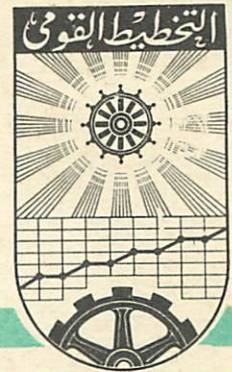# UNITED ARAB REPUBLIC

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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 adminis-
trative 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 evaluatio
of these sets of consequences. Factual knowledge and the values or pref-
erences of the deciding individual for one set of consequences as compare
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 dis-
tinguished from objectively rational behavior, decision is initiated by
external stimuli which channel attention to selected aspects of the situa
tion to the exclusion of competing aspects that might turn choice in anot
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 govern-
ing 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 organiza-

tion's activity, of the key decision premises (or set of guiding principle:

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 proc€

in the organization (i.e., an analysis of the way in which decisions actua:

were made and the locations of important decision functions in the organizi

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 <u>Administrative Behavior</u>. 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

value 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 experi-

ment 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 interpre-

tation of pictures he had seen alone before discussion with his teammates,

and again after discussion. Irrespective of the source of group identifi-

cation (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 corre-

lation 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 pro-

vide 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 con-

lucted in relation to two of Simon's communication hypotheses.

One of Simon's hypotheses on communication states that personal

notivation affects communication. That is, personal motivation (e.g., one's

notivation 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 communi-

cate 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 infor-

mation 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. How-
ever, 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 empirica
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 pre-

sents 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 useful-

ness to the operating executives of the business in making decisions and solv

ing 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 organiza

tion 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 deter-

mine 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 informa-

tion sources) and the operating people (as consumers).[22] Therefore, what

might be a good organization pattern for the use of certain types of account-