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# A Geometrical Proof for the Duality Theorem in Linear Programming

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# CHAPTER I
# INTRODUCTION

In surveying the literature which has been written since 1945, the year when Herbert A. Simon's Administrative Behavior was first edited, it becomes apparent that there is a linkup between Simon's theory and empirical research. This relationship between theory and research seems to be of two types. The first may be referred to as the hypothesis testing type. That is, several of the hypothetical propositions which Simon set forth in his theory have since been tested by means of empirical research. The second may be referred to as the direct instrument type. In other words, Simon's scheme for analyzing administrative organization in terms of the decision-making process has been used as an instrument in empirical research in the sense that actual administrative situations have been described within Simon's decisional framework. In short, the purpose of this paper is to illustrate that these two types of relationships between Simon's theory and research do exist by: (1) citing examples which illustrate how certain of his hypotheses have since been tested by empirical research; and (2) citing examples which illustrate how Simon's analytical tool was used as an instrument in empirical research.

Before proceeding with the proposed discussion, it seems appropriate to briefly summarize Simon's theory as it was presented in Administrative Behavior. The central theme of Simon's study is that an understanding of administrative organization can be obtained by analyzing organization in terms of the processes of decision-making (i.e., by analyzing the manner in which the decisions of organization members are

influenced within and by the organization). In light of this theme, Simon takes up the task of studying decision-making processes in administrative organization by explaining: (1) the anatomy of decision-making, (2) the physiology of organization, and (3) the anatomy of organization.

Simon begins by explaining the anatomy of decision-making. He states that decision-making involves three steps: (1) the listing of all behavior alternatives; (2) the determination of all the consequences that follow upon each of these alternatives; and (3) the comparative evaluation of these sets of consequences. Factual knowledge and the values or preferences of the deciding individual for one set of consequences as compared with another are the two influences on this process of choice. In short, a decision is a conclusion drawn from a set of factual premises and value premises.[1]

In his discussion of the anatomy of decision-making, Simon also examines the limits and possibilities of human rationality. Because the human mind is unable to bring to bear upon a single decision all aspects of knowledge, value, and behavior that would be relevant, human decision-making falls short of objective rationality. In actual behavior, as distinguished from objectively rational behavior, decision is initiated by external stimuli which channel attention to selected aspects of the situation to the exclusion of competing aspects that might turn choice in another direction. Human rationality, then, operates within the limits of a psychological environment. That is, individual choice takes place in an environment of "givens" -- an environment which imposes on the individual

as "givens" a selection of premises upon which he must base his decision. The stimuli may be initiated arbitrarily. Or they may be controlled, thus making it possible for a higher degree of rationality to be achieved.[2]

Next Simon attempts to explain the physiology of organization or the processes whereby an organization influences the decisions of its members. Since a decision is a conclusion drawn from a set of factual and value premises, organizational influence upon the individual may then be interpreted not as a determination by the organization of the decisions of the individual but as a determination for him of some of the premises upon which his decisions are based. A decision is rational from the standpoint of the individual if it is consistent with the facts (information), values, and alternatives which he weighed in reaching it. A decision is rational from the standpoint of the group if it is consistent with the values governing the group, and the information that the group possesses relevant to the decision. Therefore, the organization must be constructed such that a decision which is "subjectively" rational (i.e., rational from the standpoint of the deciding individual), will remain rational when reassessed from the standpoint of the group. Hence, the basic task of administration is to provide each operative employee with an environment of decision such that behavior which is rational from the standpoint of this environment is also rational from the standpoint of the group values and group situation.[3]

The principal modes of organizational influence in determining its members' psychological environment of decision or "givens" are: (1) authority (2) communication, (3) identification or organizational loyalty, (4) effi-

ciency criterion, and (5) training.[4] The first two modes are influences for imposing on an organization member decisions reached elsewhere in the organization. The last three modes are influences for establishing in the organization member himself attitudes, habits, and a state of mind which lead him to reach that decision which is advantageous to the organization.

Finally, Simon deals with the anatomy of organization or the distribution and allocation of decision-making functions. It is his view that the key to understanding organization structure is to develop a clear and realistic picture of the decisions that are required for the organization's activity, of the key decision premises (or set of guiding principles developed by the top administrators) on which its activity rests, and of the flow of these and other premises which contribute to decisions in the organization.[5] The result would be an outline of the decision-making proce in the organization (i.e., an analysis of the way in which decisions actual were made and the locations of important decision functions in the organiza tion). Thus, it would also be an outline of the important features of the organization structure -- uses of authority, its communication system, its members' organizational loyalties, training, and so on.

## CHAPTER II
## HYPOTHESIS TESTING TYPE RESEARCH: ILLUSTRATIONS

There is a great deal of empirical research which supports many f the propositions hypothesized by Simon in Administrative Behavior. The ollowing discussion presents several examples to illustrate this hypo- hesis testing type of research that is linked to Simon's theory.

In his theory, Simon presents a set of hypotheses concerning rganizational loyalty (or identification). His principal hypothesis on his matter is that organizational loyalty is one of the primary modes where- y an organization influences its members' psychological environment of ecision. His reasoning is that identification is the process whereby the ndividual substitutes organizational objectives for his own aims as the alue premises which determine his organizational decisions.[6] Several studies have been conducted which lend support to this hypothesis.

One such hypothesis-testing type of study was a laboratory experiment on small groups conducted by K. W. Back. By means of plausible instructions to the subjects, he experimentally created groups of high and low cohesiveness, that is, conditions in which members strongly identified with the group and those in which identification or loyalty to the group was relatively weak. "Each team member was instructed to write an interpretation of pictures he had seen alone before discussion with his teammates, and again after discussion. Irrespective of the source of group identification (Back used three different types of identification in both high and low cohesive conditions), the subjects in the high cohesive groups influenced

each other's opinions more than the subjects in the low cohesive groups.[7] In short, as Simon's hypothesis predicts, Back found that the greater the degree of identification to the group, the greater the amount of influence actually accomplished.

These findings are corroborated by a study conducted by Festinger Schachter, and Back. Unlike the previous study discussed, this was a field study, not an experiment. The researchers investigated the relationship between the cohesiveness of social groups in a housing project (i.e., how strongly members identified with the group) and how effectively a group standard relevant to the functioning of the group was maintained. A correlation of .72 was obtained between these two variables.[8] In other words, the greater the identification of members to the group, the greater was the amount of influence which the group could successfully exert on the attitud and behavior of its members.

In conclusion, it is apparent that because both of these empirica investigations found that the greater the identification with the group, the more effective will be the attempts to influence the member, they provide empirical support to Simon's hypothesis that organizational (i.e., group) identification is one means whereby an organization group influences its members' decision premises (i.e., the values and attitudes on which a member's decisions will be based). However, even though these findings may be generalized to a certain degree because they were derived from two very differently structured studies (i.e., one study being a laboratory experime on small groups; the other being a field study on comparatively larger soci

roups in a housing project), it is important to note that neither study rew its findings from an organizational setting, which is where Simon erived his hypothesis.

Simon also presents a set of hypotheses in his theory that deal ith communication. Communication, like organizational identification, is means by which an organization influences its members' psychological nvironment of decision. In discussing this proposition, Simon postulates elated ones which also concern communication and many of which have since een supported by systematic empirical evidence. For illustrative purposes he following paragraphs discuss some of the research that has been conducted in relation to two of Simon's communication hypotheses.

One of Simon's hypotheses on communication states that personal motivation affects communication. That is, personal motivation (e.g., one's motivation to increase one's power or influence in the organization) has considerable influence on whether or not the individual who first obtains the information will transmit it to the rest of the organization.[9] Data from the experiment by Back described earlier supports this hypothesis. In this experiment the reader may recall that groups of high and low cohesiveness were experimentally created using three different sources of motivating one personally to remain in the group. These three sources were: (1) liking the members, (2) prestige attached to belonging, and (3) possibility of getting a reward for performance in the group activity. Back found that in the highly cohesive groups where attraction to remaining in the group was strongest, pressures to communicate were stronger.[10] That is, information

was transmitted and discussed at a more rapid and intense pace in these groups than in the corresponding less cohesive groups. Similarly, in a study conducted by Leon Festinger, the findings showed that where members' personal motivation to remain in the group was zero, no forces to communicate arise. As one's motivation to remain in the group increases (given a certain relevance of the item to the functioning of the group), the pressures to communicate will increase.[11] In short, it is obvious that while these two studies imply other things as well, at the same time they lend empirical support to Simon's hypothesis that personal motivation (to gain prestige, power, or influence, and so on) in an organization affects the flow of information from the beholder to the rest of the organization or group.

A second communication hypothesis that Simon presents in his theory states that the source of the communication is one of the primary determinants of how much consideration the recipient will give to it.[12] One of the most prominent studies in this vein was conducted by Carl Hovland and Walter Weiss. The overall design of the study was to present an identical communication to two groups, one in which a communicator of a generally "trustworthy" character was used, and the other in which the communicator was generally regarded as "untrustworthy."[13] For example, on the topic of "The Future of Movie Theaters" the high credibility source was Fortune magazine while the low credibility sources was an extensively syndicated woman movie-gossip columnist. The effects of source on factual information and on opinion were measured by the use of questionnaires administered before, immediately after and a month after the communication. According to the results, communica-

ions, when presented by a high credibility source, were regarded as being "justified" in 71.7% of the cases when presented to the subjects who initially held the same opinion and in 50% of the cases when presented to subjects who initially held an opinion at variance with that advocated by the communicator. When communications were presented by a low credibility source, they were regarded as being "justified" in 51% of the cases where subjects initially agreed and in 36.7% of the cases where they initially disagreed.[13] In short, Hovland and Weiss found that the immediate reaction to the "fairness" of the presentation and the "justifiability" of the conclusions drawn by the communication is significantly affected by both the subject's position on the issue and by his evaluation of the trustworthiness of the source. Also, opinions were change immediately after the communication in the direction advocated by the communicator to a significantly greater degree when the material was presented by a trustworthy source than when presented by an untrustworthy source.[14] In conclusion, it becomes apparent that the findings of this empirical study lend credibility to Simon's hypothesis that the source of the communication is a salient factor in determining the degree to which its recipient will be influenced by it (i.e., the degree to which the recipient will consider the new information in making organizational decisions).

Finally, a third example of the hypothesis testing type of link between research and Simon's theory can be mentioned. This example deals with Simon's description of human rationality, one of the central notions in his theory. Simon defines objective rationality as viewing behavior alterna-

tives prior to decision in panoramic fashion, considering the whole complex of consequences that would follow on each choice, and, with a system of values as criterion, singling out one alternative from the whole set. However, Simon hypothesizes that actual behavior falls short of objective rationality in three ways. The first is that only a very few of all possible behavior alternatives come to mind at any moment. The second is that a human's knowledge of the consequences that will follow on each choice is always incomplete, fragmentary. The third human limitation is that since these consequences lie in the future, the value that an individual attaches to an anticipated consequence may be quite different from the value that the consequence will have for him in experience. Thus, the valuation process in choice is limited in its accuracy and consistency.[15]

Several years after Simon's theory was published, several empirical studies were conducted which indicate that Simon's description is correct, rather more accurate than the historical model of economic man in which rational objectivity in decision-making has no limitations. The following list briefly mentions some of these verification studies. One of the first was a study by Max Wertheimer, a psychologist who studied the judgmental processes of man. His findings pretty well fit those of Simon's informal description.[16] A second study which confirms Simon's hypothesis is that by A. deGroot who also was a psychologist. In this interesting and significant study, the research dealt with the thought processes of chess players.[17] Finally, Simon conducted his own empirical investigation in collaboration with Allen Newell. In this study the researchers succeeded in describing in

etail a decision-making mechanism capable of exhibiting certain complex uman problem-solving behavior -- specifically, the discovery of proofs for heorems in logic. Subsequently, the researchers were able to simulate such omplex behavior, using this decision-making program, with the aid of an rdinary electronic computer.[18] Their results correspond with Simon's riginal hypothesis. In short, these studies are mentioned here briefly as vidence that Simon's hypothetical description of human rationality in dministrative Behavior has been verified in its main features.

## CHAPTER III
## INSTRUMENT TYPE RESEARCH: ILLUSTRATIONS

There is a good deal of evidence which justifies Simon's claim tha the decision-making framework can be used as a direct instrument of empirica research on organization structure. The following discussion not only presents examples to support Simon's claim but also demonstrates how the patter variable concept has been applied empirically.

One example deals with a study on the organization and role of the accounting (or controller's) department. The study team was led by Simon under the sponsorship of the Controllership Foundation. The team studied seven large companies which had all approached the problem of organizing the controllership function in different ways. The question which the study group sought to answer was: "How should a company's accounting department be organized in order that the data it assembles will be of greatest usefulness to the operating executives of the business in making decisions and solving problems?" The method by which the study team sought to answer this question was Simon's decision approach.[19] The following briefly describes how the decision scheme was applied in an investigation of this problem.

The first step taken by the study team was to identify the points in the organization at which decisions were made. This step consisted of identifying what important types of decisions had to be made in the organization and which operating executives made which types of decisions. The key points which the researchers identified in the decision-making hierarchy wer (1) the chief executive, (2) the company vice presidents for sales and for

production, (3) division executives, and (4) factory and regional sales managers.[20]

Having identified the decision centers, the next step was to determine what types of accounting data might be useful in making these decisions. Thus, by observing the actual decision-making process, specific types of data needs were identified at particular organizational levels. For example, the fundamental question asked by the factory manager, who has the basic responsibility for getting work out, is, "How well am I doing?" Therefore, communication to provide information on the results of activities is the type of accounting data needed at this level. The researchers labeled this category "score-card" information. On the other hand, the higher level officials, whose job it is to look for trouble spots, continuously ask the question, "What problems shall I look into?" Therefore, the type of data needed at this point is communication to evoke programs or "attention-directing" information. Finally, in cases where the fundamental question is, "Which course of action is better?", a third category of information is needed. This type is called "problem-solving" information or communication to provide data for the application of strategies.[21] In short, the researchers identified three categories of information, each serving a different purpose at a different point in the decision hierarchy. They also discovered that the extent to which the information was used depended in considerable part on the closeness of the relationship between the accounting people (as information sources) and the operating people (as consumers).[22] Therefore, what might be a good organization pattern for the use of certain types of account-

ing information might be inappropriate for others.

As a result of this analysis, the research group found that the accounting department's function consists of three major areas, each of which can be separated from the other. The first is record-keeping which involves bookkeeping and preparation and distribution of periodic accountin reports. In making judgments as to where this mechanical aspect of the accounting function might most appropriately be located, such factors as co and uniformity of reports are considered significant. Because no special problems of communication are involved in the record-keeping function and be cause decision premises are largely irrelevant to organization arrangements for the record-keeping function, it can be approached in rather conventiona organization terms. The second function area of accounting is current analysi which involves assistance to the operating departments in providing meaning ful "score-card" and "attention-directing" information. Here proximity to the operating units is the most important locational consideration. Not on must there be promptness of presentation but also confidence of reliability and integrity of the data. Easy horizontal communication is therefore essential. For example, in terms of "score-card" analysis, it is important that there be a close relationship between the cost analyst (a middle manag ment executive of the accounting department) and the department head (a mid management operating executive). The same general situation applies with "attention-directing" information, with the basic horizontal contact betwee the factory accountant and the factory manager. The third function area i special studies for problem-solving purposes. This involves participation

in the use of accounting information to satisfy unique management requirements and to suggest strategies. Again the factor of horizontal communication is a most significant element. Arranging the relationship between the company controller and the chief executive or the factory accountant and the factory manager in a horizontal pattern are two examples. However, in contrast to the case of "score-card" and "attention-directing" questions which indicate decentralization, the case of problem-solving questions indicates centralization for two reasons. One is that there seems to be less need to create the same kind of close relationship necessary in the "score-card" and "attention-directing" areas. The second is that these "problem-solving, special studies" cut across departments and have to be attacked at the company-wide, or at least factory-wide, level.[23]

By juxtaposing these functions and the information on who needs what information from whom, the researchers found that a rough model for accounting organization begins to emerge. Chart 2 on the following page is an example of one of the structural models which arose from this analysis. Preceding it is an example of a model which emerged from one of the more traditional approaches to analyzing organizations, such as by means of analyzing formal lines of authority.

In Chart 1, communication only flows vertically in order to observe the unity of command principle which is based on the assumption that a man can serve only one master. On the other hand, Simon's group recommends that the company should forget the unity of command idea. Since communication patterns outlined in Chart 2 exist under any circumstance, the structural arrange-

ment suggested in Chart 1 serves only to hamper or inhibit communication. In other words, Simon recommends that if the administrative situation requires communication to flow both vertically and horizontally, this pattern should be formalized in the organization structure as Chart 2 depicts. On the matter of the unity of command precept, Simon states that it should be abandoned until further studies prove it is essential. Meanwhile, Simon cites evidence illustrating that "A man can serve two masters provided that the two masters are not working at cross purposes."[26] For example, a division of formal authority over the factory accountant is entirely workable so long as the controller's department has acceptance and support of company manufacturing executives.

In summary, Simon's decision model is based on the idea that human beings, with all their failings, are continually being cast into problem-solving situations where choices are made. Thus we need to know who makes decisions and the base of information from which decisions are drawn. In the study of controllership in several large factories, this method of analysis was followed. The points of decision were identified as were the kind of decisions to be made. Since information served as the initial stimulus for the decision, as the means of guiding action, and as the vehicle for reporting action results preparatory to taking new decisions, it was obvious also that the analysis of communications or information content and flow was a necessary step. On the basis of these data, the Simon group came to certain conclusions about the nature of the accounting function in a large company and a model for the internal structure of accounting in a large

actory emerged. Furthermore, it is interesting to note that some companies ave created the formal arrangement suggested by the model without disas- rous results.[27]

Two major conclusions may be drawn from this study. The first is hat in many respects the findings on the accounting department's functions nd internal structure were not particularly dramatic or striking, but they o suggest some rather sharp departures from classic organization. The ecognition of the need for horizontal communications and the formalization f this pattern into the organization structure is an example. The second s that it would appear that the decision, with its companion study of infor- ation flows, has proved itself to be a practical means of organization nalysis.

A second example which illustrates the use of the decision frame- ork as a direct instrument of research is a study on an organization called he Economic Cooperation Administration (ECA). This study was also con- ucted by Simon who at this time had a position in the agency. ECA was reated in April of 1948 to administer the Marshall Plan, a foreign aid rogram. Some four months later, ECA was a going concern, complete with rganization chart.[28] Simon's study is an attempt to analyze these first ew months of the organization's existence. In other words, he analyzes ow the program of the ECA, and the organization to implement that program, merged.

Within the first few months, before the ECA's final organization tructure took form, Simon has identified six important approaches to the

organization. These six different approaches are: commodity-screening, balance of trade, European cooperation, bilateral pledge, investment bank, and policy-administration. In other words, the early administrative history of the agency can be written in terms of the rise and fall of these approaches and of the administrative units within ECA with which they were associated. What Simon has done is to analyze each of these six approaches individually whereby he shows that from an analysis of the key decision premises implied by each approach, one could predict the main outlines of the decision-making process in the agency, and from the decision-making process, the important features of organization structure pending the adoption of the approach in question.[29] As an example, the following paragraph briefly discusses two of the approaches to demonstrate Simon's analytical framework.

The European cooperation approach views the ECA's program as a means for bringing about a greater measure of international trade, economic cooperation, and rationalization of industry in Western Europe. Its organizational implications were: (1) that the initiative for programming should rest upon the European countries acting cooperatively; (2) that our relation with them under the program should be multilateral rather than bilateral, and that these relationships should be channelled primarily through the Paris rather than the Washington office of the ECA; and (3) that area units should be established which would specialize in the problems of the individual countries.[30]

Another alternative was the bilateral pledge approach. Somewhat

ifferent from the idea that the central aim of the program was to foster uropean cooperation was the idea that assistance should be conditioned on ilateral pledges between the individual countries and the United States. his decisional premise suggests several aspects of organizational structure hich conflict with those suggested by the previous approach. One such mplication, for example, is that because the negotiation of the pledges was high-level matter involving State Department leadership, bilateral agreeents create the necessity for direct negotiation between the State Department nd individual countries. From an organizational point of view this would eaken the Paris office of ECA as the primary channel of contact which irectly contradicts the view set forth by the European cooperation approach herein the ECA's Paris office would be the primary contact channel for egotiating multilateral agreements.[31]

In less than four months, during which it was already in operation, he agency attained virtually its final form. However, it is important to ote that during these first few months while each of the six approaches were eing considered, the top administration circulated, in draft form, a memoandum entitled "Basic Principles of ECA Organization." This memorandum mphasized the balance of trade approach and pointed to weaknesses in the ommodity screening and investment bank approaches. It also stressed the need to foster multilateral rather than bilateral approaches. As a result, the organization units, such as the Foods and Industry Division, which can be equated with some identifiable element in the commodity screening, investment bank, bilateral pledge, and policy-administration approaches withered

away or became subordinate to those units which had arisen in conjunction with the balance of trade and European cooperation approaches.[32] In short, the final structure of ECA took the form that was implied in these latter two approaches and the organization units which can be equated with some identifiable elements in these two programs became the agency's power center Therefore, it appears that once the top administrators developed a set of guiding principles (in the memorandum) that provided some of the key decision premises on which the ECA's activity rested, the resulting organizational structure was similar to that predicted by Simon in his description of the balance of trade and European cooperation approach because the decision premises in the memorandum parallelled the conceptions of ECA's program that were implied in these two approaches.

Two major conclusions can be drawn from this study. The first is that this study provides empirical evidence that the relationship between the decision-making process and an organization's structure (which Simon's theory hypothesizes) does in fact exist. Two of the major findings in this study which proved this relationship to be the case were that the organization structure took form only after the top administrators established guiding principles for action (i.e., the key decision premises) and that these decision premises accurately forecasted the mold into which the organization was forced because they set down the guide or framework for decision and action -- the conditions of "workability". A second conclusion which can be drawn from this study concerns the utility of Simon's decisional scheme as a research instrument

While the ECA as an organization grew and assumed a reasonably coherent form without apparently ever having been planned, its form was predictable. That is, while the form of ECA was not planned, Simon was able, from an analysis of the key decision premises, to predict the main outlines of the decision-making process in the agency, and from this process the important features of organization structure. In other words, this study vividly illustrates how Simon's analytical scheme can be effectively used in predicting or studying the structure of "growing" new organizations.

## CHAPTER IV
## SUMMARY AND CONCLUSION

In summary, this discussion has attempted to present evidence for the relationship between research and Simon's theory. In fact, it has attempted to show that this link exists in two different ways.

One such link or relationship between the two is the hypothesis testing type. The discussion cited evidence of empirical research which has been conducted since Simon's theory was first published and which lends systematic empirical support to a number of his hypothetical propositions that deal with organizational identification, communication, and human rationality Therefore, because certain of Simon's hypotheses have since been tested by empirical research, it becomes obvious that the hypothesis-testing type of relationship does exist between his theory and research. It is important to note, however, that the research examples in this vein have one major limitation as far as the verification of Simon's theory goes. That is, they were not carried out in an organizational setting but either were laboratory experiments on small groups or field studies on social groups. Therefore, while the research may lend support to Simon's theory, it does not verify his hypotheses completely. Nevertheless, the relationship between the two (i.e., between theory and research) is evident.

The second type of relationship between the two is the direct instrument type. The discussion cited evidence that Simon's decision framework for analyzing organization structure has in fact been used in empirical research. In one case the decision framework was used to analyze the

decision-making processes and organization structure of an ongoing organization. As an analytical tool, it proved to be useful in helping to answer questions on departmental reorganization. In the second example, the decision framework was used as a research tool to analyze a "growing" new organization. In this case it proved to be a useful tool in predicting organization structure. In other words, the study showed that once top administrators adopt guiding principles (i.e., decision premises), it is possible to plan the organization's structure systematically, rather than having to let it develop its form in a gradual unplanned fashion. In comparison, these two studies used the decision framework as an analytical tool in different types of organization settings and to serve different ends. At the same time, they demonstrate that the decision framework can be used as an analytical tool or instrument in empirical research on administrative organizations.

Simon was one of the first social scientists to study organization and administration in terms of the decision-making process. Therefore, in conclusion, it seems appropriate to mention some of the progress that has been made over the past quarter century toward deepening our scientific knowledge of decision-making. The following concluding paragraphs serve to mention briefly some of the recent advances which have been made in decision-making theory.

One area in which progress has taken place is that of developing new decision-making tools to help management make decisions. Since World War II there has been a tremendous development in the normative theory of decision-making that goes under the labels of "operations research" and

"management science." Through these activities, many classes of administrati decisions have been formalized, mathematics has been applied to determine the characteristics of the "best" or "good" decisions, and myriads of arithmetic calculations are carried out routinely in many business and governmenta organizations to reach the actual decisions from day to day. A number of sophisticated mathematical tools, such as linear programming, and a number of less complicated but highly useful tools, such as PERT, have been invented or developed to this end.[33] In many ways the contributions of operations research and management science to decision-making theory have been very pragmatic in flavor. The goal, after all, is to devise tools that will help management make better decisions.

A second area of significant advance has been in applying the experimental method to the investigation of decision-making. This has been done by arranging for experiments on live real-world organizations. One such example of a field experiment is the study done on the Prudential Life Insurance Company by the Survey Research Center of the University of Michigan.[34] Also this has been done by bringing organizations or "organizationoid" systems into the laboratory. The Systems Research Laboratory of the RAND Corporation, for example, studied decision-making by simulating, under controlled conditions, an entire air defense control center.[35] A more thriving enterprise, however, has been laboratory experimentation with relatively small groups. A single example will convey the flavor of such work. Cyert and March were able to produce bias in the estimates of members of a simulated organization by creating partial conflict of interest among them, but showed that under

rtain circumstances this bias did not affect organization performance.[36]
short, new knowledge about organizational decision-making has been
tained from appropriately planned experiments.

In addition, there have been several substantive developments in
ie theory of decision-making. The notion that a decision is like a conclu-
on derived from a set of premises has been a useful metaphor for analyzing
ie decision-making process. Recent studies have followed this metaphor of
mon's a step further by developing a theory to answer the question, What
ppens in an organization when there are conflicting premises pushing a
rticular decision in different directions? In summary, these studies
nclude that evoking and attention-getting mechanisms are also important
r decision-making.[37] From every point of view, the new knowledge gained
out evoking and attention-directing processes is a major substantive advance
our understanding of organizational decision-making.

Finally, advances have been made in explaining the structure of
decision. One example is a study which recounted the steps taken by a
usiness firm to reach a decision about the installation of an electronic
omputer.[38] Such studies have only been possible since the development of the
odern digital computer, a powerful new tool which has provided both a language for
xpressing theories of decision-making and an engine for calculating their
mpirical implications.

These, then, are some of the more prominent landmarks along the
oad of developing the organizational decision-making concept over the past
wenty-five years since Simon first theorized on the utility of studying

organization and administration in terms of the decision-making process. On the normative side, the analytical tool of modern operations research and management science have secured an important place in the practical work of management. On the side of the pure science of administration, there have been equally fruitful developments. The laboratory experimental method can now be used to study a wide range of decision-making behaviors that are relevant to organizations. The introduction of such concepts as "evocation" and "attention-directing" have been used to gain new understanding of the decision-making process in changing environments. Finally, in the modern digital computer we have an analytical took for studying the structure of decisions. That is, we have a language for expressing our theories and a machine to calculate their empirical implications.

In conclusion, it appears that the utility of Simon's theory does not lie only in the fact that it has served research in the past by suggestin hypotheses to be tested and by providing empirical studies with an analytical tool. Also, his decision-making theory has some utility even today in the sense that it is a dynamic rather than a static concept because theorists, methodologists, and empirical researchers seem to be continuously developing and elaborating on Simon's original body of ideas.

FOOTNOTES

[1]Herbert A. Simon, Administrative Behavior: A Study of Decision-making Processes in Administrative Organization, (New York: The Free Press, 1945), pp. 45-78.

[2]Ibid., pp. 79-109.

[3]Ibid., pp. 76-79, 123.

[4]Ibid., pp. 125-219.

[5]Ibid., pp. 220-247.

[6]Ibid., p. 218.

[7]Kurt W. Back, "Influence Through Social Communication," Journal of Abnormal and Social Psychology, XLVI (1951), 9-23.

[8]Leon Festinger, Stanley Schachter, and Kurt W. Back, Social Pressures in Informal Groups, (New York: Harper & Bros., 1950), p. 119.

[9]Simon, Administrative Behavior, pp. 162-163.

[10]Back, "Influence Through Communication," pp. 20-23.

[11]Leon Festinger, "Informal Social Communication," Psychological Review, LVII (September, 1950), 274.

[12]Simon, Administrative Behavior, p. 164.

[13]Carl I. Hovland and Walter Weiss, "The Influence of Source Credibility on Communication," Public Opinion Quarterly, XV (1952), 641-642.

[14]Ibid., pp. 635-650.

[15]Simon, Administrative Behavior, pp. 80-84.

[16]Max Wertheimer, Productive Thinking, (New York: Harper & Bros., 1945), pp. 75-82.

[17]Simon discusses Dooroot's work which is written in German in Herbert A. Simon, Models of Man, (New York: John Wiley & Sons, Inc., 1957), pp. 261-273.

[18]Allen Newell and Herbert A. Simon, "The Logic Theory Machine," Transactions on Information Theory, Vol. IT-2, No. 3 (September, 1956), 61-79.

[19]John Pfiffner and Frank P. Sherwood, Administrative Organization (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1960), pp. 390-391.

[20]Ibid., p. 391.

[21]Ibid., p. 392.

[22]Herbert A. Simon, et al., Centralization vs. Decentralization in Organizing the Controller's Department (New York: Controllership Foundation, Inc., 1954), p. 3.

[23]Pfiffner, Administrative Organization, pp. 394-395.

[24]Malcolm T. MacEachern, Hospital Organization and Management (Berwyn, Ill.: Physicians' Record Company, 1940), p. 84.

[25]Pfiffner, Administrative Organization, p. 400.

[26]Simon, et al., Centralization vs. Decentralization, p. 83.

[27]Pfiffner, Administrative Organization, p. 398.

[28]Herbert A. Simon, "Birth of an Organization: The Economic Cooperation Administration," Public Administration Review XIII (1953), 227.

[29]Ibid., pp. 228-233.

[30]Ibid., pp. 229; 232-233.

[31]Ibid., pp. 229-230; 233.

[32]Ibid., pp. 234-235.

[33]Herbert A. Simon, "Administrative Decision-Making," Public Administration Review, XXV (March, 1965), 31-33.

[34]N. C. Morse and E. Reimer, "Experimental Change of a Major Organizational Variable," Journal of Abnormal and Social Psychology, LII (1956), 120-129.

[35]Robert L. Chapman, "The System Research Laboratory's Air Defense Experiments," Management Science, (April, 1959), 250-269.

[36]Richard M. Cyert and James G. March, The Behavioral Theory of ne Firm (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), pp. 67-77.

[37]Simon, "Administrative Decision-Making," pp. 34-35.

[38]Richard M. Cyert, Herbert A. Simon, and D. B. Trow, "Observation f a Business Decision," Journal of Business, XXIX (1956), 237-248.

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tasks in the 5-year plan. This includes new results from international agreements of the state which were concluded in the meantime.

Detailing the foreign trade tasks annually is important in particular with regard to

- foreign exchange prices;
- the detailed commodity structure of export and import (in the GDR some hundred commodities on the central level and some thousand on the enterprise level);
- the detailed regional structure to different countries;
- the profitability of export and import commodities;
- the flow of foreign exchange receipts and expenses divided to different foreign currencies;
- influence of export and import on the gains or losses of industrial and foreign trade enterprises and on the financial relations to the state budget;
- transportation of export and import goods;
- concrete tasks for marketing.

In the GDR the annual foreign trade plan is sub-divided quarterly and in some cases (flow of foreign currencies, transportation) monthly in order to guarantee a continuous flow of exports and imports and of monetary relations within the year, too.

In annual planning of the GDR the connection with economic incentives is of great importance. The formation of certain bonus funds in foreign trade and industrial enterprises and thereby the possibilities for bonus payments to the workers depend above all upon the fulfilment of the targets of the annual plans.

Difficult conditions and often changing situations in the field of foreign trade make it necessary to establish a proper system of guidance and supervision. Therefore a suitable and promptly working statistical account of export and import is very important, concerning not only the realization of foreign trade activities during the current plan period but also the conclusion of commercial agreements for the commodity movement in the following years including the expected dates of delivering the commodities and of the flow of foreign exchanges. Modern computers are well suitable for these purposes.

4.4 The elaboration of the foreign trade plan in several stages:

Elaborating foreign trade plans - independently from the time horizon - is an iterative process and is carried

out in several stages. This kind of planning step by step is necessary because a lot of enterprises and state bodies on different levels of the hierarchy of managing and planning the economy are engaged in the planning process and a comprehensive balancing and optimizing of the plan needs several stages. The problem to be solved is in conformity with the theory of the connection of sub-optimal solutions for different parts with the optimum of a system as a whole. It includes the task of getting consistency step by step between the interests of different branches and enterprises (in industry, agriculture, foreign trade) with the needs of the national economy as a whole and requires a good connection between planning and applying economic incentives, too.

Furthermore, this technique of planning corresponds to the general principle of democratic centralism in socialist planning and to the theoretical principle of "2-level planning"[6] (though there are in reality 3 levels - central - branch - and enterprise level).

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(6) Kornai/Liptak "Two-level Planning" - Computing Centre of the "Hungarian Academy of Sciences, Budapest 1963.

In the GDR the annual foreign trade planning is carried out in the following main stages:

1/ Plan directives by the central authorities.

2/ Plan drafts of the enterprises.

3/ Approved state plan targets by the central authorities.

4/ Plan elaboration on enterprise level and allocation of plan targets and tasks within the enterprises.

In practical planning these stages are not isolated from each other and some activities are running parallel, with regard to the stages 1 and 2. In addition, an alternative may be formulated as a choice between "starting from below" and "starting from above". General experiences in socialist countries and in some western countries too habe proved that more duplication is involved in the planning procedure if no idea of the general development exists in the lower units.(7) Therefore it seems to be the best way starting from the top. In any case there are a lot of discussions and co-ordinations between the different bodies on all levels of the national economy during the whole process

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(7) Jan Tinbergen "Central Planning", Page 16 .

of elaborating the plan especially between foreign trade enterprises, industrial enterprises and the organs responsible for commodity balancing with regard to export and import.

The course of 5-year planning is influenced to a high extent by the fact that planning within the national economy is linked with international plan coordination between CMEA-countries. Therefore the dates of the above mentioned stages are fixed in conformity with the stages in international plan coordination.

When considering the planning activities in different stages it is necessary, too, to determine the tasks of government authorities, excutive organs of the national economy and enterprises and the kind of cooperation between these organs in planning foreign trade.

5 . Connection of Central Planning and Planning on Branch and Enterprise Levels in the Field of Foreign Trade.

5.1 The institutional framework of planning foreign trade and the principle of "2-channel-planning" in this field:

As mentioned before, a lot of organs on all levels and in many branches of the national economy are involved in the planning procedure in the field of foreign trade. Furthermore in socialist countries there are close links between the application of the foreign trade state monopoly and foreign trade planning.

In centrally planned economies some main principles have to be considered with regard to the institutional framework of planning foreign trade as follows:

1/ Foreign trade planning is not a task of some specialized bodies on the central and branch level but all state organs and all enterprises involved in managing foreign trade and carrying out foreign trade operations are included in the planning procedure, too. According to the system of hierarchy in the national economy the planning procedure is carried through on the basis of a

so-called pyramid system. The foreign trade planning pyramid is part of the comprehensive pyramid of planning the national economy and roughly we can distinguish 3 levels of planning:

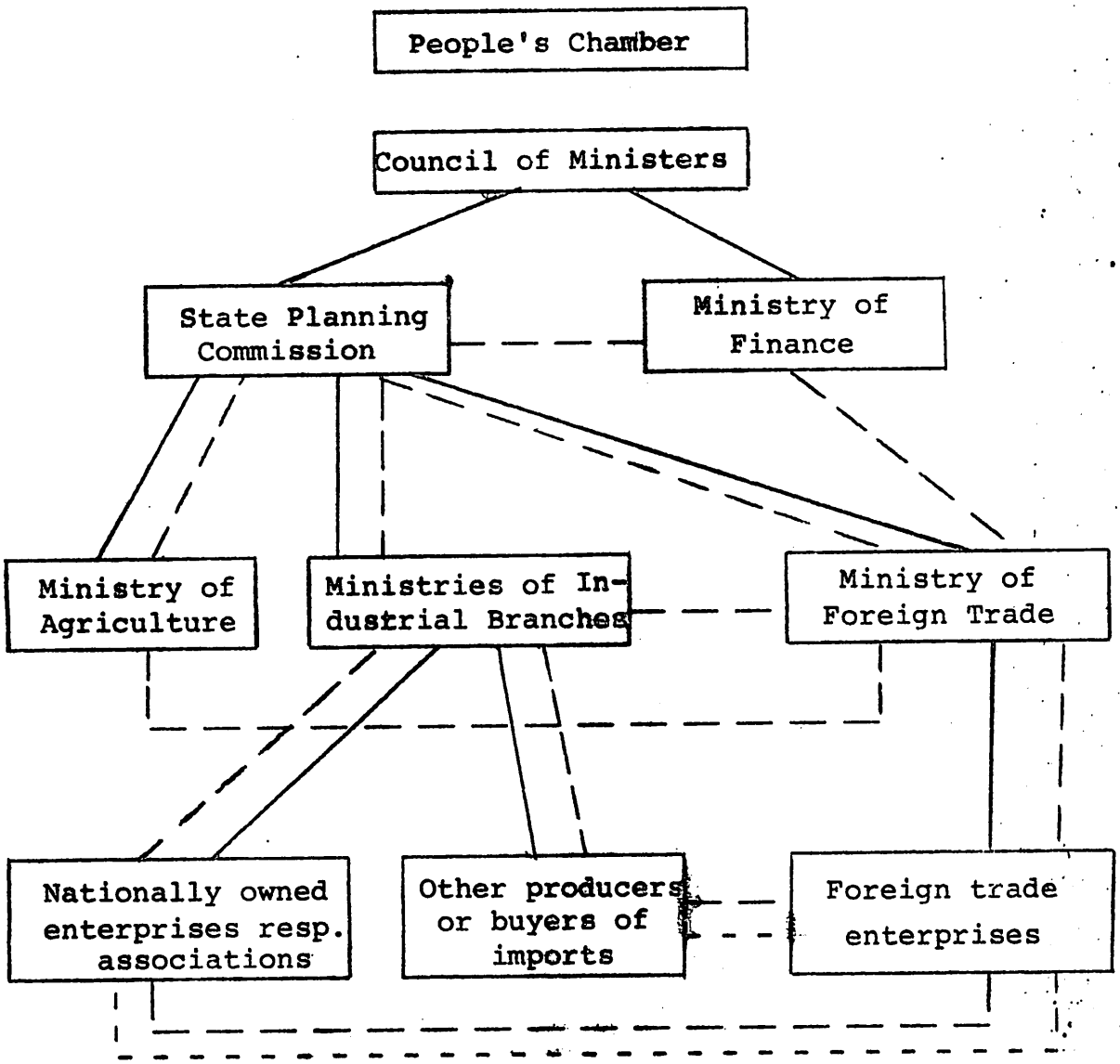
a) central level (Council of ministers, ministry of planning);

b) branch level (Ministry of foreign trade, ministries of industry, agriculture etc.)

b) lower level (producers of export goods, foreign trade enterprises, buyers of imports).

The following scheme gives an idea about the pyramid set up for foreign trade planning:

The Pyramid of Foreign Trade Planning in The GDR



2/ Starting from the statement that socialist planning in general and foreign trade planning in particular is always a connection of central planning on the top level and decentralized planning on branch and lower levels priority is given to central planning. Only on the central level the most important questions for the national economy as a whole can be decided and different opinions and interests of several branches have to be subordinated to the needs of the entire society.

There is no contradiction between priority of central planning and a broad participation of all lower units and their workers in the procedure of planning. Socialist planning includes consultations of central state authorities with branches and enterprises in preparing central directives for elaborating plans and independent plan drafts from the enterprises on different stages of the planning procedure. There must be a continuous flow of plan indicators from the top to bottom and vice versa.

Practical experiences of planning foreign trade in the GDR and other socialist countries prove that the relation between centralisation and decentralization in decision-

making in the planning procedure is not unchangeable. It depends among other things upon the reached stage in the historical development of the national economy and the framework of management and planning, the concrete situation with regard to the internal and external equilibrium of the national economy (for instance redressing the balance of payments) and different conditions in export and import of groups of commodities (complete equipments for factories, raw materials and agricultural products, single machines and similar goods).

3/ A third principle of organizing foreign trade planning is the so-called 2-channel planning system. As you can see from the scheme of the planning pyramid in the GDR there exist two channels as for the flow of plan indicators from the top level to the lower units and vice versa.

On the one hand there is a flow of plan indicators from the State Planning Commission to the ministries of industrial branches, agriculture etc and from these ministries to the production units as producers of export goods and consumers of import goods. On the other hand plan

indicators are distributed from the State Planning Commission to the ministry of foreign trade and from this ministry to the foreign trade enterprises.

After making plan proposals on the lower level these proposals are handed over to the ministries concerned and we shall find the same flow passing the two channels vice versa.

At the same time we must consider the close cooperaand connection between all organs on the same level and on different levels. Of great importance in the procedure of planning foreign trade are for instance consultations between foreign trade enterprises and producing units for determining volume and commodity structure of export and import of certain groups of commodities. Resulting from these consultations agreements are concluded between the partners concerned as a basis for commercial contracts.

Similar consultations take place between the ministry of foreign trade and industrial or agriculture ministries aimed at solving problems with regard to the development of export and import which could not be solved on the lower level of enterprises.

Summarizing we can say that these main principles for organizing foreign trade planning are a concrete expression for realizing the general principle of democratic centralism. We do not follow the concept of central versus decentral planning, but we are rather in favour of combining both activities by strengthening of central planning and, parallel to it, the extension of planning on the lower levels.

5.2 Foreign trade planning in the State Planning Commission (Ministry of Planning):

The State Planning Commission is the central organ of the Council of Ministers for planning the development of the national economy as a whole. It plans and determines the volume and the structure of export and import from the aspect promoting the proportional and optimal development of the national economy and of using foreign trade as an important factor for increasing the rate of growth of national income.

The State Planning Commission is responsible for a correct coordination of the foreign trade tasks with the development of the other branches of the national economy. It deals, in the first place, with long - and medium - term

planning. In this context it is of special importance to establish correct relations between the development of investments and the structure of export and import. In the GDR the commodity structure of foreign trade is planned on this level at present for about 30 groups of commodities and about 700 single commodities. This number changes with regard to the time-horizon of planning and depending upon the concrete conditions determining the relation between centralization and decentralization in the planning procedure (see paragraph 5.1).

Within the framework of socialist economic integration among CMEA-countries the State Planning Commission carries out international coordination of national economic plans in close cooperation with the ministries of industrial branches, the ministry of foreign trade etc and concludes agreements with the Planning Commissions of other CMEA-countries on the results of the plan coordination. Under the conditions of extending and deepening the process of socialist economic integration this task becomes more and more important and concerns the tasks of the branches and enterprises in the field of industry and foreign trade, too. Since almost all the measures in this connection like scientific -

technical cooperation, specialization and cooperation of production, common investments etc affect the flow of export and import the whole process of planning foreign trade is influenced to a high extent by this international plan coordination.

There are activities and agreements too in plan coordination with other socialist countries outside CMEA and with some developing countries which are to be considered in planning foreign trade with these countries concerned.

The State Planning Commission also maps out the methodical regulations for drawing up the foreign trade plan including the cooperation between the different branches of the national economy (foreign trade, industry, agriculture, transport etc) in the planning process.

5.3 Tasks and activities of the ministry of foreign trade and other ministries in foreign trade planning:

Whereas the State Planning Commission is able and responsible for planning the development of the national economy as a whole, the different ministries are responsible for managing and planning certain branches. At the same time they have to take into consideration the needs of the country's

society as a whole, but in the practical planning process there can arise contradictions between the needs and possibilities of the entire national economy and the wishes and proposals of the sperate branches. This general conflict between the "sub-optima" of part-systems and the "optimum" of the entire system is to be solved in a centrally planned economy by an iterative process of planning and by combining central and decentralized planning (see paragraphs 4.4 and 5.1).

In the GDR we have several ministries of industry in conformity with different industrial branches. Furthermore there exist a Ministry of Agriculture and Foodstuffs Production, a Ministry Trade and Supply, of Building etc. The following tasks will be enumerated for the Ministries of Industry, but they are of analogous validity for other ministries.

The Ministries of Industry have likewise to solve important tasks in planning foreign trade. These tasks, above all, include guidance to and control over the enterprises of the branch concerned (either allied in so-called "Associations of Nationally Owned Enterprises" or working as so-called "Combines") with regard to manufacturing and marketing of export

in a commodity structure and quality meeting the demands of external markets.

In the field of planning imports these ministries bear a great responsibility, too, whereas two different aspects have to be considered. On the one hand they have certain tasks in planning needed imports of machines, equipment, raw material, intermediary goods etc, used in the production process of the branch concerned. On the other hand the ministries and their associations are so-called "balancing organs" for certain groups of commodities covering the needs of the national economy as a whole. Within the framework of the entire quotas fixed by the State Planning Commission the "balancing organs" draw up an import plan with regard to assortments, quality, terms of delivery etc in close cooperation with the foreign trade enterprises and the potential consumers (see in detail chapter 6, especially paragraph 6.3).

The Ministry of Foreign Trade bears main responsibility for planning and managing the foreign trade activities. It directs, coordinates and controls about 25 foreign trade enterprises of which it is in charge and it is responsible, too,

for planning export and import activities of those enterprises which are in charge of other authorities. In accordance with plan indicators, handed over by the State Planning Commission and on the basis of plan proposals of the lower units the Ministry of Foreign Trade elaborates the comprehensive foreign trade plan and submits it to the State Planning Commission. This planning procedure includes a close cooperation and consultations with the Ministries of Industry, Ministry of Transport, Ministry of Finance and other central authorities engaged in foreign trade and foreign exchange flows.

One major task in this connection is long-medium-and short-term planning of foreign trade with regard to individual countries. This is particularly important since the bulk of GDR foreign trade is carried through bilaterally, and the currency balances continuously have to be kept within the agreed swing - limits. The task of planning the detailed regional structure of foreign trade is linked closely with preparing and concluding trade agreements with other countries by the Ministry. (Special problems with regard to socialist and capitalist countries see chapter 9).

5.4 Foreign trade planning on the level of enterprises:

Socialist planning on enterprise level should be considered in principle under two aspects which are interrelated with each other: A first aspect deals with the connection between central planning and decentralized planning by enterprises and starts from the prerequisite that there has to be achieved consistency between the all round plan of the national economy and the sum of all plans on lower levels. This task comprises two sides. On the one side the enterprises have to elaborate such conceptions and plan proposals that the abilities and knowledges of the many specialists on this level can be used for qualifying the central planning. On the other side they have to guarantee that the enterprise plans and their implementation completely correspond to the plan figures of the ministry concerned respectively the central plan.

The second aspect is of special importance for using the plan as the decisive basis for a qualified management. This task involves, too, that planning on the enterprises level requires not only accepting the plan figures from the ministry but ensuring a high quality in forecasting and other

research work as preparing steps in elaborating the plan for the own enterprise. Furthermore, it includes that the most important plan figures are divided to the different departments of the enterprise so that everyone knows his special tasks as parts of the plan.

Starting from this general view we have to answer first which enterprises are involved in the procedure of planning foreign trade and which are their special taks. In general we can say that all the enterprises engaged in producing and selling of export commodities and buying, distributing and consuming import goods are included. Foreign trade planning on the enterprise level comprises, too, tasks of special service enterprises in the field of transport, market research, advertising, control of export and import commodities etc.

According to their role in materializing the operative export and import activities, foreign trade enterprises bear main responsibility in planning foreign trade on the enterprise level. In the GDR the bulk of these enterprises at present are in charge of the Ministry of Foreign Trade, some other ones are in charge of other

ministries or associations of the industry. In some cases export and import is carried through by industrial enterprises. Therefore they need a special licence from the Minister of Foreign Trade.

As mentioned before, foreign trade enterprises elaborate a complex plan, consisting of several plan components, which will be approved by the Ministry of Foreign Trade (see the scheme in paragraph 4.1). When starting with the elaboration of a certain plan, for instance the annual plan, there are the following main bases to be considered:

- own conceptions as a result from forecasting the probable development with regard to the group of commodities concerned on external markets and in the national economy of the own country;
- tasks of the year's section concerned as a part of the existing 5-year-plan;
- state plan tasks from the Ministry of Foreign Trade;
- obligations from state international agreements in the field of foreign economic relations;
- commercial contracts of the enterprise already concluded with foreign and home partners on exports or imports of the following year.

Elaborating the plan by the foreign trade enterprise concerns above all fixing the commodity and regional structure of export and import according to the different assortments and types, home prices, external prices on different markets etc. For this purpose all foreign trade enterprises and their home partners reach comprehensive coordination of export supplies and import needs to be taken into the plan and record it exactly. Agreements as a result of the coordination on volume and commodity structure between foreign trade enterprises and their home partners are signed by both partners and are of great importance for elaborating the plan in the foreign trade enterprises as well as in the industrial enterprises producing export goods and in the so-called balancing organs with regard to the import.

Following this coordination, the foreign trade enterprises elaborate the complex plan proposal including the volume and structure of foreign trade, the flow of foreign currency and home financial relations, transport services with regard to quantity and value, the development of manpower and investments, activities in the field of marketing etc. The central pillar in this is the purposeful

shaping of the commodity and regional structure of export and import and the planning of foreign prices.

As a result of this work which takes place with the broad participation of the producing enterprises the plan is fixed and will be submitted to the Ministry of Foreign Trade (at the same time the plan proposals of the producing units are submitted to the ministries concerned). After being coordinated and approved by the higher levels (ministries, State Planning Commission, Council of Ministries, People's Chamber) the adjusted plan proposals of the enterprises will be approved by the ministries concerned and are now the binding basis for the work of the enterprise collectives in their respective range of tasks.

## 6 . Implementation of Commodity Balances in Foreign Trade Planning:

### 6.1 Nature of commodity balances and its use in planning:

In order to achieve optimality of the national economic plan, it is necessary that proportionality and consistency between all parts and spheres of the economy be ensured according to plan. Thus an important task of planning consists of determining both the resources and the uses of different products and factors of production either on commodity or on group basis.

The balancing method is an important auxiliary instrument for fulfilling these tasks. It permits the planning authorities to investigate the requirements of proportionality and consistency and to carry all these through in practice. There are different balances, drawing up of which have proved to be effective, e.g. input-output balances, commodity balances, trade balances, the balance of payments, the state budget etc. In the following we will explain the nature and the construction of commodity balances and their use in planning.

In principle, a commodity balance is nothing but a statement comprising all sources of supply (whether they are domestic or foreign) of a certain commodity (or group of commodities) and different uses of such commodities, whether they are also domestic or foreign. As an example, the following table represents the final scheme of a commodity balance.

Scheme of a Commodity Balance

Period:

Name of the commodity:

Unit of measurement:

| Resources | Uses |
|---|---|
| - Commencing stock (at the beginning of the plan period) | - Intermediate consumption (uses in production) |
| - Domestic production | - Final consumption<br>a) Private (individual)<br>b) Governmental |
| - Imports | |
| - Other resources | - Investments<br>a) Accumulation<br>b) Reserves |
| | - Export |
| | - Carry-overs (stocks at the end of the plan period) |
| Total resources | Total uses |

Commodity balances can be used for short-medium - and long-term planning. The period for which they are drawn may affect their construction. Long-term balances would be highly aggregated, while annual ones would be drawn in details. For 5-year plan we should have balances for each year covering the plan period.

Building up commodity balances and using them in planning involves several distinct problems among which are the following main ones:

1/ The determination of the "nomenclature" (list) of the commodity balances.

We have to answer the following questions:

- For which products is it necessary to construct commodity balances?
- How to group these balances?

Both aspects must be considered as part of the whole system of classifications and methodological regulations applied for national planning. The nomenclature will be different from country to country and from time to time (For example in the GDR there are about 4.000 commodity balances and in the A.R.E. 170 (in 1971).

Individual commodity balances should be drawn for goods of major significance for the national reproduction process in the field of production, investments and consumption. The aggregation to balances for groups of commodities depends upon the whole framework of planning in the country concerned (planning and balancing pyramids) and upon the specialities of different groups of commodities (raw materials, consumer goods, machines and equipment) with regard to the possibility of aggregating.

2/ The choice of the unit of measurement (the valuation problem):

The items included in commodity balances can be valuated on different bases the concrete one depends upon the aim of using this tool. A unified price or different prices (producer's and/or market prices, internal and/or external prices, prices of a basic period and/or current prices) can be used, and in many cases physical units may be applied, too. Each unit of measurement has its advantages and disadvantages, often

it will be necessary to use several methods (see paragraph 6.2).

3/ The problem of collecting the necessary data and the question of timing of the flow of such data (the information and timing problems):

It can be seen from the concrete scheme of a commodity balance which data are necessary for elaborating working sheets for the resources and uses and the final balances for each commodity concerned. In any case the competent balancing organs will have to cooperate with those bodies on the central level and on branch or enterprise level which are engaged in such activities like production, consumption, export, import etc. A concrete follow-up system and present base year figures (in the needed nomenclature of commodity balances) will facilitate the work of the balancing organs.

The problem of a proper timing of the flow of such information from their original sources to the body undertaking the balancing process has to be solved as a part of methodological regulation applied for the procedure of national planning.

6.2 The use of commodity balances in foreign trade planning:

As we mentioned earlier in this paper (see paragraph 1.1), foreign trade is an important means for achieving proportionality and consistency between all spheres and branches of the national economy. At the same time an optimal structure of production can be achieved by using the possibilities of international division of labour. That concerns the complementary function as well as the substitutive function of foreign trade, and this role of export and import is of special importance for those countries connected to a high extent with the world markets.

Therefore commodity balances can be used as important tools in order to take full advantage of these functions and possibilities of foreign trade. As we have seen in the scheme of a commodity balance, import and export are essential items of these balances. When elaborating a commodity balance of a certain commodity or a group of commodities, there are always decisions to be made with regard to possible variants aimed at meeting the demands of the national economy and the population and of making the most of the resources of the country. Such variants can be as follows:

a/ domesticn production and (or without) export;

b/ domestic production and (or without) import;

c/ import without domestic production;

d/ domestic production, import and export.

Commodity balances can be applied as a tool for co-ordination between different targets and a measure to maintain appropriate proportions between the foreign trade variables and other variables such as production, domestic consumption, ... etc, a matter which can greatly reduce the possibility of facing certain bottlenecks during the implementation phase. In the process of industrialization in developing countries such problems will arise very often and decisions concerning the best proportion between domestic production, import and export will be necessary as well on the central level as an branch level.

Commodity balances are not only reflecting present proportions with regard to a certain commodity or group of commodities, but they are to be used as a tool for finding the best (optimal) proportions from the point of view of the national economy as a whole. Therefore it is necessary to value the items of the balances by different prices and, if possible, to connect using commodity balances with optimizing

calculations in the process of planning the commodity structure of foreign trade.

As we mentioned before, commodity balances are only one part of a comprehensive system of balances in the national economy. For the purpose of foreign trade planning commodity balances are linked above all with input-output balances and the trade balances.

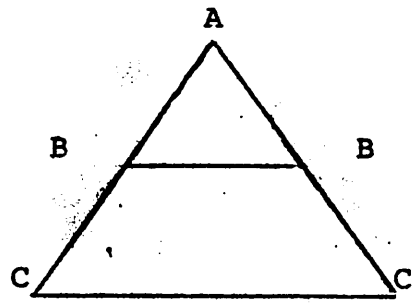
There exists a lot of interrelations between export structure and import structure which have to be taken into consideration in the process of planning and balancing. As we all know, certain inputs are required for certain exportables, which cannot be furnished by the domestic market, e.g. the import of a certain amount and a specific assortment of steel and nonferrous metal is needed for exporting machines and equipments of a certain volume and structure. As commodity balances only give an answer to proportions of one commodity or group of commodities, they cannot reveal such close relationship. Therefore we need a connection between commodity balances and input-output balances.

Another problem is the relation between the commodity and regional structure of foreign trade. These interrelations have to be considered in any case in planning foreign

trade but especially in those cases when a part of the entire foreign trade of a country is carried out on the basis of bilateral agreements and clearing currency instead of convertible currency. In order to achieve conformity between the commodity structure of export and import according to the requirements of the national economy of the own country and the possibilities and the needs of the different external markets there has to be a good connection in using commodity balances and trade balances in the planning process.

## 6.3 Experiences of the GDR in using commodity balances for planning foreign trade:

Commodity balances are one of the most important tools for planning the volume and commodity structure of export and import. They are used at various levels of planning. On the basis of the general framework of planning we have built up a pyramid of commodity balances which looks like that:




A = State Planning Commission - Level

B = Ministrie's level

C = Level of Associations of Nationally owned Enterprises and other balancing organs on decentral level (e.g. producing units).

On level A commodity balances are drawn up for goods of top priority, i.e. of major significance for the national reproduction process. The ministries (level B) are responsible for drawing up balances for such goods which are important, too, but the production or the use of which is mainly concentrated in one branch, in the sector of the ministry concerned.

The enterprises or associations of enterprises (level C) are included in this pyramid by balancing the resources and uses of particular commodity grades, assortment etc. In many

cases we are balancing on central state level homogeneous groups of commodities (some assortments of steel, grain, machine tools, motor cars .... etc) whereas the detailed assortment, different types of machines or other commodities, will be balanced on enterprise level. That means that the majority of all commodities is elaborated on decentral level.

This fact underlines the great importance of balancing organs on the lower level for determining - on the basis of aggregated balances of higher levels and considering other liabilities and limitations (see paragraph 5.4 - the concrete commodity structure of export and import in the process of planning foreign trade. As we have learnt before, these balancing activities are linked closely with the planning procedure in the foreign trade enterprises and resulting from coordinations between balancing organs and foreign trade enterprises contracts concerning export and import are concluded.

In the GDR all items of commodity balances are valuated on the basis of industry delivery prices. As far as possible items are valuated additionally on physical units (raw materials, agricultural products, some kinds of consumer goods etc).

For all export and import goods the external prices are taken, too. Thus for calculating profitability in the foreign trade operations on commodity basis we can compare the prices received on foreign markets for exportables (or paid for importables) with internal prices (see formulae in paragraph 2.4).

Exports and imports as a part of commodity balances are subdivided to different areas or groups of countries. Thereby it is possible to connect to a certain degree planning the commodity and the regional structure for foreign trade and to use the elaboration of commodity balances for solving possible contradictions between the requirements of a proportionate development of the national economy with the possibilities for selling or purchasing certain goods on foreign markets. Nevertheless we need additional tools for planning the regional structure of foreign trade (see chapter 7 and 9).

Long-term experiences have proved the use of commodity balances for planning foreign trade. At the same time we learnt that in addition to the general problems mentioned in paragraph 6.1 the following questions have to be considered carefully in the process of planning and balancing:

1/ How to determine the concrete demand of the national economy for certain commodities, above all in connection with the planned import? Sometimes the demands of potential users are greater than the possibilities of meeting these demands in the plan period, e.g. because of limitations by the balance of payments.

2/ Though there is conformity in general between the nomenclature of the plan, the follow-up system and the commodity balances, there are some difficulties to be overcome. That concernes above all comparisons with the list of commodities in foreign trade agreements with other countries and specific problems with regard to the export and import of complete plants covering different kinds of single commodities.

3/ External prices for exports and imports may change between the time of drawing up commodity balances and the implementation of the plan. This is of great influence on calculations for the profitability of exports and imports. Thus it is often necessary using prices of a basis period in an early stage of balancing and later on adding the current prices of the plan period.

4/ Equalizing resources and uses is a general aim in using commodity balances. But in the case of long-term planning (e.g. for 10-15 years) it may be useful to complete the balances of some very important commodities step by step and thus getting information on possible limitations. In addition, valuating on the basis of physical units will be the most appropriate way when elaborating balances for such long periods.

7 . Balance of Payments in Planning Foreign Trade and Foreign Exchange.

7.1 The balance of payments in the network of balances of the national economy and general relations to foreign trade planning:

When speaking about balance of payments problems it will be necessary at first to clarify the nature of this category. In theory and practice you will find two different views:(8)

a/ The balance of payments as a relation between the credits and debits on international account. Taking this approach, the balance of payment of a country must necessarily balance, when all international transactions are taken into account.

b/ The balance of payments as a relation between the aggregate foreign exchange receipts and expenditures of the national economy. In this view imbalances or disequilibrium is possible and we can speak about active or passive balances of payments during a certain period.

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(8) See: Harry G. Johnson "International Trade and Economic Growth" London Unwin University Books 1958, page 154

Obviously it is necessary to take into consideration both aspects of the theory of balance of payments but in compliance with the aim of this paper we shall concentrate upon the second aspect.

As we are interested above all in the relation between the balance of payments and foreign trade planning, we have to consider the structure of a balance of payment:

Scheme of a balance of payments (used in the GDR)

| Structure of payments | Foreign exchange | |
|---|---|---|
| | receipts | expenditure |
| 1. Payments from commodity movement: | | |
| 1.1 payments from exports or imports. | | |
| 1.2 payments for licences | | |
| 1.3 payments from other kinds of commodity movement. | | |
| 2. Payments from services | | |
| 2.1 commercial services | | |
| 2.2 non-commercial services | | |
| 3. Credit movements | | |
| 4. Other payments | | |
| 5. Reserves of gold and foreign exchange | | |
| Sum of 1-4 Saldo | | |

In the GDR more than 90% of all payments in foreign exchange are connected directly or indirectly with foreign trade activities (including payments for transporting export and import goods and credit movements resulting from foreign trade contracts), whereas in other countries the percentage of payments from other activities (tourism, services in the field of transport performances, unilateral monetary transfers, inflow of foreign capital etc) may rank much higher. But in every case the development of foreign trade will be the focal point in solving the problem of equalizing the balance of payments (in the above mentioned sense), e.g. for the A.R.E., too. And on the other hand the concrete situation with regard to the balance of payments will be an important condition or limitation for planning foreign trade. Thus we have always to take into consideration the close links between the balance of payments and foreign trade planning.

Part 1 of the scheme of a balance of payments contains the trade balance of the country. When investigating the development of the trade balance for purposes of planning or analyzing we must pay attention to how the imports are valuated. In the GDR and the other CMEA-countries valuation is carried out on the basis of fob-prices. This means that

transport costs and other expenditures in foreign currency for imports up to the border of the own country appear as commercial services in part 2 of the scheme of balance of payments and that a surplus in the trade balance may result to a certain extent to this fact. In other countries imports are valuated in the trade balance on the basis of cif-prices. For the purpose of international comparisons these differences have to be eliminated.

Trade balances and balances of payments are elements of a network of balances within the national economy and there exists a lot of interrelations to be considered in the process of planning and balancing the economy as a whole and foreign trade in particular. Above all there are to be taken into consideration the links with the

- balance of the gross social product;
- balance-sheet of the state budget;
- credit balance;
- foreign trade plan on the central level;
- plan of receipts and expenditures in foreign exchange.

## 7.2 Planning of foreign exchange:

In the paragraph before we considered the balance of payments as a relation between the aggregate foreign exchange receipts and expenditures of the national economy. As the balance of payments is drawn up not only as a "follow up balance" for analyzing past periods but also as a "plan balance" for futural periods it follows from this definition that the balance of payments is the most important tool for planning the flow of foreign exchange on the central state level in the course of long-medium-and short-term planning.

But according to the general principle of democratic centralism in socialist planning all the branches and enterprises engaged in the field of expending and receiving foreign currency have to be involved in the process of planning the flow of foreign exchange, too. In addition to the foreign trade such activities are to be taken into consideration, too, like tourism, shipping, through traffic as so as foreign exchange relations in connection with foreign policy, culture etc. In the following we shall concentrate upon planning of foreign exchange in the field of foreign trade.

In socialist countries planning of foreign exchange is connected closely with the application of the state monopoly in foreign exchange the essence of which can be defined as follows:

1/ The state concentrates all foreign currency funds of the country in its hands and determines those organs being responsible for managing, planning and organizing currency relations.

2/ International currency relations of the country are carried out on the basis of the plans and balances concerned. Currency movements outside the foreign exchange plan have to be approved by the state organs concerned.

3/ The international payment transactions are carried out and controlled by the state bank and other responsible banking establishments.

As we mentioned before, in the GDR the bulk of receipts and expenditures in foreign exchange results from exports and imports in connection with transporting these goods. That is the reason why in the planning methodology of the State Planning Commission the procedure for drawing up the plans for foreign trade and foreign exchange is elaborated in one common

chapter. In this methodology the structure of the foreign exchange plan is determined with regard to the resources or the purpose of use of foreign currency in the period concerned and to the regional aspects.

According to resources and purposes of use the receipts and expenditures in foreign exchange are subdivided as follows:

1/ exports and imports;

2/ services

- commercial services, above all transport performances for the foreign trade of the own country and for (or by) third countries;
- non-commercial services;

3/ claims and obligations from exports, imports and services;

4/ claims and obligations from bank-and other credit institutes.

In the cases 1 and 2 movements of exports or imports and foreign exchange take place in the same plan period. In annual planning the figures can be subdivided into quarters.

With regard to regional aspects the structure of the plan is as follows:

1/ Socialist countries

- separate countries taking part in the clearing system on the basis of the transferable rouble;
- socialist countries with other clearing forms;

2/ Non-socialist countries

- separate countries with bilateral clearing on the basis of agreements concerned;
- convertible currencies;

On the central level the State Planning Commission is responsible for drawing up the balance of payments in cooperation with other ministries, above all the Ministry of Finance and the Ministry of Foreign Trade. The Ministry of Finance coordinates the planning of foreign exchange of all branches besides of foreign trade and is in close cooperation with the State Bank in all questions of the international monetary policy. The Ministry of Foreign Trade is responsible for drawing up the detailed foreign exchange plan (subdivided into countries, currencies etc) as a part of the comprehensive

foreign trade plan, submits the plan drafts to the State Planning Commission and coordinates and approves the foreign exchange plans of the foreign trade enterprises.

Unlike foreign trade planning there is no "2-channel-planning" in drawing up the foreign exchange plan. This is in conformity with the state monopoly in foreign exchange, according to which monetary relations between enterprises and other organs of the national economy - also in the field of foreign trade - are organized in any case on the basis of domestic currency.

Hence it follows that foreign trade enterprises bear full responsibility for drawing up foreign exchange plans on the branch and enterprise level. Above all they are responsible for guaranteeing conformity between material, financial and foreign exchange planning as an important basis for a smooth carrying out of the exports and imports in the group of commodities they are responsible for. In addition, they have to ensure by qualified planning and concluding export and import contracts that the general targets of the foreign exchange policy will be fulfilled. According to the concrete situation on the capitalist world market (devaluation or revalorization of currencies, changing conditions in

the field of foreign exchange transactions) foreign exchange planning is extremely difficult in relations to these countries. The foreign trade enterprises are cooperating in these questions closely with special bank establishments, above all with the foreign trade bank.

8 . Prices in Foreign Trade Planning.

8.1 The role of prices in foreign trade planning:

Prices are important tools and at the same time targets in socialist planning in general and in planning foreign trade in particular. This results from the main functions of prices in a socialist economy:

1/ The price is the measuring instrument of the value i.e. of the socially necessary expense of living and embodied labour needed to produce any commodity.

2/ The price operates as an economic incentive.

3/ The price is a means for distributing and redistributing the national income.

Starting from these general functions we can determine the role of prices in socialist planning as follows:(9)

a/ The price is a means to ensure the reproduction process according to the general targets of the plan. Under the conditions of commodity production and the existence of commodity - money - relations in a socialist society prices are important tools for reflecting

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(9) See in detail, W. Wunderlich, "The role of the price in the plan of development" Memo No. 1096-Part II- of the Institute of National Planning.

and realizing the social gross product as a whole on the one hand and for supporting the development of the socially necessary proportions of the economy on the other hand.

b/ The price is an instrument to stimulate propor - tional planning and the implementation of the planned proportions in the economic development. As we mentioned in chapter 6, this task involves using the possibilities of foreign trade for achieving the best (optimal) proportions.

c/ Prices are a means to ensure enterprisal efficiency and profitability and to stimulate cost reduction. As to foreign trade planning, this role of prices as economic incentives is of special importance in the case of producing and selling export goods.

d/ The price is an instrument to support planning and implementing the equilibrium of supply and demand. Starting from the principle in general that in a socialist economy it is strived for a planned equilibrium of supply and demand on the basis of prices reflecting the values of goods, the necessity can arise for planned deviations from the values of certain commodities.

e/ Prices are used as tools for a planned distribution and redistribution of the national income. This task is closely connected with ensuring a proportionate development of the national economy as a whole and with the aforementioned necessity for deviating from the values, above all in the field of retail prices of consumer goods with the help of subsidies, taxes etc.

f/ Prices are used as a comprehensive tool of planning in all stages of the planning procedure, in all branches and enterprises and on all levels of the "planning and balancing pyramid". In accordance with the principle of the unity of material and financial planning prices are the most important tools for evaluating the different resources and funds and in so far for promoting balancing and optimizing the plan.

On the basis of this general view with regard to the role of prices in socialist planning some specialities have to be taken into consideration in the field of foreign trade planning as compared with other branches of the national economy. This results from the fact that in addition to the domestic prices planning has to involve, too, external prices (in many cases several prices for one commodity on different

markets) with additional difficulties in evaluating the futural development. The main aspects in this connection can be determined as follows:

a/ In the process of planning foreign trade it has to be decided whether the volume of export and import should be valued to domestic or foreign prices. The decision will depend upon the plan period, the task to be solved and other factors. This problem is a special aspect of the above mentioned principle of the unity of material and financial planning.

b/ There are a lot of interrelations between the development of internal and world market prices affecting decision making in foreign trade planning (see paragraph 8.3 too).

c/ Calculating the profitability of export and import is influenced to a high degree by the level and quality of internal and foreign prices (see paragraph 2.4).

d/ Solutions in optimizing the commodity and/or regional structure of foreign trade depend, too, to a high extent upon estimating the development of prices of the commodities concerned on different markets (see chapter 10).

Starting from this representation of the role of prices in foreign trade planning in general we shall now give emphasis on the following three problems:

1) Evaluation of external prices in foreign trade planning.
2) Domestic prices in foreign trade planning.
3) Application of current or unchangeable prices in planning and analyzing foreign trade.

## 8.2 External prices in foreign trade planning:

The development of world market prices is one of the most important and at the same time one of the most comprehensive questions in theory and practice of international trade. There are so many factors influenceing the level, the structure and the development of these prices that forecasting in this field is an extremely difficult task, above all for purposes of medium-and long-term planning. Nevertheless in planning foreign trade we have to assess exports and imports not only with regard to the quantity, valued on the basis of physical units and to domestic prices, but also in the term of external prices. Otherwise it is impossible to calculate the profitability of export and import and the probable terms of trade in the plan period concerned and to

use planning as a means for finding the best (optimal) solutions.

This problem has to be solved in the case of short- and medium-term planning as well as in long-term planning which is usually connected with decisions in the field of investments. Therefore we need forecasts concerning the development of external prices 5 or 10 years ahead. Obviously, the degree of uncertainty will be much higher than in the case of assessing prices for purposes of annual planning. But in spite of that we have to seek for a solution, in order to avoid wrong decisions and economic losses.

Planning external prices comprises assessing the level, the relations and the structure of prices in the plan period concerned. The development of the price level is characterized by changes of prices between a basis period and the plan period, measured for a determined structure of selected commodities. In foreign trade planning we have to assess for instance the development of differences with regard to the price level between different countries and between the own country and foreign markets. Inflation rates, foreign exchange rates etc will be of great relevance to this aspect.

Price relations concern the relation between prices of different commodities or groups of commodities. Within the same price level the development of the relations between single goods, different qualities or from country to country can vary essentially.

The price structure is the composition of the price of a certain commodity concerning outlay of funds, cost of material, wages, profit including possible influence of taxes or subsidies.

Methods or instruments for forecasting the development of external prices will differ, above all, as to

- short-medium or long-term planning;
- the kind of commodities (minerals, agricultural products, equipment, consumer goods etc);
- regional aspects.

Irrespective of this differentiation some general hints can be given. In addition to analyzing the past development of the prices of single goods or groups of commodities as a whole and extrapolating futural trends the method of "factor-analyzing and forecasting of prices" has proved to be successful, especially for purposes of medium-and long-term price planning of selected goods with great importance for the economy. The technique of this method can be described as follows:

1/ By analyzing the past development the most important factors influencing the amount and the changes of the price of the commodity concerned are determined. Such factors can result from the scientific technical progress, changes in the technology of production, used material including possible substitution, changes in supply or demand etc..

2/ Each of these factors gets an index according to the relative importance on the price as a whole. The total of all indexes is equal to 1.

3/ The development of all these factors is forecasted independently from each other taking into consideration different and partly adverse tendencies.

4/ By combining the results of the selected factors the probable price in the futural plan period will be found. By using mathematical methods interrelations between different factors influencing the price can be considered.

This or similar techniques can only be used as supporting instruments in the course of the concrete research work in this field. In any case specialists have to consider all the circumstances including political, environmental and other factors in a comprehensive way taking the final decision.

As to the experiences of the GDR and other CMEA-countries in this field, some differences in principle have to be considered with regard to planning external prices in foreign trade relations with socialist countries and with capitalist countries. This is due to differences in principle of price formation in foreign trade between CMEA-countries as compared with foreign trade with other countries (see in detail the lecture on international economic comparative studies).

8.3 Internal prices in foreign trade planning:

As mentioned before, we have to take into consideration the close interrelations between internal and external pricies. On the one hand, domestic manufacturing costs and prices in the leading export countries of the commodities concerned are the basis in principle for the formation of world market prices and on the other hand prices of import goods are a more or less important factor (depending upon the foreign trade intensity of the national economy and the price policy of the country concerned) for the domestic price level, price relations and price structure.

It follows that internal prices as figures within the comprehensive foreign trade plan always have to be seen in connection with external prices. As far as the price level is concerned or when using internal prices as a part of profitability calculations for export and/or import goods we have to consider, too, the great influence of the foreign exchange rate on possible conclusions. That applies above all to those countries (e.g. the socialist countries) where the exchange rate is not the spontaneous result of supply and demand on international money markets but where the exchange rate is fixed as a part of central planning by the government, and will be stable for a longer period.

The role of internal prices in foreign trade planning will differ in detail from country to country according to the domestic price policy. Thus in the following we shall refer to how this problem is handled in the GDR.

In the field of export domestic prices play an important role in planning and balancing the development of the volume of the commodity movement and in the process of plan coordination between industrial corporations and foreign trade enterprises (see paragraph 5.4). In the early stages of

socialist planning in the GDR exports were delivered from producing units to foreign enterprises on the basis of domestic prices in all cases. In spite of changing this method for a great part of the export industry domestic prices are still of great importance for regulating the relations between industrial and foreign trade enterprises. (As to the role of internal prices in calculating the profitability of export we refer to paragraph 2.4).

Domestic prices are of special importance for planning the export of completely new goods or of commodities with improved qualities according to the scientific-technical progress. There are sometimes tendencies in the industry for increasing domestic prices more than the use - values of the commodities concerned and the possibilities of realizing advanced prices on foreign markets were raised. Thereby the volume of export in terms of value (measured to domestic prices) would rise without a real increase of export quantity. Thus the foreign trade enterprises have to scrutinze prices for new commodities and urge for necessary adjustments.

With regard to import domestic prices are concerned on the one hand by the influence of world market prices on the price level of the national economy as a whole, above all in the field of raw materials and fuels. On the other hand

internal import delivery prices are important indicators for measuring the fulfilment of plan targets or for assessing the profitability of planned import activities. In detail the different types of the formation of import delivery prices are to be considered before conclusions can be taken. In most cases these prices are related to domestic prices of similar commodities of the own production. But if there are no possibilities for proper comparisons the real costs of the import are the basis for the internal price of the commodity concerned.

## 8.4 Application of current or constant prices in planning and analysing foreign trade:

Economic planning in general and foreign trade planning in particular can be carried out on the basis of current and/or constant prices of a certain period, e.g. prices of the last year before starting a new 5-year plan period. The same problem arises in the case of analyzing the past development. Each of these possibilities has its advantages and disadvantages and in any case it depends upon the subject and the target of the plan or the analysis concerned whether current or constant prices are used.

Provided the long-term planning is aimed above all at coming to recognize the development of volume and commodity structure of export and import in terms of use-value using constant prices (either internal or external) will be given preference. The same decision will be made when analyzing long-term tendencies of the volume of international trade. If statistics only comprise current prices, distorting influences of inflation on the foreign trade volume and of different price developments between commodities on the structure of export and import can be eliminated by using suitable coefficients.

Using current prices is to be given preference in all those cases if the influence of foreign trade on the trade balance or the balance of payments has to be considered and if optimal solutions with regard to the profitability of foreign trade are to be found.

In the GDR annual planning of foreign trade is carried out on the basis of current prices in principle. In medium and long-term planning the price-bases are used in a different way, depending upon the stage of the planning procedure and other factors. In some cases both types of prices are used side by side, thus giving the opportunity for making conclusions with regard to different aims.

## 9. Different Problems and Possibilities in Planning Foreign Trade With Socialist and Capitalist Countries:

### 9.1 The role of the regional structure in planning foreign trade:

Planning of the commodity structure and the regional structure of foreign trade is closely linked with each other. The commodity-structure of export and import is of great influence on the development of the flow of foreign trade to different countries, as buying and selling of certain commodities (e.g. the purchase of some raw materials or highly sophisticated equipment) is often limited to few selected countries. On the other hand, the structure of foreign trade with regard to countries or foreign currencies (e.g. depending upon central decisions in the field of foreign affairs or the needs of redressing the balance of payments in certain currencies) has a more or less determining effect on shaping the commodity structure of export and import of the country concerned. Thus these interrelations have to be taken into consideration in planning foreign trade.

The most important factors influencing the regional structure in planning foreign trade can be determined as follows:

- aims and conditions in the field of foreign affairs according to the close connections between policy and economy;
- effects of integration processes (e.g. in the case of CMEA, EEC, integration among Arab Countries). Experiences of the past years prove the growing influence of specialization and cooperation of production as a crucial point of economic integration on the volume and the regional structure of export and import;
- requirements resulting from the commodity structure of export and import;
- possibilities of selling and buying on different markets;
- demands for equalizing the balance of payments with regard to certain currencies and/or countries, above all in the case of existing bilateral clearing agreements;
- aspects of the profitability of foreign trade in connection with different prices (including costs of transportation, influence of customs etc) in export and import relations to single countries.

The aforementioned factors are not isolated from each other, there are many interrelations. Starting from that the following methods, instruments and techniques can be applied in planning the regional structure of foreign trade:

a/ Special plan figures and plan components within the planning procedure for the development of export, import and the flow of foreign exchange to different groups of countries, separate countries and/or currencies;

b/ Using the different possibilities of economic integration, above all activities in the field of international plan coordination or joint planning, for planning foreign trade with partner countries of the community concerned and with third countries.

c/ Using trade agreements and other types of governmental agreements in the field of foreign economic relations as a means for planning and realizing the development of foreign trade to certain countries;

d/ Customs policy, fixing of exchange rates and further financial instruments as a means for influencing the regional structure of foreign trade;

e/ Using mathematical models for calculating the optimal structure of foreign trade with regard to the regional development (see chapter 10).

Depending upon the different conditions on the socialist world market and the capitalist world market regional planning of the foreign trade has to be distinguished above all relating to socialist and capitalist countries.

9.2 Specialities in planning foreign trade with socialist countries:

The economic development of socialist countries is planned in a comprehensive way and the socio-economic conditions in these countries guarantee a high stability in economic growth and the realization of liabilities resulting from international economic agreements with other countries. Thereby favourable prerequisites exist for planning foreign trade relations with socialist countries. That is of special importance for planning foreign trade by CMEA-countries, e.g. the GDR.

Of particular importance in this connection is the cooperation in planning with other member countries of CMEA carried out in different forms and fixing, among other things, mutual foreign trade relations for several years ahead concerning

volume and commodity structure of export and import. At the same time, agreements on governmental, branch and enterprise level for further depening scientific-technical cooperation, cooperation in investments as well as specialization and cooperation in production involve a lot of concrete liabilities for futural exports and imports. In the result of these activities in the framework of socialist economic integration trade agreements, containing the volume and the detailed commodity structure as to export and import, are concluded between the CMEA-countries for the following 5-year-plan period. They are completed and - in conformity with new tendencies conditions and knowledges - corrected by annual agreements.

By connecting the preparation and the conclusion of these agreements with the continuous procedure of planning foreign trade on all levels and in all branches and enterprises a high quality in planning and realizing foreign trade relations to other socialist countries can be achieved.

The aforementioned conditions create favourable conditions, too, for planning foreign trade with socialist countries by developing countries. This results, above all, from the planned, stable economic development in socialist countries including

foreign economic relations. In addition to the methods and techniques for planning the regional structure of foreign trade as mentioned in paragraph 9.1 the following factors could be used:

a/ In connection with the elaboration of long - and medium - term plans of the economic development in developing countries there are certain possibilities for a coordination in special fields with the planning activities in socialist countries. Such a kind of "plan coordination" is possible on a bilateral level or on a multilateral level with CMEA-organs (e.g. on the basis of agreements between the CMEA and Mexico and Iraq).

b/ Based on a centrally planned development (including or without a plan coordination) long-term agreements between developing countries and socialist countries on important subjects in the field of scientific-technical cooperation, the establishment of great projects (e.g. in the fields of industrialization or improving the infrastructure) or for specialization and cooperation in production could be concluded with effects on a stable development of export and import relations between the countries concerned.

c/ Bilateral trade agreements (see for example the agreement between ARE and GDR for 1978) containing the volume and the commodity structure of export and import are useful instruments for regional planning, too, as obligations from these agreements are parts of the foreign trade plans of both countries.

9.3 Specialities in planning foreign trade with capitalist countries:

When planning foreign trade relations to capitalist countries we have to take into consideration the economic laws and concrete conditions influencing the economic development within the single countries and on the capitalist world market as a whole. Economic crises, high inflation rates and the absence of effective systems of central planning by capitalist states are some of the factors affecting not only the economy of the own country but at the same time the foreign economic relations to socialist countries and to developing countries.

In spite of these difficulties and the high degree of uncertainty foreign trade plans have to comprise export and import relations to capitalist countries, too. Otherwise a comprehensive planning and balancing of the reproduction process as a whole would be impossible.

According to the aforementioned conditions we should give emphasis in foreign trade planning with capitalist countries on the following factors:

1/ Long-term agreements on governmental level or with certain corporations, comprising concrete obligations as to the volume and structure of export and import, can be used as a means for stabilizing the mutual economic relations in conformity with the targets of the foreign trade plan as a whole. Agreements of high dimensions on "barter transactions" between socialist countries and western partners during the past years have proved to be useful instruments.

2/ Planning foreign trade with capitalist countries needs a most effective work in the field of market reseach in the course of elaborating plans and - if necessary - correcting certain targets in conformity with new market conditions.

3/ Techniques of foreign trade planning have to be adopted to these special conditions. That means above all ensuring a high movability within the whole system of planning and balancing enabling prompt reactions and decisions as to the targets and means of the plan. Permissible variations as to the commodity and regional

structure of the plan within the whole framework of methodical regulations in the field of foreign trade planning as so as material and financial reserve funds are of special importance for this part of the entire foreign trade plan.

## 10. The Application of Mathematical Models and Computers in Foreign Trade Planning.

### 10.1 The objectives of optimization calculations in foreign trade planning:

As we mentioned before, socialist planning is aimed at finding the optimal solutions for developing the national economy, taking into consideration the existing material and financial resources, the manpower potential and the entirety of internal and external conditions and possibilities in conformity with the general political, social and economic targets of the society fixed by the leading authorities of the state.

As to foreign trade planning, there are always several possible variants with regard to the volume, the commodity structure and the regional structure of export and import. As far as the volume and the commodity structure of export and/or import are concerned, each variant of the plan will have different effects on the entire reproduction process, above all on production, investments and consumption. According to different prices and transport costs for the same export and/or import goods on different markets the regional structure of a fixed volume of export or import will influence, too, the profitability of foreign trade.

In the foregoing chapters of this paper we described the techniques and tools like commodity balances, trade balances, profitability indexes, special plan components etc. which have proved to be a useful and successful means of socialist planning for establishing plan-targets being consistent and covering certain pre-determined economic criteria. Also in future these methods will be of greatest importance for planning foreign trade and we are trying to improve them in order to fit the steadily growing requirements in planning foreign trade.

But at the same time we should make use of mathematical models and computers as auxiliary instruments helping us to take into consideration the manifold interrelations and repercussions between economic processes in the field of foreign trade and to find the optimal solution out of a lot of possible plan variants. One of these new tools are input-output-balances calculating the influence of changes in the structure of production, consumption, export and import on all branches (or groups of commodities) in the national economy.(10)

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(10) Please, see Schulmeister "Tools for foreign trade planning, Part I: Balances" Memo No. 204, INP Cairo 1971.

Another tool which has proved to be a useful technique for foreign trade planning, too, is the linear programming technique, or as we say, models of optimization. Especially in cases of a diversified commodity structure of export and import in connection with a lot of alternatives between domestic production, import and export and with several possibilities for buying or selling the same good on different markets characterized by different profitability indices optimization calculations can qualify essentially decision making in the procedure of foreign trade planning.

The basis ideas for constructing and using linear programming models for planning foreign trade are as follows: (11)

1/ We have to decide which problem is to be solved for which group of commodities, e.g.:

- Optimizing the commodity structure of export and/or import in connection with the structure of the domestic production;

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(11) As to the detailed steps in applying such models please see: Schulmeister "The Application of Linear Programming Models for Planning the Optimal Structure of Foreign Trade" Memo 1014 INP Cairo 1972.

- Optimizing the regional structure of a fixed volume and commodity structure of export and import to different market;

Depending upon the task to be solved, the concrete type of the mathematical model can be determined. 2/ A linear objective function has to be formulated which aims either at a maximization or at a minimization. In conformity with the problem concerned the objective function might be e.g.:

- Maximizing the surplus of export receipts over the import expenditures of the group of commodities concerned;
- Maximizing the sum of domestic prices of the industrial corporations on the home market and export receipts of foreign trade enterprises as to a group of commodities;
- Minimizing expenditures in foreign exchange for a group of import goods according to a planned volume;
- Minimizing the sum of domestic cost of production and expenditures in foreign exchange for a group commodities.

In all these cases differences as to prices and costs between several goods within a group of commodities or between different markets will be used for the purpose of maximising receipts or profits or of minimizing expenditures in foreign currency or in cost of production.

3/ A set of linear constraints has to be determined limiting the variables of the model. These constraints have to cover the existing limitations both internally and on external markets, such as:

- Limitations in the capacity for producing the exportables;
- The necessity of fulfilling the domestic demand in products which are also exportables;
- Maximum possibilities for selling certain export goods on certain markets;
- Maximum supply possibilities for commodities on certain markets;
- Obligations arising from trade agreements or commercial contracts with regard to certain exports or imports on fixed markets;
- Requirements from the balance of payments as to certain currencies or countries.

By means of such constraints we can ensure that the objective function of the model can only operate within the bounderies decided by central plan targets and by the political, social and economic conditions and aims of the environment of the economy concerned. In that way we can promote to a high extent that the sub-optimum solution of a partial system (e.g. production, export and import of a certain group of commodities) will meet the requirements of an optimal development of the system as a whole (the national economy).(12)

4/ The necessary data for the calculation according to the model have to be collected and checked by the planners, after preparing the computer programme the model will be solved by the computer and the results of the calculation can be used by the planners as a basis for decision making.

Using optimization calculations in socialist planning foreign trade is not aimed at replacing traditional tools like balances etc. by modern tools like models of optimization. We are following the concept of combining the traditional and the modern tools in practical planning.

12) Because of the mathematical problem of the so-called "two-level-planning" please see footnote No.6.

A model, even if highly sophisticated, is without any use, if the expert or the planner has not elaborated on it in the correct lines, e.g. when determining the objective function, when fixing the limiting constraints and estimating the inputs (cost, prices, maximum sale's or supply possibilities for certain commodities on different markets, minimum demands or obligations for exports and imports on certain markets etc). Besides, we want to stress that the political, social and economic development are so manifold and include so many different factors and tendencies which cannot completely be considered in models. Thus one has always to check the results coming from the computer and to compare them with the real life before deciding on the plan for the futural development.

10.2 A linear programming model for optimizing the commodity and regional structure of foreign trade:

As we mentioned before, using programming techniques in the field of foreign trade planning requires different types of models, depending upon the task to be solved. An important problem in foreign trade planning is to find the optimal structure of the production, export and import for a certain branch or a group of commodities as a part of

the national economy. For instance we want to decide, when establishing a mechanical engineering complex for producing agricultural machines: Which is the optimal size and structure of the complex from both the internal and external side? Which assortment of agricultural machines is to be produced and which percentage shall be exported to which countries or groups of countries? Which kinds and which quantities of raw materials, intermediate products and final products of certain types of agricultural machines should be imported, meeting the demands of the domestic market?

For this purpose the following model can be used. The model is mainly directed to an optimization of the export and import structure. As the aforementioned problem touches the development of production, investments and consumption, too, the objective function and the constraints can be extended with regard to the available labour resources, investment requirements etc.

The objective function of the model looks as follows:

$$\sum_{k=1}^{n}\sum_{r=1}^{m} P_{kr}X_{kr} - \sum_{k=1}^{n}\sum_{r=1}^{m} P^{J}_{kr}X_{kr} + \sum_{g=1}^{s}\sum_{r=1}^{m} d^{J}_{gr}Y_{gr} - \sum_{g=1}^{s}\sum_{r=1}^{m} d_{gr}Y_{gr} \longrightarrow \max$$

Explanation of symbols used:

K = 1,2,3 ... n number of export commodities

r = 1,2,3 ... m number of countries/markets

g = 1,2,3 ... s number of import commodities

$P_{kr}$ = external price (fob) of the export commodity k on the market r per unit of volume .

$X_{kr}$ = export volume of commodity k on market r.

$P^J$ = internal costs or internal prices of exportables

$d^J$ = internal price for the importables (or domestic prices of the domestically produced commodities similar to or substitutes for imports).

**The constraints (limiting conditions) are formulated as follows:**

(1) $$\sum_{r=1}^{m} Y_{gr} + X_k = \sum_{j=1}^{n} a_{kj} X_j + \sum_{r=1}^{m} x_{kr} + C_k$$

(2) $$X_k \leq \bar{K}_k$$

(3) $$x_{kr} \leq \bar{b}_{kr}$$

(4) $$x_{kr} \geq \underline{b}_{kr}$$

(5) $$Y_{gr} \leq \bar{Б}_{gr}$$

(6) $Y_{gr} \geqq \underline{b}_{gr}$

(7) $\underline{S} \geqslant \sum_{k=1}^{n} P_{kr} X_{kr} - \sum_{g=1}^{s} d_{gr} Y_{gr} \leqslant \overline{S}_r$

where

$X_k$ = total production of commodity k

$\sum_{j=1}^{n} a_{kj} X_j$ = raw materials or intermediate goods j=1 ... n for the production of commodity k ($a_{kj}$ are the technical or input/output coefficients)

$G_k$ = final internal demand for commodity k

$\overline{K}_k$ = available production capacity for commodity k or the planned capacity for the plan period

$\overline{b}_{kr}$ = maximum sale's or supply possibility for commodity k on the market r

$\underline{b}_{kr}$ = minimum export or import obligations for commodity k on the market r

$\underline{S}_r / \overline{S}_r$ = lowest or highest limit for balance limitations as to the market r

10.3 Experiences in applying linear programming models for planning foreign trade:

When constructing models of optimization and applying them practically one will be facing some problems resulting both from the existing economic and other conditions influencing the model and from the mathematical apparatus. In the following we shall give some ideas how to solve such problems utilizing experiences in research work and practice of planning foreign trade in the GDR.

1/ One problem concerns the contradiction between the linear programming technique - i.e. all coefficients and parameters attached to the variables of the model will behave in a linear way - and the dynamic behaviour in real life, above all as the external prices are concerned. In many cases export and import prices (above all agricultural products and some raw materials) will behave in a non-linear way depending on a certain season during the year or on the quantities of export or import goods settled in commercial contracts.

If these changes are not remarkable one can neglect them and use average prices. Otherwise one can handle the problem as follows:

a) We make use of the parametric linear programming technique and by this investigate the influence of changes in the coefficients or parameters of the model on the optimal distribution (e.g. of the distribution of export and import goods on different markets);

b) We can divide one commodity into 2,3 or more separate items according to changes of the price depending upon the season or upon the contracted quantity. For example take for given that onions could be sold for 100$ per ton when exporting less than 100 tons. When contracting larger quantities the buyer will get a discount of 10%. In this case we should take the following items in the model

$k_1$ = onions to be sold for 100$/ton within a limit from 1 till 99 toms

$k_2$ = onions to be sold for 90$/ton when exporting more than 99 tons.

2/ Another problem deals with the possible or necessary size of the model. The number of variables and the number of equations to be included in the model is limited, especially from the aspect of collecting all data in a proper way and of solving the model in a reasonable time. We gained good experience in using models which included less than 10.000 equations or non-equations and 1000 till 2000 variables.

3/ The aforementioned problem is closely linked with the task of properly relating partial optimization models to the overall optimum of the national economy as a whole. From the national economic point of view all foreign trade models must be considered as partial models and the partial optimization must be in consistency and in full line with the overall targets and limitations of the national economy.

There exists a system of models with a different degree of aggregation and disaggregation (groups of commodities on a higher level will be divided into single commodities or types of commodities on branch and enterprise levels) which can be compared with the above mentioned hierarchical

system of socialist planning or the pyramid of balances (see chapter 1, 5 and 6).

This problem must be solved, when determining those inputs of the partial models like $G_k$, $\bar{K}_k$, $\underline{S}_r$, $\bar{S}_r$ etc. (see paragraph 10.2) which should be derived from the national plan or concept. According to the above mentioned method of a "two-level-planning" some coefficients and parameters as inputs for partial models should be the results of balancing and optimizing on the central level whereas the partial optimization on lower levels will contribute to a further improvement of the national plan as a whole.

4/ Practical experiences proved the informational problem as to be the most crucial one. The best mathematical model is of no use if you cannot feed it with correct data for the plan period. As to optimization models in the field of foreign trade, above all futural external prices as so as the demand and the possibilities for selling and buying certain commodities on certain markets are concerned. In the case of optimizing the commodity structure for medium-

or long-term planning determining the technical or input/output coefficients $a_{kj}$ (see constraint No.1 in the model described in paragraph 10.2) in conformity with the scientific-technical progress is very difficult, too.

Thus there seems to be a paradoxon. Applying programming technique is aimed at improving and rationalizing the whole procedure of planning included finding the optimum set of plan targets. But first of all the planner has to work harder as the data requirements are growing and he must spend greater efforts in getting the necessary information and in checking the data as to exactness and consistency.

Going into this matter in details, you will find that there is no additional demand for data as compared with traditional methods of planning. Using mathematical methods makes it only necessary, to fix the objectives and the limitations for the plan in a quantitative and qualitative very exact way. Hence the quality and accuracy of planning will grow and planning will benefit altogether by making use of mathematics and econometrics.