts and sent to the executive in charge. The interconnecting net of existing screens in the organization allows such messages to be sent directly to the screen of the relevant executive. Any kind of organizational activities that may take place in the boundaries of a SBU are feedback, notified right away and checks against a diagram of quantified flow. Finally, unsolved exceptions are stored in the system for a permanent monitoring. When recommendations concerning such exceptions are fulfilled, they will be taken out from the corresponding data bases.

d. Integrated Software for wielding a system of Stability Indicators

The software used for wielding a system of Stability Indicators constitute an integrated-on-line system that besides producing continuous information, yields daily, monthly, and yearly reports, and permits to integrate the tactical, strategical and normative planning.

Appendix D (Data Reports) contains illustrated slides relevant to the model reports appearing on the screen or on paper.

The design of the software agrees with specifications used by the Viable System Model. If the organization or Business Units send messages, an important action is taken throughout the Viable System Model, that is, the action is carried out at every recursion level, starting from the point of origin (Fig.48). The messages sent will be found on the screens; some of them will be algedonic signals that go to a lower level of recursion with the aim of finding out what caused the exception in the first place. The message will finally reach the relevant executive in charge of improving the organizational situation.

This program has been designed to respond to the needs of those executives responsible for decisions taking in organizations either public or private of any size and kind. The model was developed as to be adapted to the styles of the different executives. Each executive specializes in the use of certain kind of information, for this reason the software is able to produce a variety of information to suit whichever need. It may come either in graphs, written reports or statistical tables. Besides, the above, the software sends information only to the right executive, thus avoiding him/her of being overwhelmed by irrelevant data.

It is also important to remember that top level executives handle a kind of information different from that of the mid level ones. For example,

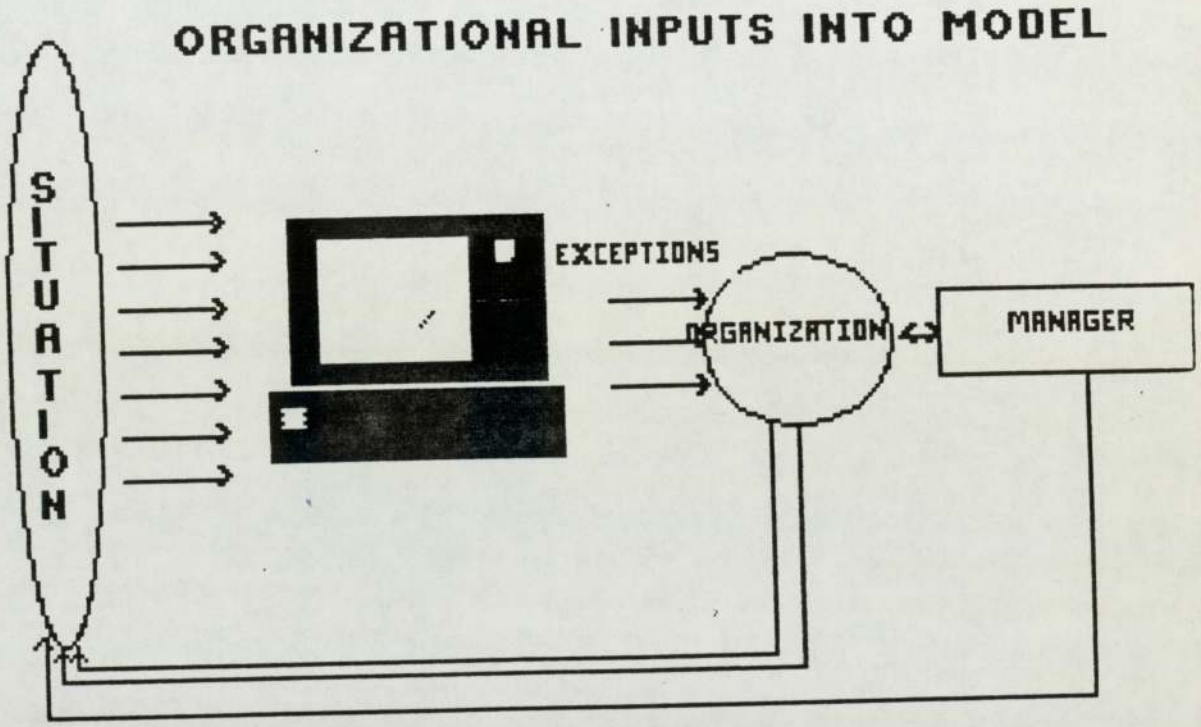

ORGANIZATIONAL INPUTS INTO MODEL
SITUATION
EXCEPTIONS
ORGANIZATION
MANAGER

FIG. 48

the latter are interested in storing time detailed information, while top executives require information produced by aggregated indicators in order to take their decisions. The analysis of Indicators help the analysts and the executives in charge of the day to day activities in the organization, it is also used in the accumulation of periodical information, that comes from the indicators, for those executives interested only in monthly information reports.

Aside from the above, the software produces different types of reports, that were already minutely related for executives to anticipate their responses, by specifying when the system is in alert, its behaviour in time or its normal tendencies. All the signals and reports are a complement in important decisions taking. Their interface modules agree with the concept of friendly software.

The system could be accessed by means of windows using menus. The objective of such menus is to be displayed on the screens in order to transmit vital information in a powerful and economical way.
The use of windows facilitates transmission, especially when they are combined with texts, graphs, tables, etc. A circuit of ramified windows should be made possible so that they could be opened when special operation take place. (Although these operations do not necessary belong to the main or principal window).

When the event so requires it, it should be feasible to erase or fade away one of the windows or, perhaps, to open another one, relevant to the present situation.

The basis of the integrated software design have been menus with a tree structure that permits in due time to study the different options. Some of the keys have been redefined with specific functions to close or open the menus. Although, the menus are something more than just a selection of tools for accessing the system with the intention of changing its values.

Therefore, this software is an integrated system of control in line with interrelated and integrated routines. Once the menus are fed with new data, they can produce real time and periodical reports continuously. Finally, the software offers a great facility for interaction since it uses conversational modules oriented directly toward the user. Such modules can integrate word- processor, spreadsheet, database, communications, statistics and graphic software.

1. Word-processor and reports generator

The system, through a word-processor and a reports generator, produces Important and Algedonic Reports. The reports should contain all the substantial information to carry out the managerial process in such a way that, as soon as a report is produced, it will immediately generate alerting signals for the executive to take a decision way before a problem comes forth in the organization.

The system of reports has been designed as to facilitate simplification, anticipation and aggregation of text as soon as either an important or

algedonic signal is produced. The system generates reports and signals and then stresses the key issues to better attract the executives' observation.

Since reports forms are constantly in evolution, a reports generator has been introduced in the computer model.

The editor is a very useful module with all the characteristics sophisticated word processors have, such as capturing results from other environments. This particular editor inserts the reports that come from Cybersyn (Cybersyn will be explained in due time).

2. Spreadsheet

The spreadsheet contain basic patterns for entering data into the system, editing reports, and performing calculations, this is the reason they are so necessary for validating indicators. The spreadsheet are also a very useful tool in planning and designing models. They are especially effective in the simulation of different future strategies for different scenarios. If anything goes wrong, the access to the system has to be modified in order to obtain a satisfactory output. This cybernetic notion is known as "the negative feedback principle" and used to control mistakes.

As a great amount of data is fed into the planning and corporate control systems, it is necessary to have powerful statistical tools to detect exceptions because they are the result of a series of analysis carried

out at the different corporate areas or at the subsidiaries. The executive must perform constantly a sensibility analysis on the information coming from the indicators. If his experience tells him so, he could modify or tune it to suit the present need.

The spreadsheet also permit handling data coherently. This is something highly important during the integration phase of the indicators since it facilitates the consolidation of results.

Modifying the information during the integrating phase of indicators by means of calculation and recalculation would be another feasible analysis; In this way and in accordance with its degree of importance, a simple datu could be changed as many times as required by present circumstances.

With a question like, what would happen if...? an analysis of sensibility could be carried out. Naturally such an analysis would call for simulation of diverse future strategies for different kind of scenarios. Simulation is attained by answering among others the following questions: How frequently should they take measurements?. What could be learned from errors and fulfilments?. What kind of management does Real Time demands? etc.

The normal behaviour of the indicators should not be forgotten at the moment of generating Important Reports as future strategies for the organization will depend on their standard values.

3. Data Bases

Besides a real time data base that capture and store the data produced by the indicators of efficiency, efficacy and effectiveness, there is another one designed to store all the information generated by the Algedonic Reports. This information includes Unsolved Exceptions or Alerting Signals produced by the system and the mean, tendency, capability and potentiality of Important Reports originated by each indicator (Fig.49). The figure depicts the way to interface with sophisticated models that wield financing, production, budgetary, inventory control, social evaluation projects, etc. in the organization. These models can feed different data bases and after the information has been transferred to a spreadsheet for validation it will be introduced with a special form into Cybersyn.

Cybersyn is a software that must be fairly flexible for all the different users to have access to both data bases dealt with, and besides they must have all kinds of facilities to interact with the whole system; that way the empowered executives could modify or consult them whenever they have the need.

This Data Base system makes it possible to aggregate, erase, edit, print and display efficiently on screens all kinds of data. Its design could be altered to modify, eliminate or combine fields and characteristics; furthermore, it relies on special system to validate the Data Bases entering information.

DATA BASES TO INTEGRATE INDICATORS

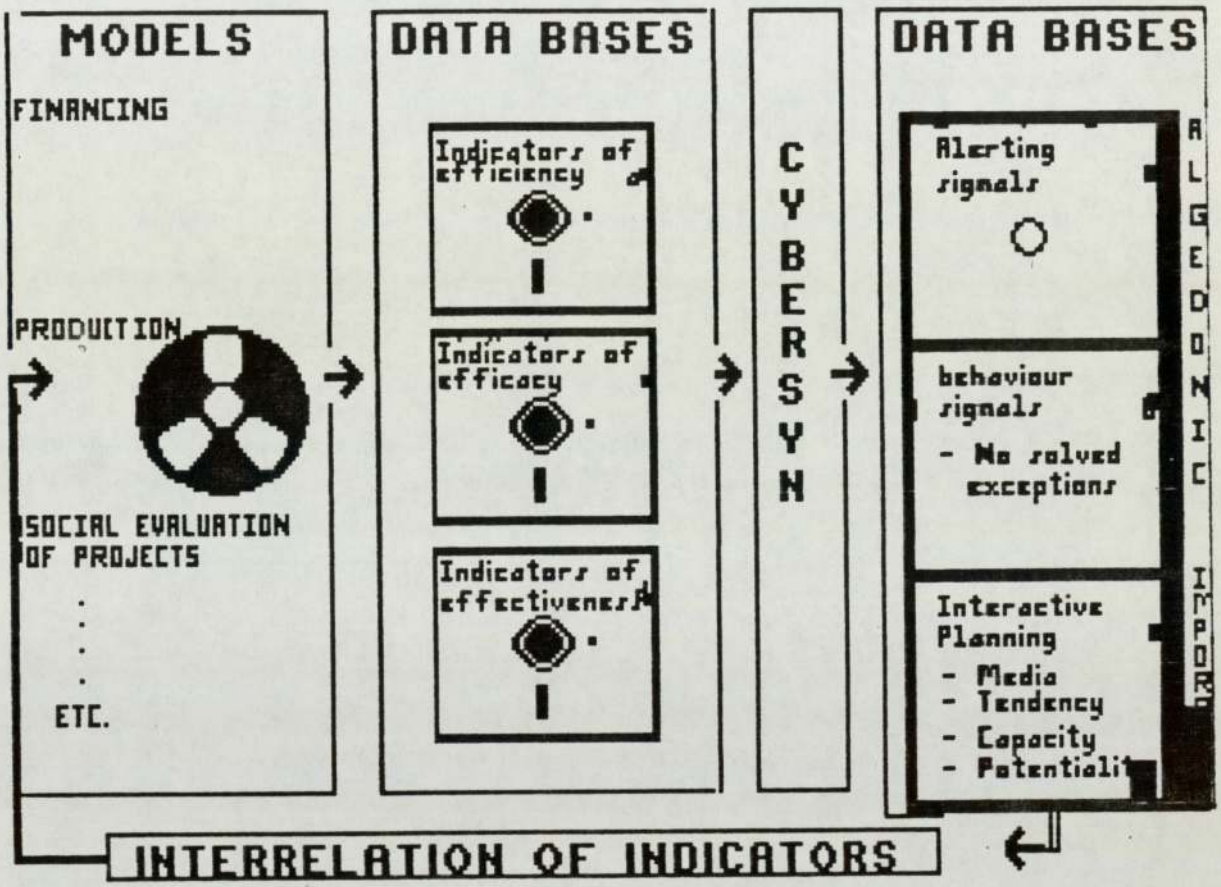


FIG. 49

4. Graphics

The art of graphics designing is a very important task in the organization. As the eye is the human being's principal information channel, a good image is well worth more than a thousand words. Besides good images are helpful in the communication of simplified and clear information and data.

Most of the graphs, used by the planning and control systems, respond to a certain kind of comparison of different data, and this is the most important factor that must be considered at the time of selecting graphic forms that emphasize mainly on the kind of data to be compared. The one to the others in isolation or the one to the whole.

A graph may represent a certain kind of information reproduced either in the shape of bars, multi-bars, cakes or lines associated with a special graphics characteristic, such as colour, size, or position.

The system allows to constantly, revise and improve graphs so as to suit the cognitive style the different executives may have and generates a series of time, represented in colour on the screen for everything. This series of time should also be constantly updated.

5. Cybersyn

Cybersyn is a software developed by Beer and Espejo which permits to measure the different indicators behaviour. "Cybersyn is a computer

package that attenuates the complexity of the world by using aggregated data and by filtering out the irrelevant one and amplifies the manager's appreciation of that complexity by supporting the structuring of richer mental models". (Espejo & Garcia, 1985).

The objective of Cybersyn is to devise a powerful tool to help create a balance between managerial capabilities and organizational complexity. The philosophy of the Viable System Model succeeds in creating and maintaining such balance essential to make forecasts, because it introduces feedback and apprenticeship methods along the line followed by the process of a new projection. The future could be projected when the analysis are based on rational principles for the analysts to predict the morrow using as much sensibility as they may have. The system has a tuning routine to make variations and expedite predictions.

The scope of Cybersyn, in planning and managerial control is related to the behaviour of the different indicators that are necessary in the achievement of strategies, objectives and organizational policies. As soon as an Indicator has been identified and measured, it is transferred to Cybersyn for a subsequent analysis. If a variation has been found in the already defined standards, an Algedonic Report is immediately send to the executive in charge. Cybersyn uses its own criterion to detect instabilities through the collection of exceptions.

Each indicator has its own series of time that are generated by the computer.The series helps to measure any change or deviation the indicator may have had from its more recent behaviour. If the measure

is a stable one, that is, when it fits the defined standards, the indicators behave as an eudemonic regulator.

Cybersyn detects changes by checking the indicator's new value against the historical one. A simple statistical check up determines whether the input is real, if such an input does not conform to statistical parameters of the population it supposedly belongs to, its validity is questioned and/or rejected. Four possibilities could occur to the variations of the behaviour of the variables could be altered by any of these four factors, variation, transient, slope or step changes each time a new datu enters the time series.

Cybersyn keeps updated the mean value for each of the essential Indicators, therefore, the established factors can be recalculated in the light of new incoming data. As it was observed in the aforementioned paragraph, Cybersyn employs special techniques to estimate the four possible factors. That are considered for each new datu introduced in the system, as the bayesian theory of probability states it. (Within engineering control this estimate is known as the Kalman Filter). Any variation in the values implies that an algedonic report should be sent immediately to the executives in case any of these values should change. It is also possible to anticipate maladjustments taking place between "planned values" and "mean statistical values" by using the alerting signals generator.

With Cybersyn, the executive has the option of altering the value of capability immediately after its adjustment if standards are redefined

(for instance definition of new specifications or decision on new strategical responses). The executive could also, with Cybersyn alter the value of potentialities after having carried out adequate negotiations and made sure the recommendations emerging from that decision have been fulfilled.

6. Communications

A good planning and control system requires the production of decentralized reports to get to the different organizational areas for them to be responsible for their own information. Creating data bases, in which the data after having entered the system only once, is shared by everybody using the data bases, is very important. That way efficiency could be increased through the communication of data by local nets.

The best managerial answer to a great many questions is the decentralization of systems. This means, in other words, taking the possibility of selecting, installing, updating, and controlling the computer net by using a complexity of nets linking every terminal in the organization.

The overabundance of computers of distributed processing has increased the need for efficient communication systems to expedite interchanging data with the different organizational areas and facilitates accessing to the different computer services or functions. The net links the various elements of information, but, this does not necessarily mean

communication. An effective communication, among the diverse elements of information, requires the previous design of a system depending on pre- established criteria to help in the creation of guidelines to, especially capture and transfer files from distant computers. The criteria permit welding indicators in a much more efficient way. Lastly, the criteria must define who should consult, feed and update each of the indicators and who should be in charge of aggregating information in case it is a part of another aggregated indicator since this is a very important matter.

7. Interface

Interface is a tool that controls and coordinates the different packages entering the system. It is necessary to wield the system as it permits to arrange different defined modules so they could operate flexibly and dynamically in the organization. The concept of software integration is a pre-requisite for an excellent operation of the model. The integration of Cybersyn, Spreadsheet, Data Bases, Communications, Statistics and Graphs is indispensable for a correct performance of the software.

Integrating all these packages into one coherent system, that permit the development of the steps described in Fig.50 (coherent systems integrated package) is an effective tool for the organizations' planning and control. In the figure it may be observed how the integrated software in accordance with the different levels of recursion feeds the decision's centre with immediate information.

The integration requires packages that permit a direct communication among the distinct systems for capturing operational data, creating data bases in real time, storing historical information, and finally consolidating and transmitting information to the other systems in the organization whether managerial or operational.

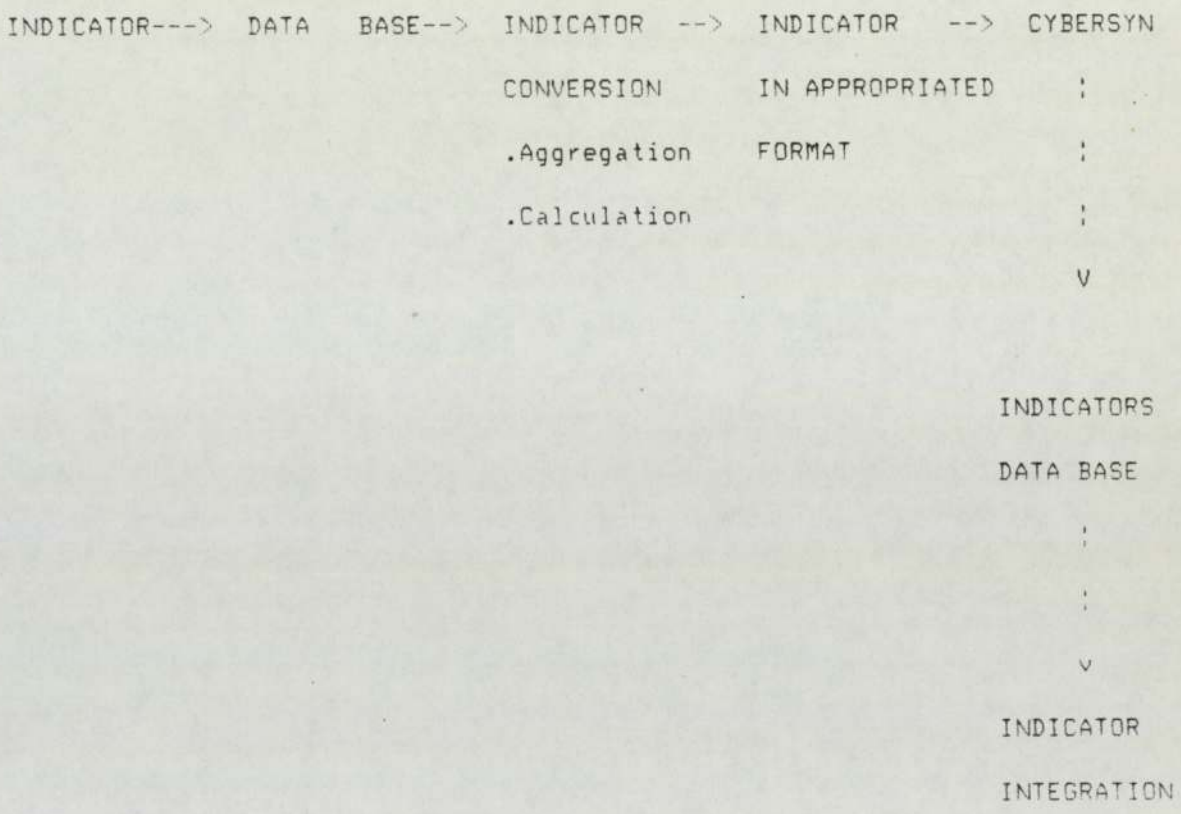


FIG.50

Interface as a tool is part of a managerial system in real time and if it is used integrally, it permits to monitor, advancing control, transmit control commands, produce data bases, measure variables in real time, simulate and optimize processes, implement strategies, etc.

Fig.51 shows how the system is fed. As soon as the executive has identified and measured his indicator in terms of actuality, the information feeds the data bases designed to capture information. The spreadsheet are used to perform preliminary calculation of indicators validation. If a deficiency is found, the analyst generates a report by means of the word processor. In due time, the indicators together with their actuality values are incorporated into a file that feeds Cybersyn where they are analyzed and their stability values actualized to suit the executives' criteria. The different kind of reports are generated simultaneously with the signals that feed the interactive planning. The Algedonic Reports contain either the alerting signals or the system behaviourial signals, besides the unsolved exceptions, the Important Reports and all the signals necessary to establish the interactive planning. Mean, tendency, capability and potentiality are such signals.

It is also important to observe how the changes occurring in an indicator may echo in the performance of all the others because all those depending on others are interrelated. The indicator's important data emitted by Cybersyn, is stored in a new Data Base and, re-transmitted into a spreadsheet, where interdependent indicators are interrelated. These patterns could be interfaced with sophisticated models to feed the different output data from spreadsheet and the variety of packages and models used in production, budgeting, inventory control, etc.

If the decision environment is a Centre of Information Systems, it

REPORTS FEEDING SYSTEM

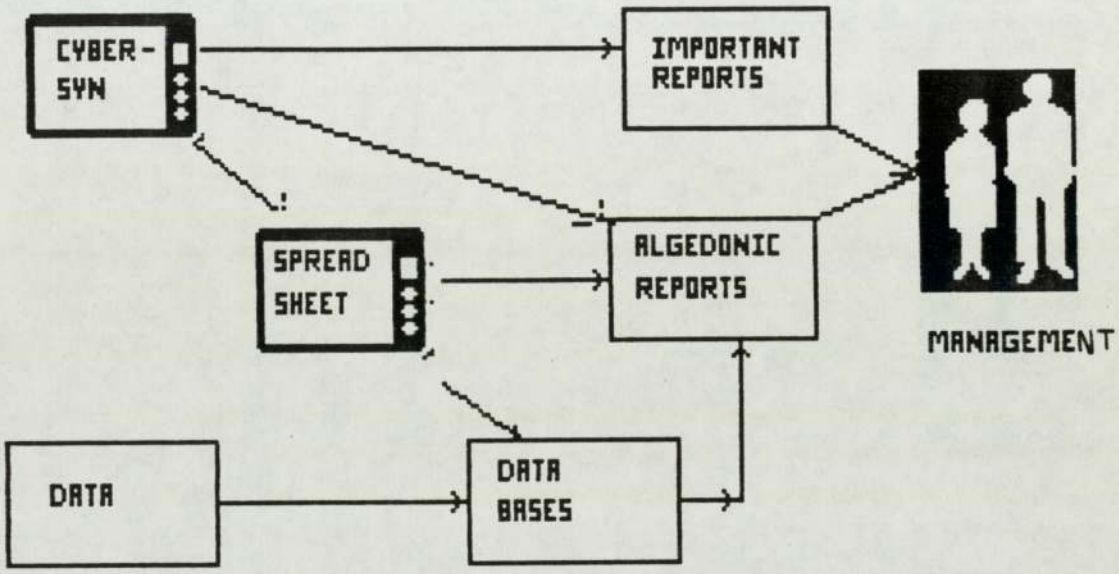


FIG.51

should include the whole organization since it must dispose of the whole information connected to the industry or sector the organization belongs to analyze competitors permanently. Messages in real time are sent to the screens of the executives in charge and those for the Higher Level Committee will be sent to the Centre of Information Systems as soon as they have been produced. The simulations carried out in the Centre are basically attained by the computer model that must be interfacing all the screens involved.

The interface system used by the computer to benefit from all the functions constitute a structure arranged in recursion modules. Fig.52 is a complete Cybernetic diagram that shows the integration of all the functions dealt with before. These functions constitute a Decisions Centre.

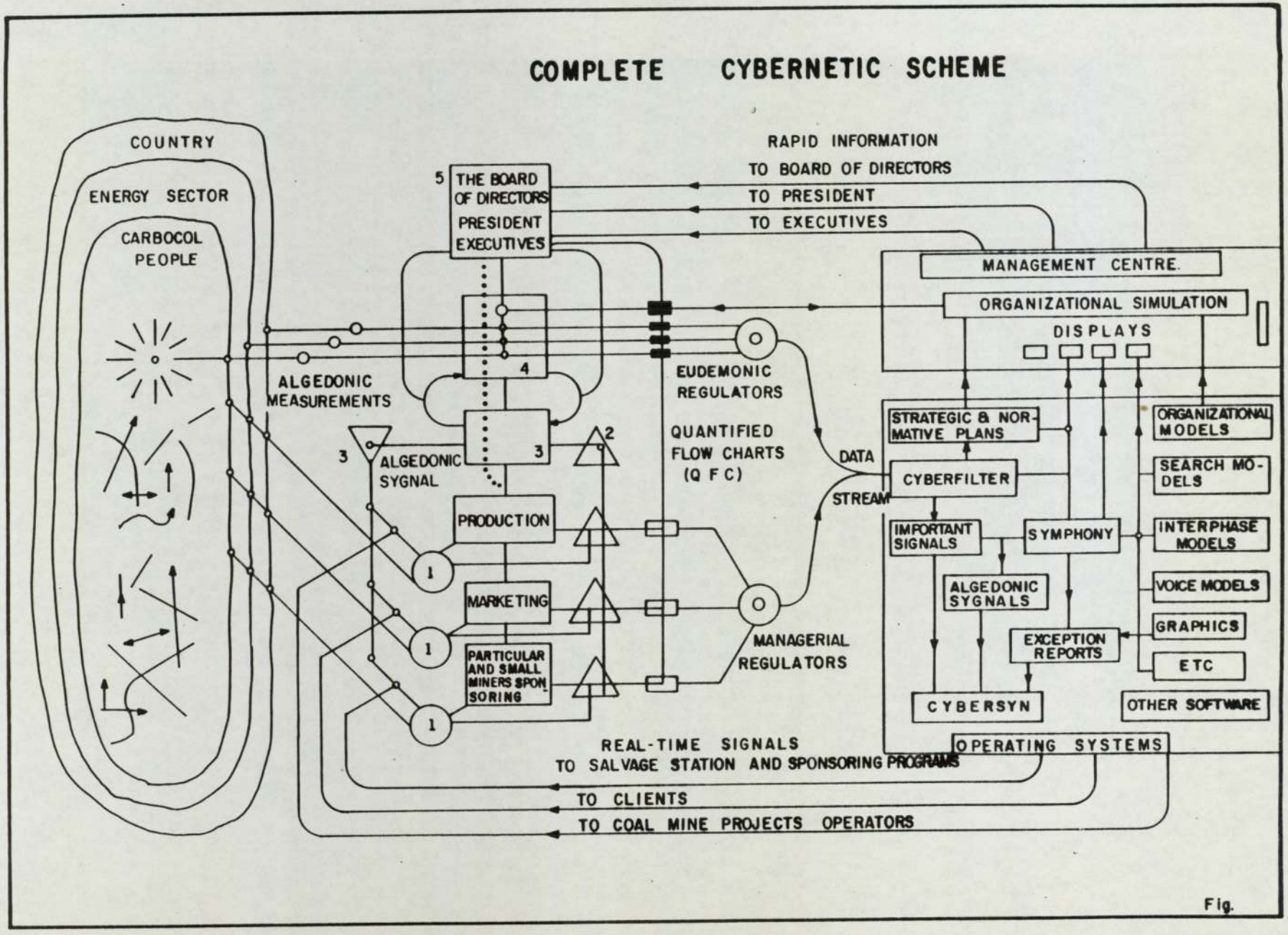

COMPLETE CYBERNETIC SCHEME
COUNTRY
ENERGY SECTOR
CARBOCOL
PEOPLE
5
THE BOARD OF DIRECTORS
PRESIDENT
EXECUTIVES
RAPID INFORMATION
TO BOARD OF DIRECTORS
TO PRESIDENT
TO EXECUTIVES
MANAGEMENT CENTRE
ORGANIZATIONAL SIMULATION
DISPLAYS
4
3
2
ALGEDONIC MEASUREMENTS
ALGEDONIC SYGNAL
EUDEMONIC REGULATORS
QUANTIFIED FLOW CHARTS (Q F C)
DATA STREAM
STRATEGIC & NORMATIVE PLANS
CYBERFILTER
ORGANIZATIONAL MODELS
SEARCH MODELS
IMPORTANT SIGNALS
SYMPHONY
INTERPHASE MODELS
ALGEDONIC SYGNALS
VOICE MODELS
GRAPHICS
EXCEPTION REPORTS
ETC
CYBERSYN
OTHER SOFTWARE
PRODUCTION
MARKETING
PARTICULAR AND SMALL MINERS SPONSORING
1
MANAGERIAL REGULATORS
OPERATING SYSTEMS
REAL-TIME SIGNALS
TO SALVAGE STATION AND SPONSORING PROGRAMS
TO CLIENTS
TO COAL MINE PROJECTS OPERATORS

Fig.

CONCLUSION

The identification and measurement of Stability Indicators need the methodology advanced here because it permits to select systematically the most appropriate Indicators.

A computer model must be developed to effectively follow up and monitor such indicators.

The methodology as well as the model help to adjust the ideal situation to the real one since they permit to reformulate the analysis that may be necessary to enrich them. The stage of "present situation" could be understood as it is and as it "should be", as far as one goes deeper in differentiating the real system from the ideal one.

The six fundamental steps the methodology follows need the people, participating directly in each situation, to support them, for they must decide on the changes that may be necessary to implant to improve definition adjustment of selected indicators.

These are the steps:

-Look for the origin of problems in planning and control in the organization

-Create the best organizational conditions for the process to be operating all the time

-Structure correctly the organization under study

-Identify and handle stability indicators

-Measure such Indicators

-And handle efficiently the implementation process

When looking for the origin of problems in the planning and control functions, a diagnosis of possible causes whether internal or external, must be carried out in Carbocol, since their ignorance may make it difficult to identify the Stability Indicators.

Creating the best organizational conditions to effectively solve the aforementioned problems is thought of as an efficient process to incorporate the methodology as part of the enterprise. The process of incorporation allows all the executives to share in continuous debates to restate, follow up or define new indicators. This way, a permanent evaluation of the enterprise could be reached.

An integral overview of the organization under study, helps to understand, through structuring, the relationship the various managerial levels of the strategic business units may have and permits to define strategies, objectives, and policies to identify the most adequate Stability Indicators to evaluate the organization in accordance with the results.

Identification of the most suitable Stability Indicators is the most valuable end-product the enterprise has because, through them, the behaviour of the organization could be observed in the short, mid and long term. Identification of Indicators provides the company with

permanent evaluation.

Measuring Stability Indicators is a way to grasp what is going on in the organization, in special circumstances, because it eases simulation of behaviour under particular restrictions and permits to detect deficiencies and exceptions in the behaviour of indicators.

An efficient handling of the process-solution guarantees implementing the Stability Indicators System and facilitates their permanent adjustments and up-dating through continuous debating. The debates are carried out by executives who, for this purpose, are backed up by an information system that guarantees they have taken the best decision.

A computer model was developed to better wield the I.S. Without such a model, it could have been very difficult to monitor and follow up the indicators system.

As far as the methodology permits to identify indicators, they are compared with reality through a permanent feedback of both the problematic and the real situation. The feedback of the whole system helps to define strategies because it is characterized by a progressive knowledge of institutional apprenticeship programs. The Stability Indicators that have been defined permit to evaluate, follow up, restate and forecast the best strategies to facilitate the feedback process of the Strategic Plan in the organization.

CHAPTER IV

GENERAL CONCLUSIONS

This chapter describes a list of problems that were encountered while developing and implementing the methodology resulting from the research carried out at Carbocol.

It also describes some of the problems found in planning and control systems due to limitations in identifying business units, planning systems, systems of evaluation and control, analysis of indicators, and decision support systems.

The chapter also describes some important issues in the definition of planning that should be considered for the development of strategic management. By, previously establishing these definitions certain errors can be avoided when later there is a need to define strategic plans.

A. DESCRIPTION OF PROBLEMS IN THE DEVELOPMENT AND IMPLEMENTATION IN THE METHODOLOGY AND MODEL FOR CARBOCOL

a. Problems in the development and implementation of methodology

Not only the development of methodology but also its implementation have been affected by the problems encountered by Cerrejon Central Zone project. Some of them are the apprenticeship process and Pinsky s agreement of treaty, that caused the project to be, finally, closed down. This closing down hindered following up the implementation of the methodology in this project.

Nevertheless, by the end of the research the survey described in Appendix B was used again with Carbocol s executives to make a corporate level diagnosis. The methodology was thus feedback, especially in what concerns searching the source of planning and control problem.

These are some of the issues found:

-The enterprise s planning is not the result, although it should be an integrated Strategic Plan depending on the country, the energy sector, coal sector and specific actions taken up by the enterprise.

This lack of dependence makes it difficult to plan for the mid and long term and approval and efficient follow up of budgeting.

-To make the methodology operate, it is essential to decentralize, even more, the planning and control process that require a greater commitment from executives and officers in each area of the enterprise and the development of a strategy culture for the organization. The users of this process consider their participation rather passive so far. The members of the Board of Directors should, as top priority, spend more time in the planning and control process because they are in charge of making the methodology to flow through all the levels of their area; they are also responsible for the development of a strategic culture for the organization.

-The structure of the present SBU's should be analyzed in order to optimize integration, coordination and communication among the different function and supporting areas. The segregation of these units into sub-units must be revised because there is no formal identification or, in the event of its existence, it is unsuitable since it does not reflect the organizational reality. As a consequence, it could lead to an inappropriate organizational structure such as the allocation of resources, for instance.

-It is necessary, for the methodology, to permit an organizational modelling, a little bit more in accordance with Carbocol's reality, for the SBU's to be defined based on criteria that reflect Carbocol's mission, for the SBU's to be constantly adjusted according to the changes taking place in the environment. These SBU's should segregate into sub-units because, both units and sub-units are the basis needed

for adjusting Carbocol's organizational structure.

-The segregation process of strategies and managerial objectives is considered to be weak because the activities, according to the criterion of the relevant area--although not regarding corporate objectives, are priority number one. This fact leads to the inexistence of a sequential chronogram for managerial activities priorities. As there is neither an original and sequential plan for the activities developed by the organization, most of the areas must duplicate their efforts.

-Since there is no feedback in decentralizing the planning process, for the time being, parallel planning systems are produced in some of the areas whose results are not necessarily the same as the planning and control process at corporate level. The Plan for the Enterprise is not the integration but the addition of plans from the different areas, because, by producing inappropriate mechanisms for the consolidation of such a plan, Synergy is lost.

-Although an effort has been made towards preparing plan- follow up reports, their results have not been employed neither as control mechanisms nor as managerial instruments so far. The process of following up and controlling the Strategic Plan does not provide an integral evaluation of the enterprise that could be used to determine its positioning, when it is so required, thus helping to understand its target within a planning horizon. Therefore, more conscientious personnel, at enterprise level, in what concerns the Plan as planning element are required. That is why it is essential for the methodology

to allow, not only the evaluation of the organization as a whole but also the evaluation of each SBU.

-It is necessary to be more conscientious about the importance of planning in the mid and long term for enterprises like Carbocol whose investments and contracts are established for the long term. Mid and long term planning permit to develop bases and criteria for negotiation in time. Simultaneously a consolidation of the plans in the different planning horizons, permitting to integrate normative, strategic and tactical planning, must exist. It is essential to have a Sectorial Plan to expedite the consolidation.

-The organization is not conscious of the importance and usefulness of information regarding strategic and competitive aspects. Therefore, the information has not been appropriately generated and used. There is no area responsible for the integrated information of the enterprise to take corporate decisions because it is believed that decisions taking people do not need an efficient information support.

-A support information system for decisions taking executives, containing key indicators to be used for the enterprise s strategic decisions as well as for following up and diagnosing the Strategic Plan is required. As soon as these indicators are actualized, they should be edited for everyone to be acquainted with.

b. Limitations in the application of the methodology

-The circumstances implicit throughout the document does not make Carbocol different from any other enterprise in the application of this kind of planning and control methodology. Because of the complexity and continuous changes in the environment of the 90 s, nowadays enterprises, not facing problems of any type that make it difficult planning and control, are scarce.

-Although a strong effort towards creating a flexible methodology was made, the planning and control systems emerging from the approaches, so far used, are not sufficiently flexible or adequate to the entrepreneurial reality of today. The speed of the changes taking place in the environment, that influence the enterprises directly, goes over the flexibility these methodologies have been designed with.

-There should be a permanent search for flexibility in the methodology. Both methodology and planning process must be constantly revised to avoid rigidity. The important thing is not to adopt a given methodology but to adapt and continuously feed it back in the enterprise and the SBU.

-A methodology permits every officer to work under it and expedite allocation of resources. There is great danger that the implanting process of the methodology becomes an up-down process without a down-up feedback. The methodology must be participative permitting to incorporate a two-way feedback process (up-down and down-up) in the

different organizational levels.

It is generally consider that the methodology could provide the enterprise with an adequate course to define priorities and at the same time furnish a tool to develop a managing platform approved and backed-up by the Board of Directors. When the Plan is framed by a planning horizon, it facilitates a chronogram that could be used to operate and attain its follow-up and control processes.

-The methodology must also permit strategic diagnosis in the short, mid and long term. It is advisable to formulate various probable predictions and measure the scope of their consequences. He who forecasts is forced to predict changes. Important changes can not be predicted based on past experiences only. History is a good teacher but not the only source to predict the future.

A stable situation and the real and probable changes concentrate the attention of the strategic forecast. A change of strategy implies necessarily reallocating resources. It could also imply a mix of clients from different geographical areas, etc.

-The success in implementing the methodology depends on a successful combination of culture with changes in the structure; systems and people. The methodology could be a complete secondary factor in defining real commitments with the organization s executives. Their permanent participation through continuous debates permit to re-state, follow up or re-define the methodology to attain the constant evaluation

of the organization because it determines its degree of adaptation.

c. Limitations in the development of the methodology

-It is difficult to undertake this kind of research in organizations in Colombia, particularly one that belongs to the government such as Carbocol. While the role played by the researcher within organizations in developed countries is defined, in developing countries such as Colombia, it is necessary to start by implanting the idea that carrying out research is important.

-Companies have to be made to realize that research contributes to better efficiency, efficacy and effectiveness. Furthermore that researcher can detect and solve problems in the organization by keeping in contact with executives, who can thus transmit their knowledge and experience and foster communication among the different areas in the organization.

-The pilot sample had to face a number of problems at the moment of its inception. Firstly, North Zone was chosen, but although, the President of Carbocol agreed as to the relevant information needed to control the project, it was impossible for Carbocol to demand information from Exxon because of political problems concerning the association contract. As a consequence it was decided to conduct research on the much smaller Central Zone project. Besides, it was thought that the experience accumulated in Central Zone could permit a better definition of indicators to control the North Zone in the future.

-The existing political atmosphere, in the organization, may deeply affect the implementation of the research. Carbocol requires more time to take political decisions than technical ones. Although, political handling is doubtless equally or more important than technical handling, the researcher s political dependency makes the organization to, most of the time, condition or influence his/her criteria.

-To implement the research, it is important to have the institutional support concerning availability of human, financing, and technical resources necessary for the normal development of its operation. Although negotiating resources is a difficult task.

-One of the characteristic difficulties in Carbocol is that there is no written record. There is only to be found scattered and isolated information throughout the areas of the organization, sometimes published in leaflets or in the Executives Memoirs. This is, especially, the situation of what concerns the definitions of strategies, objectives, procedures, etc.

-Systematized information on production in the organization, at the moment, is no reliable. Therefore, whenever a new datu is obtained, it is necessary to check up its inconsistencies. This causes a tremendous working delay.

B. DESCRIPTION OF PROBLEMS ENCOUNTERED IN THE FUNCTIONS OF PLANNING AND CONTROL FOR ALL KINDS OF ORGANIZATIONS

a. Limitations in identifying Business Units

-When considering autonomy in organizational units, it is possible to lose advantage by sharing resources at the corporate level.

-Business units may not be apparent in a complex organization where boundaries among products and market segments are not easily identified. There is often risk in determining which is more relevant; customers, group of customers, geographical scope, product replacement, or competitors identification. In practice, segmenting a corporation into "Strategic Business Units" is more of an art than a science.

-It can become quite difficult to specify accurately the success of the business units. Success can be defined in relation to the market status the business competes in, the products it sells, the behaviour and price characteristics, the way the products are produced and sold, and finally, the method by which these various segments are financed.

-Strong criticisms have been voiced regarding the misapplication of portfolio models and techniques, however, most actually aimed at specific problems created when applying such techniques. The validity of certain assumptions, the formulation of competitive strategies and the appropriate analytical scope to define the right strategies of

action have also been questioned.

b. Limitations of planning.

-There is no a standardized planning system that can be universally applied. All that exists are methodologies or models that can be adjusted for a particular organization or business area.

-Planning with corporate vision is a difficult task. The total of the business plans are not necessarily convergent towards obtaining the best for the corporation as a whole.

-There is risk if the plan becomes an exercise in bureaucracy and the planning process a routine activity. This can possibly be avoided by switching from strategic planning to strategic management.

-Mid term and long term planning are risky because of the amount of time between their establishing and their execution. The responsibility of those plans is accepted only under a certain kind of assumption. As the future is designed today, through assumptions, there is always a risk of finding deficiencies in the reality of the morrow's plans.

-Integration of plans for the different organizational areas may not exist because they have been established by "Planning Office" without input or participation from line executives. The biggest mistake that can be made is to centralize planning into a "Planning Office".

Nevertheless, planning coordination must exist at the organizational level.

-The executives' mission, strategies and objectives are frequently ambiguous. Even if it is easy to define the mission of an enterprise, it is quite another thing to define the executives' responsibilities and functions to fulfil the objectives that guarantee success in such a mission.

-Different strategic missions require different types of managers. Some executives are excellent managers for specific types of business but are altogether a failure in others. Therefore, it is important to furnish the executives with enough motivation concerning different kinds of strategic missions.

-Selection of strategies may lead executives to work in a sort of strait jacket that inhibits creativity and innovation. Personnel Office should be instructed on the kind of executives necessary to carried out specific tasks at corporate level.

-Some firms define strategies so abstract that all significance is lost when trying to implement them. It is worthwhile not to forget that there are costs associated with inaccuracy and error in defining the business strategies for the different kinds of organizations.

-Subjectivity in assigning relative weights (pondering) hinders the competitive strategy from being fulfilled under the defined conditions.

-Corporate culture influences the ability of the organization to carry out strategies and objectives, and in defining Stability Indicators. The control the executives have over culture is limited, making it necessary to adjust business strategies to the corporate culture.

-Developing Countries are characterized by political and economic instability. For example, if inflation and devaluation are considered, forecasts may be inaccurate in accordance with their behaviour in time. According to Haines (1988) " Most of Corporate planning models published in the literature are impractical for Developing Countries, as they require a precision of input that is not possible in those Countries". These planning models require clarity in their definition, that is why it is necessary to be exact in its inputs and outputs and to have stable behaviour. However, clarity definition, precision in data and stable behaviour are difficult to find in Developing Countries.

c. Limitations in evaluation and control

-Planning evaluation must be based on results. However, an evaluation based on a consensus-pre-established time schedule causes the plan to become obsolete as soon as it has been modified.

-Problems associated in measuring intangible indicators (people s productivity for instance) can be encountered. In relation to supporting function, the result measured derives from the success of the

function, independent from the supporting function, which is only partially controlled. This process causes problems at the time of quantifying results.

-It is difficult to identify significant behaviourial measurements for executives, since their job does not generate end product, neither tangible nor calculable.

d. Limitations in the analysis of indicators

-There is a lack of accuracy and knowledge of the variables relevant to the identified indicators.

-It is necessary to go deeper in determining standard (capability and potentiality) indicators, especially in determining change tendencies with respect to competitiveness.

-It is important to have guidelines which allow a simplification of reality in identifying variables on which to decide strategies.

-Analysis of Stability Indicators must not be a cold calculation or an interpretation of figures isolated from reality. On the contrary, it should be encompassed by a set of facts and situations that make up the environment in which the enterprise operates.

-It is difficult to identify and measure intangible indicators as by

definition they can not be expressed in a quantitative way. Such critical areas as information, communication, technology, know how, managerial action, executives efficiency, employees loyalty, etc.

-The mechanical usage of indicators, can lead to a series of wrong practices. It may seem to be more important to get mathematical accuracy rather than choosing the indicators that furnish the best valid information.

-It is important to have uniform criteria in identifying the variables especially those related to effectiveness- measuring stability indicators. For example, comparing enterprises according to profits. Success can be either measured according to which of the enterprises made more money (profit) in a given period of time, which won more gains (here gains is understood as the existing relation between sales and assets), per employee, or percentage on paid capital.

Which criterion serves to define the correct indicator to categorize and compare enterprises?. If arbitrary criteria are used in identifying indicators then applied as standards for the sector where the enterprises operate, it would favour the image of some enterprises and harm others.

For instance, if different enterprises belonging to different sectors are analyzed, it could be said that measuring gains in terms of sales discriminates in favour of supermarkets who sell very large amounts of goods at narrow profit margins. Measuring gains as compared to assets

discriminates against every enterprise requiring a large investments, as would be the situation of utilities and real estate developers, although it would favour private utility services and pharmaceutical laboratories with small investments.

-In regards to the effectiveness of indicators, it is important to analyze whether it is worthwhile sacrificing the value of indicators today for their value in the morrow. As an example, increasing the extraction of coal in a given stratum could affect the coal recovery indicator (the ratio between steril m3 removed and commercial coal ton) in the medium or long term, bringing as a consequence an alteration in the production plan, and creating more immediate profits while perhaps causing future losses.

e. Limitations in decisions making supporting information systems

-These information systems do not consider uncertainty, natural in organizational processes. They have been so designed that they do not acknowledge the environmental uncertainty and complexity, therefore they stop being both useful and responsive when problems emerge within the organization.

-Most information systems developed up to now have had either little or negative effects on organizations. Instead of filtering relevant information, they have contributed to an overabundance of data and information.

-The enterprises tend to pick up and process data periodically but not continuously, making it difficult for the model to operate in real time. It is possible to know what is going on daily, weekly, monthly, quarterly, yearly, etc. but not constantly. For continuity sake, information should be analyzed as soon as it is produced.

-When the volume of information produced exceeds the amount the executives can analyze, it is almost impossible for anybody to take decisions particularly if working in a pre- established and short time span. The analysis must be carried out previously and in detail by lower level employees so that only relevant information will get through to the decision making executive.

-Operating in real time increases the capability of executives to process information. To recognize the patterns and to analyze the complexity of the situation under study. The need for constant integration of a great amount of data, makes it difficult, but not impossible to achieve interactive control. By constant monitoring of indicators, as new information arrives into the system, instabilities of a specific organizational process can be detected.

C.IMPORTANT FACTORS IN THE DEFINITION OF PLANNING

For a harmonious and flexible development in the implementation of plans, to expedite their evaluation, some of the following important factors must be considered:

-Planning and organization are homologous- The essence of planning is to define the goals of the enterprise by identifying objectives and strategies to fulfil the plans, subsequently implemented step by step as part of a whole. A planning process is an organized and disciplined way of implementing the sequence of necessary tasks to develop organizational strategies, since they help to unite the corporate courses of action.

-Planning is a continuous feedback process- It is not an activity that results from some specific plans. Continuity is attained by constantly readjusting rational expectations according to probable scenarios. Attainment can be reached, even when rational expectations and probable scenarios may be changing. The plan or an action to be followed should be continuously updated in the light of new information inputs.

According to Carpenter (1986), "Strategic management in the future requires a rolling agenda, capable to react to strategic needs of business, as they evolve. This is more than an annual process to be considered at one-year intervals. This process is carried out through a combination of daily dialogues on the schedule for the strategies of major business during monthly meetings to follow up, review and solve

problems as soon as they arise".

-Plans should be continually aborted- The organizations should be able to abort their plans continually. Plans should be produced constantly in order to make them dynamic in the light of new information. To do so, a sequence of corporate planning that could be aborted is required instead of a concrete unreal one, "The Plan", which can neither adhered to nor continuously adjusted in the organization, according to its adaptability. Plans have to be examined and then implemented day by day to adapt to present needs. A previously planned action may seem inappropriate as more timely information becomes available.

-Planning is a process implying adaptability- The real object of planning is to ensure the enterprise s adapted to an uninterrupted survival. The enterprise exists in an environment full of opportunities for change. Planning is the essential mechanism needed to adapt successfully to the ups and downs of the environment.

-Planning is a continuous decision making process- Planning is the result of a continuous decision making process based on communications, negotiations, and interpersonal understanding among executives concerning the principal factors affecting the organization.

The planning process must encourage employees' self-motivation. It allows the development of managerial competitiveness among the members of the organization, and helps to enrich the common understanding of the business corporate objectives, and the way in which these objectives

can be turn into reality. To make this possible, organizations must have future oriented personnel to plan, manage and commit resources.

-Planning process involves organizational closures- Planning is a continuous process repeated year in and year out, over the life span of an organization, dealing with changes in the environment, goals, and objectives contained in a close loop. Planning means a dynamic closure where there must be a continuity in the integral sense of past learning, present action, and future behaviour.

-Only results should be measured in the planning process- Plans should be generated and evaluated at any time during the year rather than according to a prescribed time scale. If they are measured by results and reevaluated as soon as the results are attained, a greater quantification of efficiency and efficacy can be obtained.

-A constant evaluation is important in the planning process- Important results are frequently those related to quality, quantity, punctuality, cost and customer service. These may require separate performance indicators. Most of the time, multiple measures are necessary, therefore, it is important to use a group of indicators which are of the balance measuring variety showing success or failure.

Supporting functions are frequently opposed to such measures, especially when they contain a great number of interrelated variables with an impact on performance.

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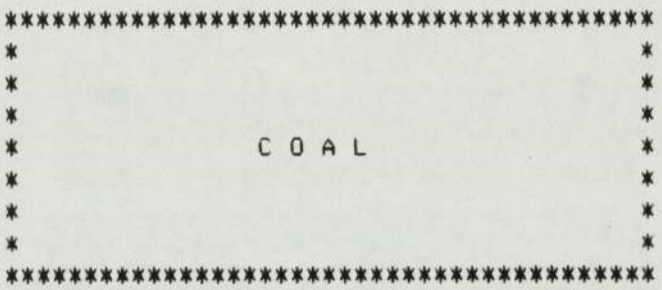

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APPENDIX A

ORGANIZATIONAL DESCRIPTION: CARBOCOL OF COLOMBIA

A. BACKGROUND:

After recognizing the importance of coal as an energy resource, the magnitude and quality of the Colombian reserves, their advantageous location, as well as an increase in international demand, the Colombian Government undertook the task of creating a company which would administer policies directed towards a greater development of the mining and energy areas. This development has had great social and economic effects in the country.

"On November 16, 1976, CARBOCOL was created as a State Industrial and Commercial Company, under the umbrella of the Ministry of Mines and Energy. Initial capital investment was US.$ 10.6 million, with shares being owned by other state entities. (Carbocol - Annual Report January/85)".

Colombian studies developed by the National Institute for Geo-Mineral Research (Ingeominas) reveal coal deposits which account for more than 40% of the Latin American Reserves. In seven of the 35 potentially coal rich zones in Colombia, there are 16.5 billion tons of proven, probable and inferred reserves. The North Cerrejon Mine has proven reserves of 1.6 billion tons at depths of up to 200 metres and 3.0 billion tons at depths up to 300 metres.

B. STRUCTURE OF THE FIRM:

Carbocol, S.A., has been in the coal business for just over fourteen years. "The General Shareholders Assembly that met on July 17, 1984, approved amending Article 27 of the Statutes of the Firm, whereby the conformation of the Board of Directors (the company's highest authority), was modified, as follows:

1. Minister of Mining and Energy, who presides, with the President of the Colombian Petroleum Company (Ecopetrol) as his substitute.
2. Minister of the Public Treasury (Finance), with the Director of the Bank of the Republic (Banco de la Republica) as his substitute.
3. Minister of Economic Development, with the Director of the Exportations Promotion Fund (Proexpo) as his substitute.
4. Four Representatives of the President of Colombia, each with his own substitute.

According to its statutory faculties, the Board of Directors organized three committees extracted from both the members of its Board in the Financial and Technical-Commercial areas and the National Coal Fund.

In 1979, a law was passed to create The National Financial Coal Fund, although it was modified according to the Miner Code in 1988. Carbocol's major objective is to finance different activities in the coal industry, to give financial and technical assistance for miners, to improve their social and economical conditions and also, to control the

environment.

In 1989, the shareholders participation according to the financial statements was:

-ECOPETROL, the colombian oil company (59.2%).
-PROEXPO, the national agency for promotion of exports (37.75%).
-IFI, the institute for industrial development (2.93%).
-INGEOMINAS, (0.06%).
-ECOMINAS, (0.06%).

The organizational structure of the Firm was modified by agreement of the Board and the functions of the three Vice-presidencies were reorganized into: Technical, Commercial and Financial departments. (Carbocol, Annual Report 1984).

In 1989 the firm underwent another reorganization. The following chart shows the current structure of Carbocol (Fig.53).

C. WORLD COAL MARKET SITUATION

The following historical summary is based on "The Commercial Report issued by the Board of Directors of Carbocol", internal working paper 1988, and the 4th Pacific Rim Coal Conference (held in Cartagena-Colombia in June 1989):

1945-1972

Just before World War I coal provided almost 80 per cent of the world's energy. During the postwar period, both industrialization and generation of energy were based on oil whilst the price was kept stable (U.S $ 2.00 per barrel).
The pattern of trade was determined by market forces and the UK secured about half the world exports via an efficient logistic network of coal chains from mine to final customer. Germany was second, supplying only European markets. These two leading exporters of the past, today make minimal sales to international coal markets. The world's dependence on coal declined, and over half the growth in energy demand was captured by oil. Technological changes are capable to destroy and create key markets.

In the decade after World War II, Europe's internal energy production failed to keep pace with demand, and traditional exporters diverted export coal to only domestic use, resulting in a further decline in trade. Coal progressively lost its markets in industry, transport, and the home, and the world economy became increasingly oil-based. The only coal trade was the strong demand for high quality metallurgical coal for the steel industries of Japan and Europe. If supply is not stable and competitive, markets will be lost.

1973-1980

Due to the last two major oil crisis of 1973 and 1980, a conversion from fuel oil to coal was stimulated creating an enormous demand for the import of steam coal. In 1973 coal became the lowest-priced fuel, and

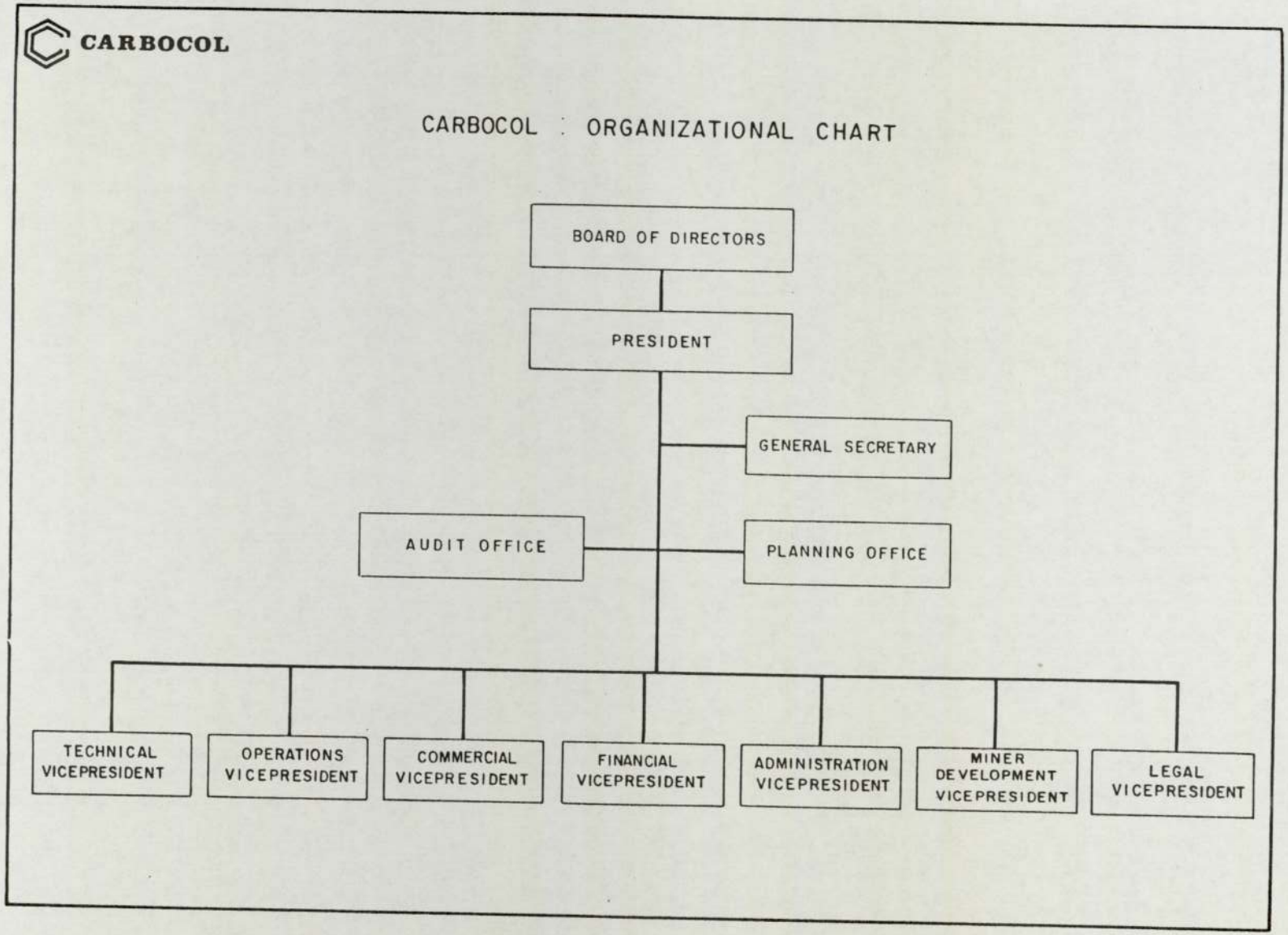

CARBOCOL
CARBOCOL : ORGANIZATIONAL CHART
BOARD OF DIRECTORS
PRESIDENT
GENERAL SECRETARY
AUDIT OFFICE
PLANNING OFFICE
TECHNICAL VICEPRESIDENT
OPERATIONS VICEPRESIDENT
COMMERCIAL VICEPRESIDENT
FINANCIAL VICEPRESIDENT
ADMINISTRATION VICEPRESIDENT
MINER DEVELOPMENT VICEPRESIDENT
LEGAL VICEPRESIDENT

FIG. 53

it looked like it was to stay that way, apart from unusual spells of very low oil prices likely to recur from time to time. A tremendous potential opened up for coal increasing its share of bulk heat markets where its comparative advantage was enormous. Not only coal importing countries installed coal-fired power plants but also the cement industry switched to coal.

This spurred traditional exporters such as South Africa, Australia, U.S.A, Poland, and Canada to make major investments to increase their production. The above mention crisis helped new coal producing countries like Colombia and China to obtain a foothold in the market.

1980-1988

The world economic recession beginning in the 80's has created an overproduction of coal. "No-one here, or anywhere in the trade for steam coal business wants to remember 1987. It was chaotic. Everyone arrived with their new mines to find the market two thirds the size of that forecast when they had invested their money. Coal prices disengaged entirely from any other fuel -they slid to an all time low partly under the weight of the collapse in oil prices but mainly just because of the fighting within the small traded steam coal market." Edwards M.J. (1989).

The sanctions and tariffs on South Africa during September 1986 enforced by some European countries as well as the U.S.A., had two impacts:
1) The final consumers in countries that did not sanction South Africa gathered immense low price South-African coal inventories.
2) South-African exporters adopted a very aggressive commercial policy in those countries which did not enforce sanctions. Those not imposing sanctions included the countries of Mediterranean Europe and The Far East.

The steam coal flows in the international market starting December 1987 show Australia and South Africa as the major exporting countries, and Europe and Japan as the major importing ones. To maintain their competitiveness the Australians put pressure on the control of export coal prices. This was done mainly by their government allowing them to negotiate at lower FOB prices, which added to cheaper freight and made their coal more attractive to the European market. As a result of all this, the first semester of 1987 was characterized by a reduction in coal pricing in all areas. Therefore, many of those producers who scarcely covered their cost variable were forced out to the markets. As a consequence, Australia had to close down seven of its mines, and South Africa, Poland, and U.S.A had to decrease their export production to 4 million tons, 3 million tons, and 2 million tons respectively in 1987. Today's exporters should not take for granted their current positions.

The decreasing world steam coal production, due to the closing-down of less competitive mines, the miners strikes both in South Africa and Australia, as well as China's difficulties to cope with its export obligations, brought an imbalance between supply and demand for the first semester of 1988. This disequilibrium added to the revaluation of the Rand and the Australian dollar in relation to the American dollar.

This change, plus an increase in railroad fares in South Africa, created a 2 to 3 dollar reaction in both European and Far Eastern markets. The biggest European consumers had to decrease their reserve inventories while coming to an agreement with the producing countries.

APPENDIX B

The following survey intends to discover the origins of planning and control problems always present in the organization. An analysis of effectiveness of the strategic planning system, focusing on major items is carried out: the System or Planning Process in itself and the Strategic Plan.

According to the kind of executive being interviewed, the relevant questions from the survey will be chosen to verify the existence and usage of efficient planning systems and techniques to attain the aforementioned scopes.

The emphasis is on a Total Planning System for the whole organization, that is, not one for a group of selected executives. Besides, the real objective of the survey is to perceive and analyze the impact the Strategic Plan may have had on the Organization and weigh the possible need to implant programs of evaluation of activities for such a plan to be successfully carried out.

A. SYSTEM OF PLANNING PROCESS

a. Planning process in itself

a) Could you perform a brief historical summary of the planning process and its evolution in Carbocol?.
b) Could you describe the present planning system?
c) How has been the learning process from past experiences?
d) Have there been experiences, that could have been used, considered? Have there been attitudes that could have been avoided or reinforced to attain success?
e) Could this planning system provide alerting signals towards possible arising changes and problems?
f) What mechanisms have been introduced to reach self-control, self-regulation and self-organization with the present planning system?
g) How are risk and uncertainty dealt within the present planning system? (e.g. price vis. fluctuations offers and supplies)
h) How is the organizational complexity handled? (e.g. kinds of contracts with operators and customers)
i) How are flexibility, adaptability, apprenticeship, and development handled in the present planning process?
j) How does the enterprise adapt to the fluctuations of the environment?
k) Is it possible, under the present planning system, to create a morrow for the organization?
l) How is the existing relationship between planning and control in the organization?
m) Do you think there is need to modify this relationships to better handle the planning and control cycle or do you think they are performing correctly?
n) Has there been any attempt to define planning and control in real time?

b. Decentralizing process

a) How has been the planning process decentralized?
b) How do other areas, in the company, participate in the design and actualization of the planning process?
c) What negotiations are carried out to decentralize information and resources from the different organizational areas?
d) Does the planning system generate competitiveness among the areas?
e) Which is the feedback system kept in the organization, especially in the other areas involved in planning?
f) Is there any kind of problems in planning with a corporate vision?
g) Is there some kind of committee, as communication generating mechanism, to support the planning function?
h) How does the organizational culture influence the process for this to be carried out?
i) Are top level executives or the Planning Office who motivate and provided the workers with confidence and security in the planning process?
j) Do you think executives delegate responsibility on the workers?
k) Are suggestions from workers considered? If this is so, are there working groups with the vision towards the morrow in the organization?

c. Methodology of the planning system

a) Has the company used any kind of particular methodology to make the planning system effective?
b) If this has been so, which was the selecting process to decide to this specific methodology?
c) Were the different methodologies used by the various strategic planning schools analyzed?
d) Was the efficiency of the methodology considered in relation to the organizational problem?
e) In its selection, was the kind of organization, maturity of the organization vis. the sector, maturity of coal vis. other sources of energy considered?
f) Describe the methodology that has been used?
g) Has the company received suggestions from a particular school? Have they been followed up?
h) Does the Planning Office design and coordinate the methodology to be used in the other areas?
i) Is the methodology standard in all the organizational areas?
j) At corporate level, how does the methodology integrate all the areas?
k) Is every worker in the organization acquainted with the methodology?
l) Has the use of this methodology been followed up by the organization?

d. Strategic Business Units (SBU)

a) Which criteria was used in defining SBU's?
b) Why are commercial and socii-economic activities acknowledged as SBU's?

c) Has the company made any effort towards the identification of the different levels of recursion in each particular SBU and in Carbocol altogether?
d) Has the company identified the levels at which crucial decisions are taken?
e) How are these levels recognized to concentrate decisions taking towards more important aspects?
f) Has the company made any attempt into understanding the structure of control to suit the problems of each level?
g) How does the company obtain a balance in allotting the resources from the SBU's?
h) How are resources shared among the different SBU's?
i) How does the organization keep control of all the processes?
j) Is there any difference between strategic units and supporting areas?
k) If this is the case, does the company have a particular methodology to make them out and then relate them?
l) Is there a mechanism permitting to identify when and where a supporting area interferes with a SBU?

e. Information System and Data Bases to support the Planning System

a) Does the Planning Office have an Information System or Data Base to support the Planning System?
b) If this is the case, is it used for the sole purpose of the Planning Office or is it used by the whole organization?
c) Could simulations, to readjust the expectations of the plan, be made through the Information System?
d) Is the Information System flexible enough to answer continuously to changes occurring in both information and technology?
e) Is the information timely and reliable?
f) How is the historical information used?
g) How is information organized?
h) How are Data Bases and Information Systems used in the making of economical, social and organizational studies?
i) What information problems are there?
j) Has anybody thought of an Information System for executives?
k) In the event information coming from the Planning Office were decentralized, how do other areas handle this information?
l) Describe the process of information flow among the areas?
m) What kind of mechanisms do they use to activate the flow?
n) Do the right worker and his organizational area receive this information flow?
o) Does management know the kind of information that must be transmitted for every type of executive at each level of recursion?
p) Who is in charge of integrating the information coming from every SBU at the time of taking corporate decisions?
q) Are there corporate level available statistics?
r) How does the company get information from its environment, and how does it handle offer and supply?
s) What kind of Information Systems or Data Bases are handle at the coal energy sector?
t) Where are Information Systems or Data Bases actualized?
u) What kind of information from competing enterprises is necessary?

f. Planning in the short, medium and long term

a) What kind of planning related to planning horizons are there?
b) Could the life span of planning in the short, medium and long term be estimated?
c) What has been done for the planning system to be enforced in real time?
d) What kind of criteria are used to plan in the short, medium, and long term and how are they carried out?
e) Has the long term planning been successful?
f) What working groups have been created to analyze what impacts the Plan may have had in the organization in the long term and what have been the results?
g) How are plans integrated and compared in the different planning horizons?
h) How are the ideas of tactical planning (short term), strategical (medium term) and normative (long term) developed in accordance with monitoring and control?
i) How could the organizational behaviour be evaluated in the short, medium or long term?
j) How is the integration process of the different plans in accordance with the planning cycle of the enterprise carried out?
k) How has the Plan been designed to be flexible within the different planning horizons?
l) How does the "Consolidation Plan" (Plan para la consolidación) consider the different kinds of plans?
m) How is the continuity of the planning horizon and the medium and long term kept when the president is changed?
n) Does the Plan change essentially from one year to the other and why?
o) How does the Planning System overlaps with the budgeting System?

g. Planning the Coal Sector

a) Which do you think are the external factors that most affect the enterprise?
b) How are the different opportunities for Carbocol, within the Planning System considered?
c) How is the Strategic Plan for Carbocol related to the Strategic Plans for the operators (Exxon, Intercor, etc.)?
d) Does the relationship among Carbocol and the different operators for each coal project, customers, etc. have any influence in the plan?
e) How is the participation of the Planning Office in the National Commission for energy used to profit and who are the commissioners?

h. Organizing the Planning Office

a) How is the Planning Office organized internally?
b) What guarantees that the way the Planning Office is organized would give the needed support for the Planning System to be effective?
c) How many workers are there in the area at present?
d) Are they enough and with the relevant background to develop the functions correctly?
e) Are these workers sufficiently trained so as to be planning

assistants?

f) Which are the company areas directly related to the Planning function?

B. STRATEGIC PLAN

a. How the Strategic Plan is carried out

a) Could you describe briefly the process to be followed in designing the Strategic Plan?
b) How is the Plan for Carbocol connected with other Plans either from the State or the Energy Sector?
c) Does the Planning Office, at the moment of designing the Plan, identify problems or think of solving alternatives, does the P.O. talks them out with the people involved?
d) Are there any guiding patterns to help executives define the Plan (productivity, profitability, marketing, sales, etc.)?
e) Which have been the changes in the Plan and how have they been communicated ?
f) How are priorities decided? Is there a risk of wasting too much time on easy to solve problems?
g) What has been done to avoid bureaucratizing the Plan?
h) Is the design of the Plan such a mechanical process that the worker thinks it is another routine like task?
i) Which is the wording and addition process of the Plan?
j) Who, how and when must actualize the terms used in the Plan?
k) Are the changes in terminology communicated? To whom and how?

b. Actualizing the Plan

a) What actualizing mechanism are used for the Plan in the short and medium term? (e.g. How could the Mission be modified? in case it is required?)
b) How does the P.O. introduce in the Plan the actualization related to a reorganization of the company or the changes in the business environment?
c) Is it possible to modify objectives and tasks when strategies are modified?
d) How is the Plan re-evaluated in the light of new information?
e) Once objectives have been defined, are policies and plans defined to guarantee the Plan will not be in the intention stage? (How are results reached, how are they quantified and when)
f) Does the attainment of objectives guarantee the fulfilment of the strategy?
g) How do you avoid objectives from becoming obsolete?
h) How are the profitability objectives intertwined with the financing strategy and the strategic products of the enterprise?

c. Evaluating the Plan

a) Could you briefly describe the system used in the evaluation of the Plan?
b) How are strategies and objectives followed up and monitored?
c) How is the evaluation, commitment, and responsibility of the Plan?
d) Are the evaluating method sufficiently flexible to provide, in some given circumstances, a handier solution?
e) Is the evaluation based on attained objectives or results?
f) Are goals established to be attained in a time horizon?
g) How does the environmental change affect attaining an objective in time? What has been done to avoid such a change from affecting the attainment of objectives?
h) Is it possible to evaluate plans, at any moment, with the present system?
i) What has been done to carry out or evaluate the external variables interfering with the Plan for Carbocol?

d. Efficiency of the Plan

a) What is done with the evaluation results?
b) What has been done to guarantee the Plan be really effective?
c) How are correcting actions generated?
d) How are alerting signals detected with the present system?
e) How is productivity improved? How are costs reduced?
f) How are instabilities detected?
g) Is it possible, with the present system, to detect what should be done before anything abnormal happens?
h) How are resources, bottlenecks, and restrictions detected and evaluated?
i) How are necessary organizational developments detected?
j) Has the company established measuring standards? What kind of?

APPENDIX C

GUIDELINES TO IDENTIFY INDICATORS

This list of questions could be used as guidelines to help in the identification of Indicators.

a) How would you define the functional organized process involved in your particular job?
b) How would you describe the environment, you are at, not influencing the process? (Environment, Human Resources, Social System, Technology, Modus Vivendi, etc.)
c) Are objectives specific enough to serve as standards for measuring the organization performance?
d) Is there available information to set new objectives, and quantify and to measure them?
e) What measurements could be developed to determine the fulfilment of objectives?
f) How could you control the activities you are responsible for?
g) Could key organizational variables be identified to allow the enterprise to perform most effectively?
h) Can you identify both most important and high priority issues?
i) How more effective the present measurements for controlling the company could be?
j) What other measurement could be taken if data was available?
k) What additional data could be necessary to control correctly the critical variables of the organizational activity?
l) What other kinds of measurements are you supposed to take?
m) Could you define the measuring criterion you have used? Do you know its meaning?
n) How is it possible to measure actuality, capability, and potentiality of critical variables?
o) How would you define the boundaries of each variable in accordance with the established limits of stability?.

APPENDIX D

DATA REPORTS

This Appendix contains some slides pertaining to the input data as well as the reports generated by the MODEL on screen or on paper.

The information required to manage the indicators involved in the exploitaition phase for the Central Zone project, is considered an entire system that integrates the commercializing and production functions (Fig.26). Together, It contains all the necessary steps, to be considered from mine lode until the coal reaches the final customer. Production includes mining, trucking and stocking at Central Cerrejon, North Zone (Albania) and Port. Commercialization includes sales and their after control.

The systems department at Carbocol selected the computer tool, ORACLE, for its open architecture and software portability. As a consequence, the utilized prototype was developed in ORACLE. In the MODEL all the menus and reports are generated in Spanish; the official language used internally in the company is Spanish.

The Coal Production Indicator is the sample because of its significance and because it was used to illustrate measurement of indicators in chapter III.A.e. In this Appendix the required information to follow the "production" indicator is considered in detail and is directly related to tons produced, delivered, transported and shipped. It also considers the coal commercialization and its information to manage other indicators such as clients, contracts, and employees that already have been defined but are not included in detail in this particular example.

The idea is to have a prototype that permits management of the production indicator in all its runs and to make proofs and demostrations of the effectiveness of the MODEL.

The indicators in the MODEL are defined in a relational DATA-BASE whose information can be placed on screen or captured in the different operational models that exist at Carbocol (financing, production, etc. as it is shown in Fig.49). On the other hand, reports generated by CYBERSYN as alerting signals, behaviour signals and interactive planning are captured in another Data Base.

The slides in the attached envelope at the end of this Appendix, is a visual aid of the assembled model. The numbered slides from #1 to #19 correspond to reports or input data generated in ORACLE. The numbered slides from #20 to #27 correspond to reports or input data generated from CYBERSYN dealing with data analysis.

1. Input Data to the MODEL

The input Data to the MODEL and the reports generated by the MODEL on the screen are developed in ORACLE. The forms developed for this example are explained below.

The PRINCIPAL MENU (menu principal) contains seven options for use. These options are chained to other menus and other data forms as it is shown in slide #1.
The seven options defined are in the following order: Indicators, Measurements, Clients, Contracts, Employees, Points and Exit.

The INDICATORS MENU (menu indicadores) as a branch of the Principal Menu, allow us access to the DATA-BASE that contains relevant information of indicators (Fig.49). The INDICATORS MENU is shown in slide #2. This form facilitates the codification and definition of the indicators. Each indicator considers its description and its formula definition. The code, which identifies each indicator, should be unique in the system.

Slides #3 and #4 show the CAPABILITY (capacidad de un indicador) and POTENTIALITY (potencial de un indicador) of each indicator. Essentially, through a corresponding code to the existing indicator, both forms capture the same information,. The formula, which characterizes each indicator, appears on the screen. The date on which the capability or the potentiality is modified and its respective values, are input to the system, according to the design of the respective screens.

In slide #5 appears the INDICATOR'S TENDENCY (tendencias de indicadores), its formula, its description and its date. These data is captured from CYBERSYN.

Slide #6 shows the corresponding form to the REPORT OF EXCEPTIONS (excepciones de indicadores). This form captures the indicator's code, the date on which the exception occured, and the deviation value that CYBERSYN reports. The number of times an exception of the indicator occurs is represented on the screen by the counter, "numero". Each exception is allowed to be reported to the employee up to four times. The reports include texts regarding findings, comments, recomendations and risks of the detected deviation for Cybersyn.

The second option of the Principal Menu is MEASUREMENTS (mediciones), which is found under Sub-Menu of slide #7. The Sub-Menu allows us to invoke the relevant forms to the measurements taken at the mine. The amounts of coal extracted and the sterile displaced to obtain that particular coal are measured at the pit (mediciones en minas). Most of the time, the value of the physical inventory does not match the estimated one because of a series of variables that could alter either the final value or the factors relevant to quality. Such factors could be measured as stored measurements (mediciones almacenamiento). Physical inventories are continually measured at the open land storage points (inventario fisico). (See Chapter III.A.e.2e.a).

The option MEASUREMENTS OF MINE (mediciones en minas) of slide #8 allows entry or access to the mine code with its name and location (in this particular case it corresponds to the Central Cerrejon coal project). The place (ubicación), date (fecha medicion), amount of coal extracted (carbon) and sterile displaced (esteril) are also taken into consideration on this screen.

The option STORAGE MEASUREMENTS (mediciones en puntos de almacenamiento) of slide #9 corresponds to the required form for the information regarding quality control at the land storage. At both the mine and the shipping harbour (as a point of storage), quality control is carried out. On the screen it is important to report where the measurements for quality control were taken (codigo y nombre del punto), the date when the measurement was taken (fecha) and the quality factors when and where they measure it. Coal quality depends on the following factors: fix coal (carbon fijo), moisture (humedad), ash (ceniza), volatile matter (material volatil), sulphur (azufre) and BTU or units of energy produced per coal. In addition an input on the physical location of the sampled coal is described: whether it was enroute to exit or entry.

The option PHYSICAL INVENTORY (inventario físico por punto) of slide #10 is a form of multi-inputs where one can enter the point of location (codigo punto), date (fecha inventario) and coal quantity (cantidad fisica de carbon) and the stock inventories from different locations simultaneously. There are mechanisms to validate the information entered into the system, which permit, for example to check if the storage points are geographically accurately defined.

Returning to the Principal Menu of slide #1 and taking the option CLIENTS (clientes), appearing in slide #11, where the computer gives each coal client a code number (codigo del cliente), the company name (nombre), the president or the company contact (presidente), the buyer (jefe de compras), the city (ciudad) and the country (país) where established, and the port (puerto) where shipments should be made. Additionally, there is the salesperson (vendedor) at Carbocol who is responsible for working with the client. There is an automatic validation for each client, its employees which the Carbocol salesperson verifies.

The following option of the Principal Menu CONTRACT MENU (menu de contratos) appears in slide #12 that corresponds to the Sub-Menu which controls the contract forms and invoices. The contract forms (contratos) have two associated blocks; one for entry of the client's contracts and the second for the entry of agreed deliveries for each contract as it is shown in the invoices (facturas).

The CONTRACTS (contratos) option appears in slide #13: it contains the contract number (contrato No.) ; the contract term (plazo) which can be short, medium, and long-term (when unspecified, the system assumes a long-term contract); the client (cliente); the coal quantity agreed upon in the contract (carbon opcional); the coal quality which are measured within ranges of the minimum and maximum values corresponding to moisture (humedad), ash (ceniza), sulphur (azufre), volatile matter (material volatil), and BTU's. Finally, the information at bottom

determines the initial contract values (valor); the adjustments (ajustes) and to calculate the final values (valor final).

Slide #14 SHIPPING INVOICE (factura-embarque) concludes the contract cycle of slide #12. This form verifies that the contract number (contrato numero), the coal delivery number (entrega No.), and the client are accurately defined. In addition, it introduces to the model the country (pais), the transport ship (buque), the quantity of coal to be billed (carbon), the form of payment (forma de pago), the quality factors [moisture (humedad), ash (ceniza), sulphur (azufre), volatile matter (material volatil), and BTU's], from the invoice. The F.O.B. price of the coal (valor F.O.B.), and the freight price (valor flete) agreed upon initially and the quality or quantity adjustments (ajustes) give us the "total" value of the bill (total). The user of the model should take into account the adjustments made previouslly in slide #13 and include those contract adjustments to the final invoice or bill.

Returning to the Principal Menu, the option EMPLOYEES (funcionarios) appears amplified in slide #15. This form is associated with the management employees at the firm. Each employee (codigo funcionario, nombre y cargo), responsible for a specific task within the firm, has association with an immediate upper manager (codigo y nombre del Jefe) to whom it reports the exceptions when required.

The last option of the Principal Menu is POINTS (puntos de almacenamiento y/o produccion). It is a control screen which is shown in slide #16. The points to be defined are either storage or production. With the entry code, the system verifies whether the point exists and brings up its number; in the contrary case, the name stays in white until the user enters the value for it.

One of the system's reports for the production indicator of any month is PRODUCTION CENTRAL-CERREJON shown in slide #17. This report shows the data on a daily basis of the tons of coal produced daily, that is entered into CYBERSYN as actual data, the tons of sterile produced, the mine inventory, the coal quantity transported by trucks from Central Cerrejon project to North Cerrejon Project (Intercor), the Intercor stock, the quantity in tons of coal transported by rail from the "inventory at the port" and the quantity of "tons shipped", corresponding to the tons of coal dispatched to a determined client. In the lower part of the report appears the totals of the month for each one of the descriptions completed for the Production Indicator. Equally, there are some statistics measurements that are considered significant with the monthly behaviour of the indicator such as the oldest, youngest and average value of the coal produced or in inventory during the month.

Slide #18 pertains to a new report of the system examining the quality of the dispatched coal for any month "QUALITY CENTRAL-CERREJON". In this report appears the date, the quantity of coal produced with the specified quality disintegrated in the six factors: moisture (humedad), ash (ceniza), sulphur (azufre), volatile matter (material volatil), and BTU's. Equally, at the end of the report are quality data, average, extremes that have been produced during the month, disintegrated

accordingly to each one of the production factors.

2. Reports from the MODEL

CYBERSYN facilitates the data analysis from the MODEL. Data is entered on the screen in the ORACLE's Forms described already, and automatically reports are generated from CYBERSYN. Some of these reports are explained below:

Slide #19 pertains to the definition on the Production Indicator which is generated onto the CYBERSYN screen. Here it is necessary to define the indicator, the units in which it has been defined and its description.

Slide #20 shows a CYBERSYN screen with the respective actual data, capability and potentiality for the Production Indicator. The productivity, latency and performance index values are also shown for July 12, 1988. In this slide the values are shown simultaneously, which facilitates the index analysis.

Slide #21 shows the time series corresponding to horizontal time analysis for planning coal production quantity.

Slide #22 shows the Stability graph corresponding to the time series analyzed for the coal production indicator.

Slide #23 shows the index planning time scales: tactical, strategic and normative. In the same form the levels that defined the tuning have taken into account the possible states one is able to find in the system, and its corresponding percentages of probability.

Slide #24 shows the planning values for the Production Indicator in tons. These values correspond to the potentiality, the capability and the actuality for the final date of the actualization of the DATA-BASE.

Slide #25 is the Tactical Plan for the Production Indicator for July 12,1988; It shows the date that capability and potentiality values were defined for the system; the statistical values for the current mean, forecast mean and the achievement index. Additionally, a new plan with its respective values appears for the current plan and the achievement index.

Slide #26 is the Strategic Plan of the Production Indicator and has the latest values of actualitty, capability, and potentiality. It also shows the monthly values for actuality and the index of achievement.

Slide #27 shows the state of the indicator for a date desired, its respective values and the exceptions that it produces.

M E N U P R I N C I P A L

_Indicadores

Mediciones

Clientes

Contratos

Funcionarios

Puntos

Terminar

Manipulacion de Indicadores - Capacidades,Potencial, Tendencias y Excepciones
Char Mode: Replace Page 1 Count: *0

SLIDE No.1

MENU INDICADORES

- Indicadores
- Capacidades
- Potenciales
- Tendencias
- Excepciones
- Exportar
- Menu Anterior

Creacion, Modificacion, Eliminacion y Consulta de Indicadores

Char Mode: Replace Page 3 Count: *0

SLIDE No.2

C A P A C I D A D D E U N I N D I C A D O R

CODIGO IND _ FORMULA

DESCRIPCION

FECHA

NUEVO VALOR

Char Mode: Replace Page 1 Count: *0

SLIDE No.3

P O T E N C I A L D E U N I N D I C A D O R

CODIGO IND _ FORMULA

DESCRIPCION

FECHA

NUEVO VALOR

Char Mode: Replace Page 1 Count: *0

SLIDE No.4

TENDENCIAS INDICADORES

INDICADOR FORMULA

DESCRIPCION

FECHA VALOR

Char Mode: Replace Page 1 Count: *0

SLIDE No.5

E X C E P C I O N E S I N D I C A D O R E S

INDICADOR

DESVIACION NUMERO FECHA NEG.

HALLAZGOS

COMENTARIOS

RECOMENDACION

RIESGOS

FUNCIONARIO NOMBRE

FECHA

SLIDE No.6

M E N U D E M E D I C I O N E S

_ Mediciones en Minas

Mediciones Almacenamiento

Inventario Fisico

Menu Anterior

Ingreso de mediciones de Produccion en Minas
Char Mode: Replace Page 2 Count: *0

SLIDE No.7

MEDICIONES DE UNA MINA
(en toneladas)

CODIGO MINA _ NOMBRE

UBICACION

FECHA MEDICION CARBON

ESTERIL

Char Mode: Replace Page 1 Count: *0

SLIDE No.8

MEDICIONES EN PUNTO DE ALMACENAMIENTO
(en toneladas)

CODIGO PUNTO _ NOMBRE

FECHA MEDIC.

HUMEDAD

MAT. VOLATIL

BTUs

CANTIDAD DE CARBON

CANTIDAD DE CENIZA

CANTIDAD DE AZUFRE

ENTRA/SALE 1

Char Mode: Replace Page 1 Count: *0

SLIDE No.9

INVENTARIO FISICO POR PUNTO
DE ALMACENAMIENTO

CODIGO PUNTO FECHA INVENTARIO CANT. FISICA DE CARBON

Char Mode: Replace Page 1 Count: *0

SLIDE No.10

C L I E N T E S

CODIGO CLIENTE _

NOMBRE

PRESIDENTE

JEFE COMPRAS

CIUDAD

PAIS

PUERTO

VENDEDOR

SLIDE No.11

M E N U C O N T R A T O S

Contratos

Facturas

Menu Anterior

Ingreso, Modificacion y Consulta de Contratos con sus respectivos Embarques

Char Mode: Replace Page 4 Count: *0

SLIDE No.12

C O N T R A T O S

CONTRATO No. _ PLAZO

CLIENTE

CARBON : FIJO 0 OPCIONAL

CALIDAD : min max
HUMEDAD

CENIZA

AZUFRE

VOLATIL

BTU

VALOR 0 AJUSTES 0 VALOR FINAL 0

Char Mode: Replace Page 1 Count: *0

SLIDE No.13

F A C T U R A E M B A R Q U E

FACTURA NUMERO _

CONTRATO NUMERO ENTREGA No.

CLIENTE PAIS

BUQUE CARBON FORMA DE PAGO

HUMEDAD	CENIZA	VOLATIL	AZUFRE	BTU

VALOR FOB 0

VALOR FLETE 0 SUBTOTAL 0

AJUSTES 0 TOTAL 0

Char Mode: Replace Page 1 Count: *0

SLIDE No.14

F U N C I O N A R I O S

CODIGO FUNCIONARIO _

NOMBRE

CARGO

CODIGO JEFE

NOMBRE JEFE

Char Mode: Replace Page 1 Count: *0

SLIDE No.15

PUNTOS DE ALMACENAMIENTO
Y/O
PRODUCCION

CODIGO PUNTO — NOMBRE

SIGUIENTE PUNTO NOMBRE

TIPO DE PUNTO

UBICACION

TIPO DE TRANSPORTE

Char Mode: Replace Page 1 Count: *0

SLIDE No.16

PRODUCTION CENTRAL-CERREJON

DATE	COAL-TONS	STERIL-TONS	MINE-STOCK	DELIVER-TONS	INTERCOR-STOCK	TRANSPORTED-TONS	PORT-STOCK	SHIPMENT-TONS	
01-Jul-88	0	7084	3663	345	14936			0	
02-Jul-88	0	7910	3442	221	15157			0	
03-Jul-88	0	0	3442	0	15157			0	
04-Jul-88	0	1708	3442	0	15157			0	
05-Jul-88	0	6188	3205	237	15394			0	
06-Jul-88	0	4256	3035	170	15564			0	
07-Jul-88	750	4844	3374	411	15975			0	
08-Jul-88	1350	6118	4340	384	16359			0	
09-Jul-88	825	5894	4795	370	16729			0	
10-Jul-88	475	0	5270	0	16729			0	
11-Jul-88	925	14	5978	217	16946			0	
12-Jul-88	3600	7588	9257	321	17267			0	
13-Jul-88	0	8064	9000	257	17524			0	
14-Jul-88	1380	4606	9950	430	17954			0	
15-Jul-88	1620	4942	11038	532	18486			0	
16-Jul-88	390	5418	10813	615	19101			0	
17-Jul-88	0	0	10323	490	19591			0	
18-Jul-88	270	5628	9057	1536	21127			0	
19-Jul-88	540	4158	8491	1106	22233			0	
20-Jul-88	875	5348	7589	1777	24010			0	
21-Jul-88	750	6104	7053	1286	25296			0	
22-Jul-88	1125	7686	6809	1369	26665			0	
23-Jul-88	250	4564	6403	656	27321			0	
24-Jul-88	0	2492	6403	0	27321			0	
25-Jul-88	950	6496	5962	1391	9142			19570	
26-Jul-88	950	7868	5484	1428	10570			0	
27-Jul-88	0	7728	4978	506	11076			0	
28-Jul-88	0	7518	4340	638	11714			0	
29-Jul-88	1100	5614	4297	1143	12857			0	
30-Jul-88	75	3360	4372	0	12857			0	
31-Jul-88	0	0	4372	0	12857			0	
TOTAL MONT 7	18200	149198	4372.00	17836	12856.94			19570	COST 2331.16
TOTAL +	3600	8064		1777					
TOTAL -	0	0		0					RATIO
AVERAGE	587	4813		575					

SLIDE No.17

QUALITY CENTRAL-CERREJON

DATE	PRODUCTION	MOIST	ASH	VOLATILE-MATTER	FIXED-CARB	SULFUR	BTU
01-Jul-88	345.46	10.37	8.87	33.46	47.30	0.72	11389.00
02-Jul-88	221.02	10.57	5.55	33.84	50.04	0.71	11731.00
05-Jul-88	236.98	9.96	15.25	30.87	43.92	0.91	10520.00
06-Jul-88	170.74	7.67	8.89	33.48	49.96	0.96	11807.00
07-Jul-88	411.02	7.50	6.50	34.75	51.25	0.81	12382.00
08-Jul-88	383.56	10.82	2.38	35.22	51.58	0.69	12529.00
09-Jul-88	369.68	12.11	1.87	35.35	50.67	0.72	12418.00
11-Jul-88	216.84	8.43	3.45	37.07	51.05	0.94	12711.00
12-Jul-88	320.92	10.06	3.30	35.16	51.48	0.75	12517.00
13-Jul-88	256.64	10.35	2.59	35.44	51.62	0.76	12605.00
14-Jul-88	429.68	9.59	4.33	34.99	51.09	0.89	12623.00
15-Jul-88	532.30	9.62	2.48	35.88	52.02	0.85	12748.00
16-Jul-88	615.38	8.10	2.79	36.13	52.98	0.74	12833.00
17-Jul-88	489.54	10.45	2.34	35.07	52.14	0.79	12630.00
18-Jul-88	1536.44	9.75	4.28	35.05	50.92	0.83	12387.00
19-Jul-88	1105.80	8.41	5.69	35.67	50.23	0.78	12342.00
20-Jul-88	1777.22	8.30	4.89	36.07	50.74	0.69	12492.00
21-Jul-88	1285.96	8.61	8.11	34.20	49.08	0.71	11918.00
22-Jul-88	1369.32	7.32	5.52	36.24	50.92	0.77	12525.00
23-Jul-88	655.50	8.01	3.27	36.84	51.88	0.53	12756.00
25-Jul-88	1390.62	6.95	4.37	36.12	52.56	0.66	12806.00
26-Jul-88	1427.76	8.99	3.25	35.41	52.35	0.74	12697.00
27-Jul-88	506.06	8.49	3.49	35.52	52.50	0.78	12736.00
28-Jul-88	638.30	7.79	4.07	36.10	52.04	0.84	12685.00
29-Jul-88	1143.16	7.28	3.21	37.06	52.45	0.82	12899.00
MONTH-AVERAG 7	17835.9	8.62	4.63	35.56	51.18	0.76	12489.57
TOTAL +							20
TOTAL -							5

SLIDE No.18

Current User: Syncho Ltd.

CyberFilter Index Review For PRODUCTION-INDEX

Principle Definition

Index name: PRODUCTION-INDEX
Units: TONS
Full description:
COAL QUANTITY PRODUCE IN CENTRAL CERREJON

SLIDE No.19

Current User: Synoko Ltd.

CyberPilot- Index Review For PRODUCTION-QUANTITY 12 JUL 1988

Tactical Information Summary

Current Assessment

Potentiality: 8888

Latency: 0.87

Capability: 7000

Performance: 0.73

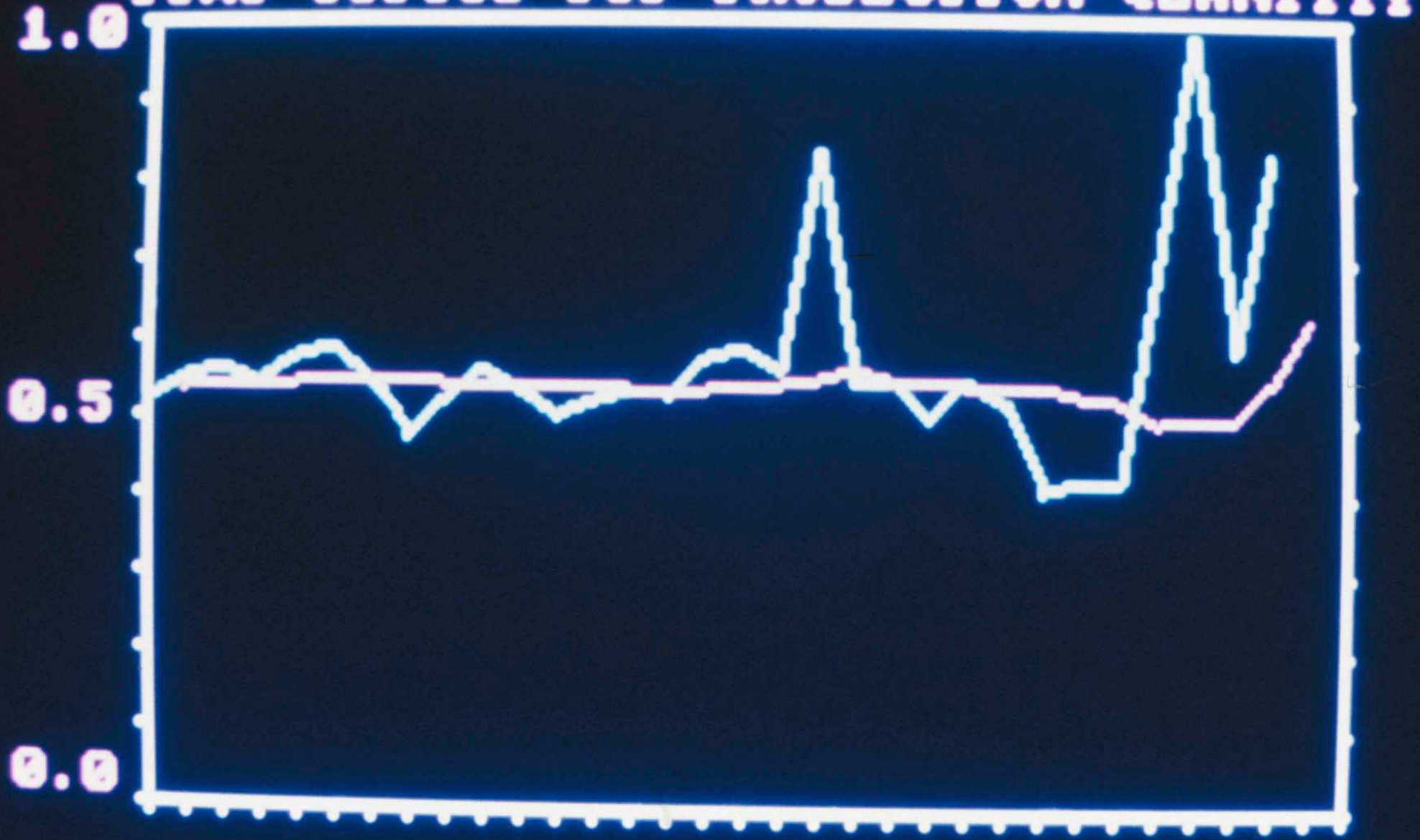
Achievement: 0.83

Optimality: 5824

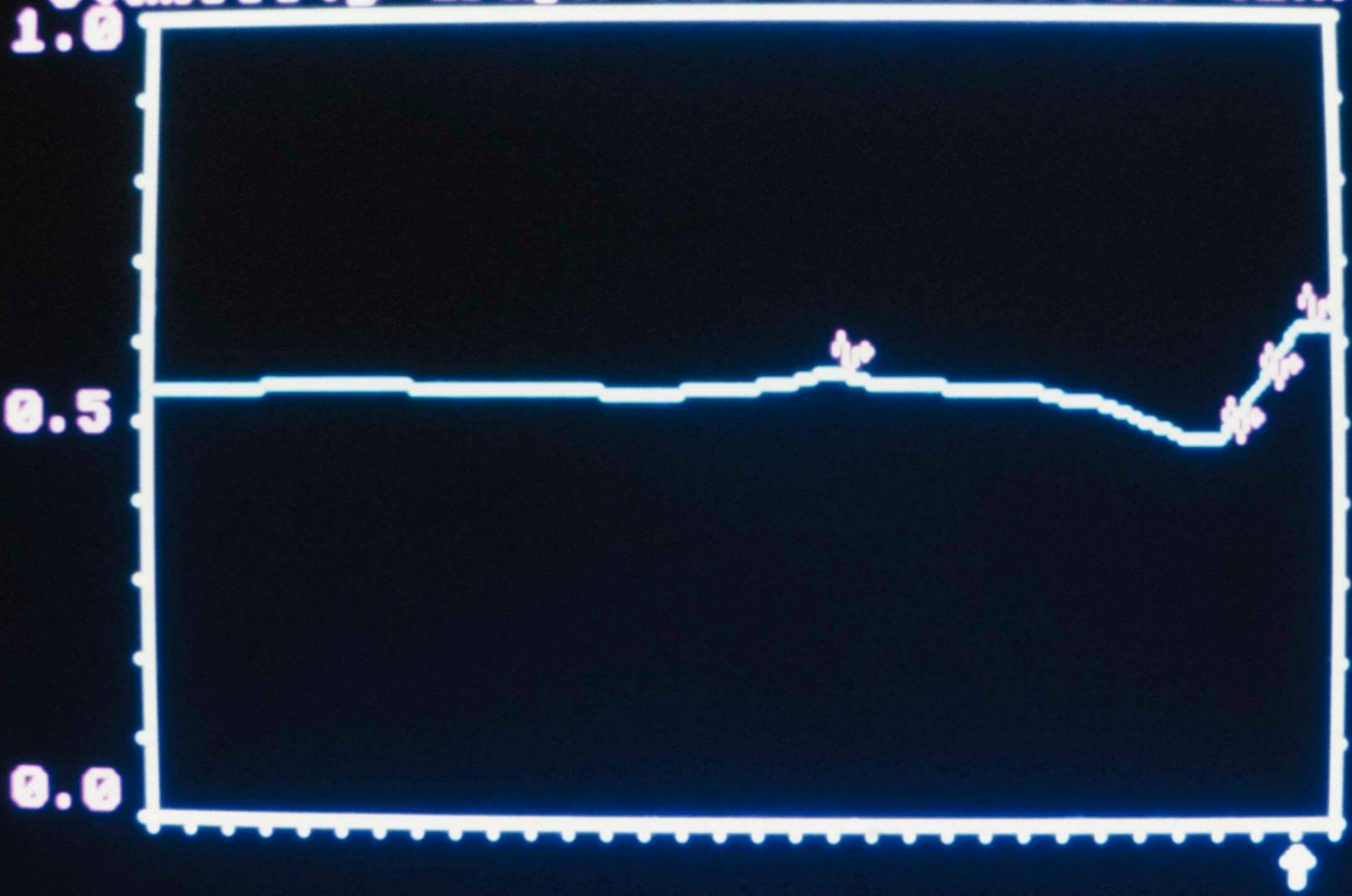
Last data received on 12.07.88

Press Esc to exit or any other key to continue.

Time Series For PRODUCTION-QUANTITY



Stability Graph For PRODUCTION-QUANTITY



Index Planning Time Scales

Tactical:	Daily (inc. weekends).
Strategic:	Monthly (calendar).
Normative:	Yearly.

Start from: 01.06.88

Index Tuning Levels

State.	Probability.
No change:	90.00%
Step:	0.30%
Slope:	0.30%
Transient:	9.40%

Overall Sensitivity: 60%

SLIDE No.23

Planning Values For PRODUCTION-QUANTITY

Units:	TONS
Actuality:	3600
Date:	12.07.88
Capability:	7000
Last Amended:	12.06.88
Potentiality:	8000
Last Amended:	12.06.88

Esc: Exit. F1: Act. F2: Cap. F3: Pot.

Tactical Plan For PRODUCTION-QUANTITY
Date: 12.05.88

Current capability:	7000
Last actuality:	5824
Current achievement:	0.83
Current mean:	5824
Mean achievement:	0.83
Forecast mean:	5824
Forecast achievement:	0.83
Suggested plan:	
Current plan:	5824
Planned achievement:	5824
	0.83

Esc: Exit. F1: Plan. F2: Notes.

Strategic Plan For PRODUCTION-QUANTITY

Latest actuality:	5824
Associated capability:	7000
Latest achievement:	0.83
Current strategic mean:	0.83

Planned Strategic Values

	Date.	Actuality.	Achievement.	Date.	Actuality.	Achievement.
>	01.08.88	5900	0.84	01.02.89	6300	0.90
	01.09.88	6000	0.86	01.03.89	5900	0.84
	01.10.88	5700	0.81	01.04.89	5980	0.85
	01.11.88	6100	0.87	01.05.89	6100	0.87
	01.12.88	6050	0.86	01.06.89	6120	0.87
	01.01.89	6200	0.89	01.07.89	6300	0.90

Esc: Exit. F1: Adjust. F2: Note.

Unresolved Exceptions For PRODUCTION-INDEX

Date.	Exception.	Date.	Exception.	Date.	Exception.
>27.07.88	Transient	07.08.88	Transient	19.08.88	Transient
28.07.88	Transient	08.08.88	Transient	20.08.88	Transient
30.07.88	Transient	09.08.88	Transient	21.08.88	Transient
31.07.88	Transient	10.08.88	Transient	22.08.88	Transient
01.08.88	Transient	11.08.88	Transient	23.08.88	Transient
02.08.88	Transient	12.08.88	Transient	24.08.88	Transient
03.08.88	Transient	14.08.88	Transient	25.08.88	Transient
04.08.88	Transient	15.08.88	Transient		
05.08.88	Transient	16.08.88	Transient		
06.08.88	Transient	17.08.88	Step Down		

Esc: Exit. F1: Details. F2: Notes.

Use arrow keys to select exception.

SLIDE No.27