

AN INTERORGANIZATIONAL ANALYSIS
OF URBAN TRANSPORTATION PROJECT DEVELOPMENT
IN CAIRO, EGYPT

by

MARTIN FRANK MICHAEL

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ABSTRACT

In May 1977, the Massachusetts Institute of Technology and Cairo University (Cairo, Egypt) jointly initiated a Technology Adaptation Program. One component of the Program is an Urban Transportation Project. This project has three elements: a transportation system model for Cairo, an analysis of automobile ownership in the city, and a project programming methodological adaptation effort. This thesis is based on the research undertaken as part of the effort to adapt U.S. project programming methodology for use in Cairo.

This study is an interorganizational analysis of the urban transportation project development process for the Cairo, Egypt, metropolitan area. Relying on a network structure concept, it first identifies and describes the functions, roles, and authority "states" of the set of public and private organizations which participate in project development. It subsequently analyzes the interactions of these organizations as a series of information exchanges which move a

project from conceptualization to legitimization, a prerequisite for implementation. The analysis portrays this process as a bargaining activity.

Underlying the analysis is the notion of uncertainty, and project development is considered as a series of activities which are intended to reduce uncertainty.

With the overriding purpose being the understanding of existing development activities as a prelude to the adaptation of project programming methodology for use in Egypt, the implications of the analysis for this effort are briefly examined.

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Chapter 1

INTRODUCTION

This thesis is a study of the manner in which urban transportation projects are developed for the Cairo metropolitan area. The interest in this process was spurred by the initiation of a joint MIT-Cairo University project aimed at the adaptation and transfer to Egypt of U.S. transportation project programming methodologies.

The first section of this chapter briefly outlines the nature of the joint MIT-Cairo University Technology Adaptation Program, providing the context of the thesis. The second section is an introduction to "programming."

Context of the Thesis

In 1977, the Massachusetts Institute of Technology and Cairo University (Cairo, Egypt) jointly initiated a "Technological Planning Program"--known at MIT as the Technology Adaptation Program (TAP). The Program, funded by the U.S. Agency for International Development, has a dual nature. First, it presents an opportunity for MIT faculty, staff, and students (as well as their counterparts at Cairo University) to undertake major research work pertinent to their academic interests. Balancing this research orientation is a strong product focus. There is a real emphasis on successfully adapting and transferring to Egypt a variety of technologies which might aid its development. A number of individual projects have been established under the TAP umbrella, including projects dealing with the construction of housing, the shoe industry, intercity transportation, national accounting, power generation and

distribution, water resources, rural-urban migration, and the provision of health services.

The immediate context of this study is one of the TAP projects--the Urban Transportation Project. This project involves MIT faculty, staff, and students from the Departments of Urban Studies and Planning and Civil Engineering, and Egyptian faculty and students primarily associated with Cairo University but also from Assyuit and Alexandria Universities, as well as government officials associated with the Egyptian Ministry of Transportation and the Cairo Transit Authority.

The project has three elements:

1. Transportation Survey System--The intent here is to develop a detailed data base consisting of a model of the city's street network and existing origin destination travel patterns in the city for use by public officials in transportation planning for Cairo. The basic data has been collected through vehicular and mass transit passenger surveys and will be coded for use with a standard computer package designed for this type of data analysis. The survey and analysis procedures are being recorded so the data base can be updated in future years.
2. Transportation Project Programming--The intent of this element of the work is to adapt/develop a method to facilitate the efficient and effective timing of investments in the variety of urban transportation projects in the Cairo area. (This element is discussed in greater detail in subsequent sections.)

3. Automobile Ownership Policy Study--The purpose of this work is to analyze the factors which influence the level and pattern of distribution of automobile ownership in Cairo. Because even marginal changes in the level of ownership may have major impacts on the transportation network of a city like Cairo, this is an effort to identify potential levers which might be used as policy implementation instruments with respect to the level of automobile ownership.

This thesis culminates my one and one-half years of work on the project-programming element of the project. The purpose of the thesis is to assemble, detail, and expand on the "development" aspects of our research concerning the urban transportation project development and implementation activity in Cairo and to consider the extent to which the underlying themes used are adequate and/or others have stronger explanatory and practical force.

"Programming"

As traditionally used in the U.S. transportation sector, programming is ". . .the matching of available projects to available funds to accomplish the goals of a given period."¹ Programming, therefore, is dependent on the existence of:

1. Goals--Whatever their source, scope, and focus, goals provide the criteria for measuring the success of programming.

¹Bruce Campbell. Priority Programming and Project Selection. Manuscript (NCHRP Project 20-5, Topic 7-07), Third Draft, March 1977.

2. Resources--Primarily financial resources. Programming is concerned with the flow of funds available for use in implementing transportation projects.
3. Projects--Parallel to the consideration of the flow of funds, programming is concerned with the set of transportation projects which are available for implementation.
4. Methodology--Programming requires a method of integrating information concerning goals, funds, and projects.

Conceptually, programming might be envisioned as the employment of a method with the objective of allocating available funds among a set of projects and determining the extent to which that allocation is consistent with certain goals. The allocative pattern, in turn, determines a schedule of implementation for the set of projects. The activity is comparative; alternative patterns of fund distribution and alternative sets of projects may be examined to determine alternative degrees of goal achievement.

The reality of transportation project programming strains the purity of the concept outlined above. Centered in a political environment of conflicting interests and needs, programming rarely has the explicit, clear goals with which to establish decision criteria. The resource allocation implication of programming has a significant impact on the existing pattern of social relationships. The resource dependent organizations can hardly risk ambivalence to the programming activity, and they attempt to influence its form and uses so as to protect and/or further their interests.

In an ideal state, all projects--both capital expenditures on new projects and maintenance/operating expenditures--would be subject to programming. The reality of the programming environment (organizational structures, cultural/institutional setting, and political activity) usually considerably narrows the scope. In the U.S., programming typically deals with only new roadway construction projects, or, separately, maintenance projects.

Methodological constraints arise in the translation of programming-concept to programming-reality. The history of U.S. transportation project programming might be viewed as a history of methodological development. There has been a general evolution toward methodologies which are capable of integrating more and different types of information about goals and projects.² This development has its drawbacks, however. Increasing methodological sophistication necessitates larger professional, time, and money commitments for utilization. While the capability to integrate larger amounts and more diverse information may be theoretically desirable, the newer methodologies have voracious appetites for detailed data about goals, projects, and resources.

Underlying these limitations is a more fundamental problem characterized as "uncertainty." In a real-world programming environment, uncertainty is pervasive: goals are ambiguous, the flow of funds is erratic and variable in magnitude, project information is incomplete or colored, the methodology is considered to be "inadequate" to the task.

²Martin Michael. "Transportation Implementation Programming," memorandum, Technology Adaptation Program, Urban Transportation Project, May 30, 1977.

and is questioned, and/or intentions and motivations of the organizations involved in goal-setting, resource-allocating, and project concept generation are contradictory and never fully revealed.

This effort at technology adaptation is, in reality, an exercise in methodological development. Methodology is a tool, a "systemized, instrumental means for obtaining objectives," but it is also more.³ In use, methodology becomes "part of the social fabric of maintenance and change."⁴

The observation of the complexity of the programming environment in the United States, coupled with the sense that the technology to be adapted (a methodology) becomes part of that environment, leads one to conclude that an understanding of the potential programming environment is prerequisite to the development of a methodology for use in programming. This is done both because the environment (the existing goal-setting, project generating, resource-allocating, and uncertainty qualities) constrains the form of a utilisable methodology and because the developers of methodology want to be able to assess the impacts the methodology will have on that environment. These are the motivations for this study.

This thesis addresses in particular the question, how are project options developed? In doing so, it also provides insight into any goal-making activities which might serve as criteria for programming

³Michael Teitz. "Toward a Responsive Planning Methodology." In Planning in America: Learning from Turbulence, David Godschalk, ed., Washington, D.C.: American Institute of Planners, 1974, p. 88.

⁴Ibid., p. 89.

and examines the nature of uncertainty in project development. Brief comment is made on the relationship between resource allocation patterns and development. The intent is to assess the ways which these factors will impinge on the adaptation and use of a programming methodology for Cairo.

Chapter 2

THE NATURE OF THIS STUDY

Background

This study examines the existing project development process as an interorganizational activity. The choice of this approach reflects the initial observation that the activities which together constitute the process are undertaken by a variety of organizational entities whose interactions link them together to form a "field" (Warren) within which the process occurs.

Other approaches might have been adopted, such as a focus on less aggregate social units (i.e., individuals or groups). Such an analysis, however, would pose the problem of scale. One overriding characteristic of the process is its breadth; it cuts across the activities of almost 20 organizations. Focusing the analysis on interindividual and/or intergroup actions would have shifted the analysis away from its primary objective of developing an understanding of a large-scale social process. While these levels of analysis might offer certain insights into the process (individuals and groups are important components of organizations), I believe that the purposes of this study are better served by focusing on those social units--organizations--which are most obviously and directly tied to the overall process of development. One need not resort to an analysis of interindividual and intergroup behavior in a building block approach to the study of social activity (Mouzelis), but I believe that this analysis provides a foundation for such work if it is desirable.

While this study might arguably be classified an "institutional analysis," I have purposely limited its scope in a way that makes me wary to categorize it as such. First, as indicated above, the focus is on organizational entities and their interactions; an institutional analysis would be more flexible with respect to the types of entities observed.⁵ Second, the central element of an institutional analysis is the description and analysis of the normative structures which underlie institutions.⁶ While this study analyzes organizational interactions and, at least in part, the pattern of shared expectations which influence those interactions, it cannot be claimed that this constitutes a thorough examination of normative structure.

The reasons for the limitations on this study are several. First, the concept and form of institutional analysis currently, I believe, lack a distinctive identity or methodology.⁷ Second, the intercultural nature of this work necessitates caution in relying on the assumptions concerning human behavior and motivations which might be appropriate in intracultural work. Testing these assumptions and formulating new ones

⁵See:

- a. Robin Williams. American Society: A Sociological Approach. New York: Alfred A. Knopf, 1970, p. 4.
- b. Thomas E. Nutt-Powell, with Stewart Landers, Bonnie R. Nutt-Powell, and Levi Sorrell. Toward A Theory of Institutional Analysis. Cambridge: MIT Energy Laboratory Report, 1978.

⁶Ibid.

⁷One approach to institutional analysis is detailed in Toward A Theory of Institutional Analysis by Thomas Nutt-Powell, et al. This appears to be one of the earliest efforts to explicitly bridge the gap between shadowy textbook references to the study of institutions and the reality of undertaking such a study.

requires time and experience. While this study necessarily relies on some such assumptions, the information is not yet accumulated which would allow me to abandon this restraint. This is compounded by, third, the language barrier. We rely on the English of our counterparts in our discussions. While most of the Egyptians with whom we have worked are competent users of the language (far superior to my nonexistent Arabic-speaking abilities), there is a nagging uneasiness that the subtleties of our questions and their responses are lost in the problem of understanding each other in a literal sense.

In summary, I have chosen to adopt a perspective which offers, I believe, the best opportunity to conduct a reasonably thorough analysis of the entirety of the development process, while purposely avoiding the pitfalls of heroic assumptions and extrapolations. The result is consistent with the needs of the technology adaptation project at this early stage and an entry point for further work on either a relatively micro or macro level.

A Conceptual Framework

The purpose of this section is to present a framework for understanding a model--a "conceptual pattern for defining and organizing" the empirical observations of the project development activity.⁸ The conceptual framework is not a theory. As a broad spectrum of theories

⁸Dwight Waldo. "Theory of Organizations: Status and Problems," in Readings on Modern Organizations. Edited by A. Etzioni. Englewood Cliffs: Prentice-Hall, Inc., 1969, p. 8.

of human behavior in organizational contexts exist,⁹ I do not attempt to expand or detail that spectrum. It is, rather, my intention to draw on several existing theories to develop a framework which encourages a clear and a useful understanding of this particular case so as to provide the foundation for the overriding goal of adapting technology.

Project development can be viewed as a manifestation of certain interactions among a number of organizations. Those organizations and interactions constitute a "field."¹⁰ The concept of an interorganizational field is a logical extension of the concept of an organization-environment relationship.¹¹ The extension is simply a change of perspective; it is

⁹ A variety of "maps" of such theories are available. See, for example:

a. F. E. Kast and J. Rosenzweig. Contingency Views of Organization and Management. Chicago: Science Research Associates, Inc., 1973.

b. N. Mouzelis, Organization and Bureaucracy. Chicago: Aldine Publishing Co., 1967.

c. Thomas E. Nutt-Powell, et al. Toward A Theory of Institutional Analysis. Cambridge: MIT Energy Laboratory Report, 1978, pp. 9-17.

d. C. Argyris and D. Schon. Organizational Learning: A Theory of Action Perspective. Reading: Addison-Wesley Publishing Co., 1978.

e. W. Scott. "Organization Theory: An Overview and An Appraisal." Journal of the Academy of Management, Vol. 4 (April 1961), pp. 7-26.

¹⁰ A field is a "totality of coexisting facts (in this case, "organizations") which are conceived of as mutually interdependent." Kurt Lewin, Field Theory in Social Science: Selected Theoretical Papers, p. 240, as quoted in Roland L. Warren, "The Interorganizational Field as a Focus for Investigation," Administrative Science Quarterly, Vol. 12 (December 1967), p. 397.

¹¹ For an introduction to studies relying on this concept, see Andrew H. Van De Ven, Dennis C. Emmett, and Richard Koenig, Jr., "Frameworks for Interorganizational Analysis." In Interorganization Theory, edited by Anant R. Negandhi. Kent: Comparative Administration Research Institute, 1975.

the recognition that the "environment" consists of other organizations.¹² The analysis of an interorganizational field focuses on a set of organizations (Evan)--an interorganizational collectivity rather than a single organization.

This study examines an interorganizational field/collectivity in terms of its structure. Social Structure involves "those aspects of social behavior that an investigator considers relatively enduring or persistent."¹³ More specifically, it "refers to the differentiated interrelated parts in a collectivity. . .[it is] the patterns discernable in social life, the regularities observed, the configurations detected."¹⁴

The structural concept employed in this analysis is that of a network (Ekeh). The concept of network is basic to a variety of disciplines; electrical engineering (electronic circuits), transportation systems modeling (street network), and mathematics (graph theory), for example. In the social sciences, the concept has been utilized in studies of human social communication patterns,¹⁵ and more pertinent here, in the study of social organization interactions, both at the intra-

¹²"Each organization is itself the environment of some other entity. . ." Charles Perrow. Organizational Analysis: A Sociological View. Belmont: Wadsworth Publishing Co., 1970, p. 129.

¹³George Homans. "What Do We Mean By Social 'Structure'?" In Approaches to the Study of Social Structure. Edited by Peter M. Blau. New York: The Free Press, 1975, p. 52.

¹⁴Peter M. Blau. "Introduction: Parallels and Contrasts in Structural Inquiries." In Approaches to the Study of Social Structure. Edited by Peter M. Blau. New York: The Free Press, 1975, p. 14.

¹⁵See, for example, Karl W. Deutsch, The Nerves of Government. New York: The Free Press, 1966.

organizational and interorganizational levels.¹⁶

The concept of network is used in this study in an analytical, not simply metaphorical, sense.¹⁷

A network structure consists of nodal points and internodal linkages. In an interorganizational context, the nodes are organizations, and the linkages are organizational interrelationships. These two elements become the units of analysis (Marrett). Finally, as indicated earlier, the field under examination consists of a subset of the universe of all organizations; that is, the network being analyzed is a subset of some universal network. All organizations and organizational interrelationships not part of the network being analyzed are considered collectively as the environment (Warren).

A simple graphic display of these ideas is presented in Figure 1. The following is a more detailed discussion of the network elements.

1. Organizations have been defined in a multitude of ways. For this thesis, an organization is considered to be the "rational coordination of the activities of a number of people for the purpose of achieving certain goals" (Schein). Goals define "states" with respect to broad organizational objectives. Organizations share several basic objectives (Bensen), including the securing of resource inputs, the maintenance of an identity, and the fulfillment of functional requirements.

¹⁶ Refer to Footnote 2.

¹⁷ J. C. Mitchell. "The Concept and Use of Social Networks," in Inter-Organizational Relations. Edited by William M. Evan. Philadelphia: University of Pennsylvania Press, 1978, p. 293.

CODE:

- the boundary of the network
- an organization
- a relationship

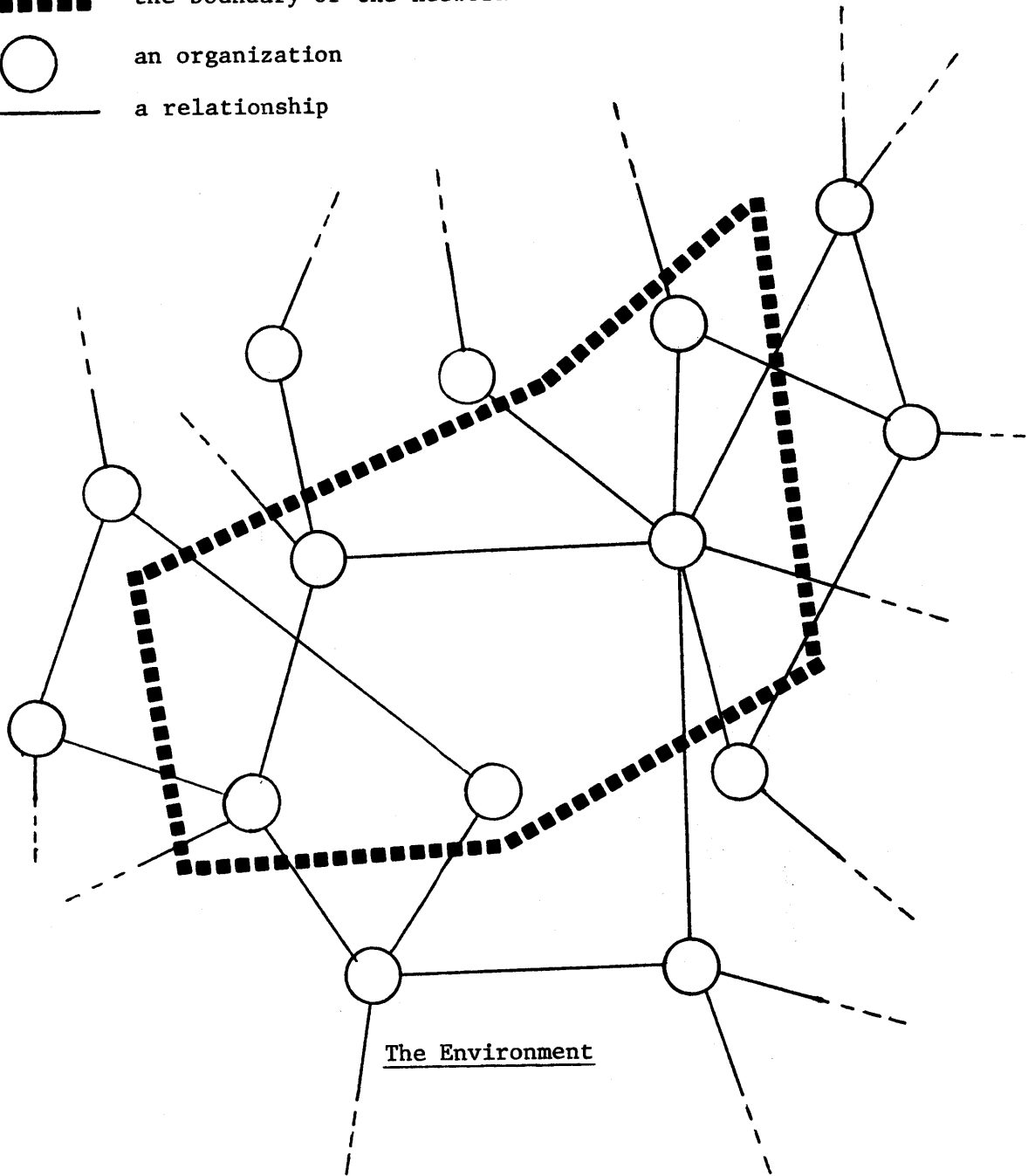


FIGURE 1: NETWORK CONCEPTS

Goals serve both as yardsticks for measuring organizational success and as motivators and delimiters of future actions. Organizations undertake actions which they believe are consistent with their objectives, and more directly, contribute to the achievement of their goals.

Organizations in a social collectivity serve certain social functions--and as indicated above, the fulfillment of these functions is an organizational objective.¹⁸ As a reference frame for their actions, organizations adopt certain social roles (Nutt-Powell).¹⁹ Each organization has one or more roles in its behavioral repertoire (Terreberry), and an organization may adopt any one of a variety of available roles at any particular time based on its perception of whether a certain role will enable it to act more consistently with its objectives (in a way more likely to lead to goal achievement).

Organizations make decisions. They are often in a situation of choice--though rarely unlimited choice (March and Simon). Decisions must be made with respect to future organizational actions. Decision making and acting requires resources (Aldrich and Pfeffer). Observation and

¹⁸ Function is "the contribution made by a unit or process (e.g., an organization). . .to the maintenance of the organism or to the maintenance of the structural continuity of society." Talcott Parsons' introduction to Webber, The Theory of Social and Economic Organization, pp. 18-20, as cited in Karl Deutsch, The Nerves of Government. New York: The Free Press, 1966, p. 47.

¹⁹ Social role is an "action strategy." Thomas E. Nutt-Powell, et al. Toward a Theory of Institutional Analysis. Cambridge: MIT Energy Laboratory Report, 1978, p. 7. Roles have associated with them sets of expectations and behaviors (Popenoe)--they entail a sense of predictability.

theory (March and Simon) reveal that organizational demands for resources typically outstrip their availability. When more than one organization draws on a pool of limited resources, organizational interdependencies are generated (Perrow).

- Organizations, then,
- are resource dependent
 - serve social functions
 - adopt roles as strategies for action
 - act purposely to achieve goals
 - make decisions about future actions.

In a network, organizations may be differentiated from one another. A variety of differentiating criteria may be selected. For example, one might categorize on the basis of type, size, shape, internal structure, "state,"²⁰ function, roles, and position (Perrow). The last four of these will be relied on in this analysis because they are most obviously related to the actions of the organization as an entity/component of a larger social network.

2. The second unit of analysis is organizational interrelationships.

A relationship is,

A multiperson [in this instance, specifically multiorganization] effort to satisfy needs (i.e., achieve goals) through one another (Leavitt).

Relationships are created, sustained, and revealed in social interaction (Nutt-Powell). A relationship, in fact, is a particular class of interaction:

²⁰By "state" I mean, for example, its power, its influence, its authority, its money, raw materials, and human resources.

Where a given interaction pattern is repeated often enough to give rise to relatively stable expectancies among the actors, we call it a social relation (Williams).

The nature of organizational relationships, then, can be detected and studied by examination of their social manifestation--organizational interactions.²¹

Observation reveals that interactions are not uniformly distributed in time and space. Not all organizations interact with one another; those that do may interact differently. Interactions are discrete; they are directed. It is this nonrandomness which allows an observer to identify, analyze, and classify social interactions (Deutsch).

An act is social when,

By virtue of the subjective meaning attached to it by the acting individual (or individuals), it takes account of the behavior of others and is thereby oriented in its course.²²

Social acts, then, are purposeful and carry meaning. The organization-perpetrator of an act does so with the intent of evoking a response act from an organization (March and Simon). Organizations have action influencing objectives and goals, so one organization's response evoking act can be viewed as its attempt to induce a response act that it has determined will be compatible with (or better still, contributory to) its own objective-consistency (goal-achievement). This is a dynamic

²¹This is the underlying premise of the research method employed. See Appendix I.

²²Max Weber. The Theory of Social and Economic Organization, p. 88, as quoted in Peter M. Blau, Exchange and Power in Social Life. New York: John Wiley and Sons, Inc., 1964, p. 13.

process, for a shift in perspective reveals that an organization's action is at once responsive and evocative.

Interorganizational cooperation, which contributes to network integration (Lawrence and Lorsch), may be induced by the limited resource pool, by compatible goal configurations, and by the character (e.g., nonaggressive) of actions which organizations may undertake to achieve those goals. Interorganizational tension (i.e., conflict), which is a network disintegrative force, can also be induced by a limited resource pool when goal configurations are incongruent, and one organization's actions severely interfere with the goal achievement activities of other organizations. Conflict threatens the existing social network. Social interaction is a process whereby these threats are revealed, localized, defined, and resolved--either by reaffirmation of the existing social network (i.e., no or minimal change in the existing characteristics of the organizations and relationships) or by change (Popenoe).

In a multiorganizational setting, various interactions occur "involving the flows of people, information, capital, influence, goods and services, etc." among the organizations.²³ Commodities flow through the network by organizational exchange interactions. The project development and implementation process "happens" due to (i.e., is a manifestation of) these exchange transactions.

²³William M. Evan. "An Organization-Set Model of Inter-organizational Relations." In Interorganizational Relations, edited by William M. Evan. Philadelphia: University of Pennsylvania Press, 1978, p. 85.

Exchange transactions may be differentiated from one another in a number of ways,²⁴ including:

- a. the parties to the exchange. (This is a tie-in to the analysis of organizations.)
- b. the type of commodities exchanged. (This reflects the respective needs of the parties.)
- c. the quantities of commodities. (This reflects the value attached to various commodities by the respective organizations.)
- d. the standardization of exchange. (The fixedness of the units, types of commodities, and procedures of exchange.)
- e. the results of exchange. (The change or non-change of the "states" of the parties.)
- f. the agreements underlying the exchange activities. (Explicit or not, generally accepted expectations as to who, what, and how much exchanges).

²⁴See, for example:

- a. Peter P. Ekeh. Social Exchange Theory: The Two Traditions. Cambridge: Harvard University Press, 1974, p. 209.
- b. Cora B. Marrett. "On the Specification of Interorganizational Dimensions." In Sociology and Social Research, Vol. 56 (October 1971), pp. 89-96.
- c. Sol Levine and Paul White. "Exchange as a Conceptual Framework for the Study of Interorganizational Relationships." In Administrative Science Quarterly, Vol. 5 (1961), pp. 583-601
- d. Harold Guetzkow. "Relations Among Organizations." In Studies on Behavior in Organizations, edited by Raymond Bowers. Athens: University of Georgia Press, 1966.
- e. Peter M. Blau. Exchange and Power in Social Life. New York: John Wiley and Sons, Inc., 1964.

Interorganizational relationships, then, are manifest in social interaction. These interactions are purposeful, nonrandom, the means of network maintenance or change, involve the exchange of commodities, and impact on the "states" of the participants.

3. As indicated earlier, there exists a universal social network composed of all possible social nodes (e.g., individuals, groups, organizations, institutions, societies) and all forms of relationships which might exist among them. This study focuses on a subset (a "network") of this universal network. This subset consists of the organizations in Cairo which are involved in urban transportation project development and implementation.

Defining a subset is an act of drawing a boundary line on the basis of certain criteria. [Taking a General Systems Theory approach, subnetwork and supra-network activities may be considered as black boxes for purposes of examining this particular network (Berrien)]. The

boundary line determines which elements of a network will be examined in a detailed manner and the elements of the network which are treated collectively as a backdrop for a particular subset.

Criteria which may be appropriate for the establishment of boundaries to define a social network for analysis include characteristics of nodes (e.g., size, function, or as in this instance, level-- an organization); characteristics of interrelationships (e.g., type); or characteristics of networks as entities (e.g., size, stability, or as in this instance, manifested social process-- project development). Social networks can, and do, overlap. Any single organization may have

a variety of characteristics and may be party to a number of different types of relationships. (In a limited resource situation, organizations are constrained in this regard. Interaction and decision-making utilize limited resources. Organizations must chose how to allocate their resources.)

As was indicated earlier, supra-network organizations and relationships are collectively labeled the environment. Drawing a General Systems Theory analogy (Berrien), the network relies on the supra-network for input resources; the network processes these resources in some manner (this is the topic of the thesis), and a resultant output is produced (the output here being, loosely, urban transport facilities for Greater Cairo). Similarly, all suborganizational relationships and social entities are part of the network's environment: the input resources to the network (the products of complex and sub-organizational activities), the processing (utilization of these resources for organizational-level action decisions), and the output (e.g., jobs).

Many of the studies of interorganizational behavior have, as suggested earlier, employed a single organization-environment relationship-based analysis.²⁵

²⁵ See, for example:

a. Edgar H. Schein. Organizational Psychology. Englewood Cliffs: Prentice-Hall, Inc., 1970.

b. Howard E. Aldrich. "An Organization-Environment Perspective on Cooperation and Conflict Between Organizations in the Manpower Training System." In Interorganizational Theory, edited by Anant R. Negandhi. Kent: Comparative Administration Research Institute, 1975.

[Footnote continued on next page.]

The results of these studies of environment are applicable in a multiorganization context also. A network might be examined, for example, in terms of:

- a. the homogeneity of its elemental organizations and relationships;
- b. the pattern of organizational domains (e.g., functions, roles, states);
- c. its stability through time;
- d. the distribution of resources;
- e. size, shape, and other physical characteristics;
- f. points of linkage of the network to its environment;
- g. the "anchorage" (concepts of centrality and gravity in the configuration of relationships);

25 continued

- c. F. E. Emery, and E. L. Trist. "The Causal Texture of Organizational Environments." Human Relations, Vol. 18 (1965), pp. 268-281.
- d. Robert B. Duncan. "Characteristics of Organizational Environments and Perceived Environmental Uncertainty." Administrative Science Quarterly, Vol. 17 (1972), pp. 313-327.
- e. J. Kenneth Benson. "The Interorganizational Network as a Political Economy." Administrative Science Quarterly, Vol. 20 (June 1975) pp. 229-249.
- f. Andrew A. Van de Ven, Dennis C. Emmett, and Richard Koenig, Jr. "Frameworks for Interorganizational Analysis." In Interorganization Theory, edited by A. R. Negandhi. Kent: Comparative Administration Research Institute, 1975.
- g. Shirley Terreberry. "The Evolution of Organizational Environments." Administrative Science Quarterly, Vol. 12 (1968), pp. 590-613.
- h. J. C. Mitchell. "The Concept and Use of Social Networks. In Inter Organizational Relations, edited by William M. Evans. Philadelphia: University of Pennsylvania Press, 1978.

- h. density of relationships (extent to which links that could exist do exist); and
- i. the degree of uncertainty in the network.

This last characteristic has received considerable attention in the studies previously cited. Uncertainty is pervasively important because it influences all actions and decision-making and, in not being able to determine the "correctness" of any one action and/or decision,

Uncertainty means that we do not have a complete description of the world. . . Instead, we consider the world to be in one or another of a range of states. . . Our uncertainty consists in not knowing which state is the true one.²⁶

Both Emery and Trist²⁷ and Duncan²⁸ have studied specifically the concept of environmental (and as applied here, network) uncertainty. An integration of their results produces a "map" to the network-uncertainty characteristic (see Table 1).

In summary, the model relied on in this analysis is that of a social network. Networks have nodes and links. Organizations are one type of social node. They are goal-achieving, decision-making, resource-dependent aggregates of individuals. The organizations serve social

²⁶Kenneth J. Arrow. The Limits of Organization. New York: W. W. Norton & Co., Inc., 1974, pp. 34-35.

²⁷F. E. Emery and E. L. Trist. "The Causal Texture of Organizational Environments." Human Relations, Vol. 18 (1965), pp. 268-281.

²⁸Robert B. Duncan. "Characteristics of Organizational Environments and Perceived Environmental Uncertainty." Administrative Science Quarterly, Vol. 17 (1972), pp. 313-327.

Table 1

MAP OF NETWORK--UNCERTAINTY CHARACTERISTICS

CHARACTERISTICS OF THE ENVIRONMENT	<u>Simple</u> (Duncan)	<u>Complex</u> (Duncan)
<u>Static</u> (Duncan)	<u>Placid, random:</u> unchanging, random distribution of goals and "noxious" (Emery and Trist)	<u>Placid, clustered:</u> goals and "noxious" hang together in certain ways (Emery and Trist)
-stable decision influencing factors (Duncan) -infrequent consideration of new and different decision-influencing factors (Duncan)	-low perceived uncertainty (Duncan; Emery and Trist)	-moderately low perceived uncertainty (Duncan; Emery and Trist)
<u>Dynamic</u> (Duncan)	<u>Disturbed, reactive</u> (Emery and Trist)	<u>Turbulent:</u> ground in motion (Emery and Trist)
-changing nature of decision-influencing factors -frequent consideration of new and different decision influencing factors (Duncan)	-moderately high perceived uncertainty (Duncan; Emery and Trist)	-high perceived uncertainty (Duncan; Emery and Trist)

functions and adopt certain roles as strategies for action. They are differentiable from one another in a variety of ways.

An organizational interrelationship (a link) is a multi-organizational effort to satisfy needs through one another. A relationship is manifest in organizational interactions, which are non-random in nature. Interactions can be viewed as a "couple"--a response evoking action and a response action--though it should be clear that any act is both response and response evocative.

One type of interaction is the exchange of commodities. A series of exchange interactions involving one commodity is a flow. Interactions, like organizations, are differentiable.

The combination of all possible social nodes and all their interrelationships is the universal social network. For analytical purposes, a subset (a network) of this universal network may be defined. Defining a subset is the act of drawing a boundary which determines the type(s) of social nodes and type(s) of interrelationships to be singled out for examination. A variety of criteria may be utilized for determining which social nodes and interrelationships might be deemed a subset. After establishing the boundary, all other elements of the universal network are considered to be the environment.

Networks may be analyzed and characterized. A particularly important characteristic is the nature of the uncertainty associated with the network.

The focus of this study is a social network, consisting of the organizational nodes and exchange interactions among them which in

aggregate constitute the urban transportation project development process. The organizations examined are those which consistently undertake actions which have significant impact on the development of those projects. The exchange interactions examined are those involving the commodity of information. These are the boundaries of the social network studied.

This, then, is an analysis of the urban transportation project development activity in Cairo in terms of the flow of one commodity--information--among a set of organizations which are categorized on the basis of function, role, and state.

The data for this study were collected by assembling a series of project case histories. Each project was examined with regard to the organizations involved in its history--from idea to constructed facility--and the variety of money and information exchanges which determined that history. (Appendix 1 presents a more detailed explanation of the methodology.)

Chapter 3

THE ORGANIZATIONAL PARTICIPANTS IN URBAN TRANSPORTATION PROJECT DEVELOPMENT IN CAIRO

The starting point for this work was the assembly of a brief "case study" for each of the urban transportation projects which have recently been, or are currently being, developed or implemented for Cairo (see Appendix 1). The information in these case studies has been analyzed on two levels. One of these is a direct interpretation of the cases as a set, with the intent being the identification of the common characteristics--the process-implying regularities--in project development and implementation. The result of this analysis is a simple model which is presented, and subsequently used as the basis for an examination of the process, in the following chapter.

The other level of analysis--and the topic of this chapter--crosscuts the development aspects of the model, focusing on "who" and "how." In this chapter, the organizations which participate in the process are listed, described, and analyzed in terms of their function, role, and authority state (i.e., their positions in an authority hierarchy).

1. The People's Assembly is the national legislative body. The Assembly's 350 members are elected by secret ballot from 175 geographically defined districts. The organization is of relatively recent origin--it was first established as a popularly elected, representative body in 1923. Members serve five-year terms, and the constitution requires that at least one-half of the members be laborers or farmers. The Assembly divides

itself into 18 committees, one of which is the Committee on Transport and Communications, which generally oversees transportation-related activities in the country.

The Assembly is not a policy-making body; its primary involvement in the implementation of transportation projects is via its responsibilities with regard to the final approval of the annual national budget. The indications are that the Assembly plays a relatively minor role in determining the content of the budget.

2. The Cabinet includes the Prime Minister, his deputies, and 37 Ministers. Each of the Ministers directs a governmental "executive" agency. These agencies vary enormously in size and influence, some having fairly narrowly defined responsibilities (e.g., the Ministries of Insurance and Marine Transport) and others broad areas of responsibility (e.g., the Ministries of Interior, and Economy and Economic Cooperation).²⁹ Several Ministries participate in urban transportation project development. It is my impression that a number of function and role overlaps and conflicts exist among the Ministries (see Table 2). The result of such a situation is that many issues which might conceivably be resolved on a "technical" basis at lower levels of administration (e.g., the technical characteristics of a new bridge) rise to the Cabinet for resolution. At that level, the issues become increasingly symbolic in nature--representative of organizational domain (roles and functions) conflicts.

²⁹ I would be negligent if I did not point out the Ministry which has, perhaps, the most intriguing title: The Ministry of Follow-up and Control.

While the Cabinet's formal tasks include administration, legislation drafting, and policy implementation, the focus of its activities is the preparation of the draft national budget for submission to the People's Assembly. It is the Cabinet which determines the content of the budget.

3. The Ministry of Transport and Communication is the formal representative of the interests of transportation in the Cabinet and the government as a whole. Its various subelements are engaged in a range of transportation activities including: overall responsibility for urban, regional, and national transportation planning (the Transport Planning Authority), responsibility for the operation of the nation's railway system (Egyptian Railway Authority), budget allocation (the Cairo Transit Authority receives its annual capital expenditure budget through the Ministry), and project implementation (e.g., the Transport Planning Authority's technical supervision of the execution of the new signal synchronization system for central Cairo).

The Ministry is authorized an advisory review of all proposed transport projects, whatever their source. There is a general sense that the higher echelon officials in the Ministry wish to amplify and solidify this advisory position.

3a. The Transport Planning Authority (TPA) is an element of the Ministry of Transportation. It is treated separately here because it is very active in project development. It focuses its interests on relatively high technology projects, such as a synchronized signal system and proposed rapid transit system.

The TPA supervised the preparation of a comprehensive transportation plan for the Cairo metropolitan area in 1971-1973 which was prepared by a foreign planning firm. The TPA has also been a participant in other transport planning activities (national transportation plans, rapid transit planning, Cairo roadways studies), but its activities generally focus on the development, promotion, and analysis of individual projects rather than comprehensive systems planning. (Comprehensive planning appears to have only a minor impact on transportation project development; the 1973 Cairo Transportation Plan unified the perspectives on urban transport projects in some measure, but there is little evidence that it has in any sense become a framework for the subsequent consideration of projects).

4. The Ministry of Local Affairs is the Cabinet-level organization overseeing and representing the interests of the 28 Governorates of Egypt (i.e., national geographic political subdivisions), as well as the Governorate's political subdivision (municipalities, towns, villages, and "shiakets"--an administrative district within a city). The Ministry is a link between the national and local governments; it is the conduit of national funds to local governments.

The Ministry appears to be the primary source of territorial-based influence in transportation project development. The logical alternative, the People's Assembly, has, as was indicated earlier, only a peripheral (and largely ceremonial) involvement in the process through its budget-approval responsibilities. This territorial-based influence,

however, appears to be minimal. Virtually all the major urban transportation projects currently under consideration or construction are in the Cairo metropolitan area. While this geographic concentration of resources is severe, it is likely that most measures of "need" in urban transportation would lead to a focusing of resources there³⁰ (Gakenheimer).

5. The Ministry of Finance influences project development in an indirect (though significant) manner through its responsibilities for the management and control of the nation's currency. The Ministry is also actively involved in the preparation of national budgets, specifically with respect to the budgets for wages and salaries and operations. It apparently concentrates on outlining aggregate budget expenditure limits rather than on the details of the specific allocations.

6. The Ministry of Economy and Economic Cooperation usually has only a minor impact on transportation project development. Projects involving high cost or extraordinary consequences will, however, often bring the Ministry into a more active position, particularly if they involve foreign credit or components. Projects dependent on foreign

³⁰For example, the Cairo metropolitan area has approximately nine million inhabitants--that is, over 20 percent of the total Egyptian population. Within the Cairo Governorate itself (which is the core of the total metropolitan area), the population is almost six million, with an average density of over 750,000 persons per square mile. See: Richard F. Nyrop, Area Handbook for Egypt. Washington, D.C.: U.S. Government Printing Office, 1976, DA PAM 550-43.

credit are regularly channeled through the Ministry of Economy (e.g., a major USAID commodities import loan was initially granted to the Ministry of Economy, which in response to an earlier request, allocated part of the foreign credits to the Cairo Transit Authority for the purchase of U.S. manufactured buses).

The Ministry is responsible for allocating (in reality, proposing allocations subject to the approval of the Cabinet and the People's Assembly) foreign loan credits among all of the Ministries.

7. The Ministry of Planning has the responsibility of preparing the annual national capital investment budget for submission to the People's Assembly for approval. The responsibility potentially permits the Ministry to play a major role in the determination of which projects will be constructed at what time. It has a "transportation section" with a staff of 50, which is officially responsible for the evaluation of all transportation project proposals. This activity is undertaken on a project-by-project basis, rather than involving any broader view of the problems in Cairo. In the course of project evaluation, intra-sectoral, and then intersectoral, trade-offs are considered. The Ministry's stated criteria in its evaluation and budget proposing activities are to favor: (1) projects which maintain service standards at current levels, (2) the completion of projects in progress, and (3) projects for which special foreign credit is assured.

It appears that the Ministry's influence on project development is much less than might be suggested by these official responsibilities. First, it is not obvious that the Ministry actually has a free hand in

evaluating projects which have large scale political and economic ramifications. Second, it is unclear to what extent the Ministry's evaluation results actually influence the pattern of allocations in the national budget.

8. The Ministry of Housing and Reconstruction (MOHR) was initially created as the Ministry of Housing. At the end of the 1973 war, the Ministry was assigned the responsibility of managing the redevelopment activities along the Suez Canal. The Ministry's background in developing and supervising the construction of these projects led to an expansion of its responsibilities: it was assigned several sewerage, water supply, and transportation projects in the Cairo metropolitan area.

In Egypt, the majority of public works construction firms are partially or totally owned by the national government. Until May 1978, their formal attachment was to the Ministry of Housing and Reconstruction. During the recent past, the Ministry of Transportation has been assuming a policy-adviser position, while the Ministry of Housing and Reconstruction had a project implementer position. Most recently, however, there is evidence of a shift in these positions: control of four major road construction companies was transferred to the Ministry of Transportation.

8a. The General Organization for Physical Planning (GOPP) is an agency within the Ministry of Housing and Reconstruction with responsibility for the overall planning for Cairo, as well as the whole of Egypt. The GOPP was originally an agency of the Governorate of Cairo; and at that time, its responsibilities were limited to the Cairo metropolitan area.

It was later reassigned to the Ministry of Housing and Reconstruction and given broader responsibilities. It completed the preparation of a master plan for the metropolitan area in 1970. This was primarily a land development plan, but it included a brief examination of urban transportation facilities.

The history of the GOPP is similar to many of the public organizations involved in planning--there appear to be periodic expansions and contractions in its areas of responsibility and functions. There are suggestions that the GOPP had in the past occupied a more influential position with regard to the development of transportation projects in the Cairo area. The diminishing influence may be partly the impact of the increasingly active participation of several of the other organizations described here.

9. The Governorates of Cairo, Giza, and Kalioubeia are significantly active in the project development. (The Greater Cairo Area-- a legally defined entity which has no government structure--includes all of the Cairo Governorate and portions of the Giza and Kalioubeia Governorates.) It appears that a number of the initial ideas for urban transportation projects originate with the Governorates; no doubt because the territorially-oriented units of government are more accessible to people who complain about unsatisfactory transportation conditions (Gakenheimer) and also because of the Governorates' access to the Cabinet through the Ministry of Local Affairs. General plans are prepared by the Governorates, and they appear to have several developing project proposals "in the works" at all times. Even still,

the Governorates' transportation related offices appear to be understaffed physically and technically.

The Governorates are also formally responsible for the supervision of transport project execution within their boundaries. In reality, this responsibility involves relatively small units of government supervising the work of powerful construction firms and so may be a less than fully accomplished task.

10. The Cairo Transit Authority (CTA) is the organization responsible for the operation of public mass transportation facilities in the Cairo metropolitan area. These facilities include 17 garages, a 2,800 vehicle bus system, a 400 vehicle tram system, a trolley bus system with 160 vehicles, and several river ferries.

The CTA, in addition to operational responsibilities, also regularly initiates, plans, and executes new projects, extensions, and modifications of the existing systems and new equipment purchases. It is currently planning to undertake an extension of the tram network and acquire new trams. It has recently received the first shipment of a new fleet of buses purchased from the U.S. under the U.S. AID Commodity Import Loan Program. The CTA also becomes involved in interorganizational negotiations concerning funding and control in instances when a new project alters or disturbs transit services--as in the case of the Embaba Bridge.

The CTA receives the capital budget allocations through the Ministry of Transportation and its operations and wages/salaries budget allocations through the three Governorates in which it operates. The

system is subsidized by the national government. Public transport is essential for the mobility of the large proportion of Cairo's population which does not own automobiles; as such, its operations have significant political ramifications.

11. The Implementation Agency for Greater Cairo is an agency originally created, under a different title, within the Ministry of Housing and Reconstruction. This agency was responsible for the implementation of several of the Suez Canal reconstruction projects. As mentioned earlier, the success of those efforts enhanced the position of the Ministry of Housing and Reconstruction and, in particular, the Implementation Agency. The Agency appears to be fairly autonomous in its current activities, which include supervising the implementation of the Helwan-Heliopolis Autostrade.

12. Ad hoc "steering committees" may also be created on a project-by-project basis as a coordinating mechanism. These committees are generally formed for projects which territorially span more than one Governorate. In addition to these government organizations, other organizations--primarily in the private sector--participate in project development. These include several large construction companies (domestic) and design/planning companies (domestic and foreign).

13. The largest of the construction companies in Egypt, Osman Ahmed Osman Company, has been active in a number of transportation projects in the Cairo area. Other construction companies exist, but Osman clearly dominates the field. This company (as well as the other construction companies) favors large-scale roadway and bridge projects

which require large labor forces and certain construction techniques (e.g., prestressed concrete construction) with which the engineers on its staff are familiar and competent.

14. Domestic design firms and domestic construction firms appear to form "combines" which work to their mutual advantage. The Muharrum-Bakhoun design firm, for instance, has been closely associated with the Osman construction company in recent years. The domestic design firms seem to be prominent sources of project concepts, which their "combine" partner construction companies then assist in promoting and (if this is successful) constructing.

15. Foreign planning/design firms have also been indirect participants in transportation project development. A series of foreign consultant planning contracts have been completed in recent years. These planning studies were undertaken by Egyptian government agencies (typically, the TPA) in conjunction with the foreign consultants. These efforts include the proposed subway network (SOFRETU--a French planning/design firm), a plan for circumferential roadways in the Cairo area, and the planning and installation of the synchronized signal system in Cairo.

The university community is also active in project development. A number of faculty members apparently work individually as consultants to the domestic construction companies, the domestic and foreign design/planning firms, and government agencies. The only organized involvement of faculty members is through the Supreme Traffic Council.

16. The Supreme Traffic Council is loosely associated with the National Academy of Sciences, an academic research support organization. The Council's membership is dominated by faculty and government officials. Proposed urban transportation projects may be openly discussed in Council, from both technical and policy-implication perspectives. While the Council has no administrative authority over any of the organizations listed here, or even an officially-mandated review authority, its open forum setting and the general interest of the participants in examining broader technical and social issues allow the Council to exercise indirect but not insignificant influence on the determination of which projects will be invested in by the government.

These organizations fulfill several social functions and take on a variety of roles.³¹ The social functions of the organizations in the network are several:

- a. Political--the function of determining what is socially acceptable.
- b. Economic--the function of standardizing exchange.
- c. Regulation--the function of maintaining and enforcing the prevailing notions of acceptability and exchange.
- d. Service--the facilitating function.
- e. Research--broadly, the function of identifying what is "new."
- f. Production--the function of creating social resources.

³¹The source of these function and role concepts is Thomas E. Nutt-Powell, Toward a Theory of Institutional Analysis, Cambridge, Massachusetts: MIT Energy Laboratory Report, 1978. The list here is not all inclusive--it is those functions and roles observed in this case.

The roles (action strategies) which the organizations adopt are more varied. These are the predominant roles observed in this setting:

- a. Legitimator--one whose actions impart authority to the actions of others.
- b. Integrator--one who acts to establish unity and order to current and future actions.
- c. Adviser--one who recommends to others the actions they should undertake.
- d. Initiator--one who introduces new action-influencing factors.
- e. Promoter--one who acts to induce others to undertake certain actions.
- f. Administrator--one who directs others to undertake certain actions.
- g. Translator--one who acts as an intermediary.
- h. Delimiter--one whose actions restrict the future actions of others.

The specific functions and roles of each of the organizations are shown in Table 2.

To conclude this discussion of "who" participates in project development, Figure 2 depicts the legal-rational authority relationships among the organizations.³²

³²Legal-rational authority is power which is legitimated by rules that are rationally established. See: Max Weber, From Max Weber: Essays in Sociology, edited and translated by H. H. Gerth and C. Wright Mills, cited in David Popenoe, Sociology, Englewood Cliffs: Prentice-Hall, Inc., 1977, p. 402.

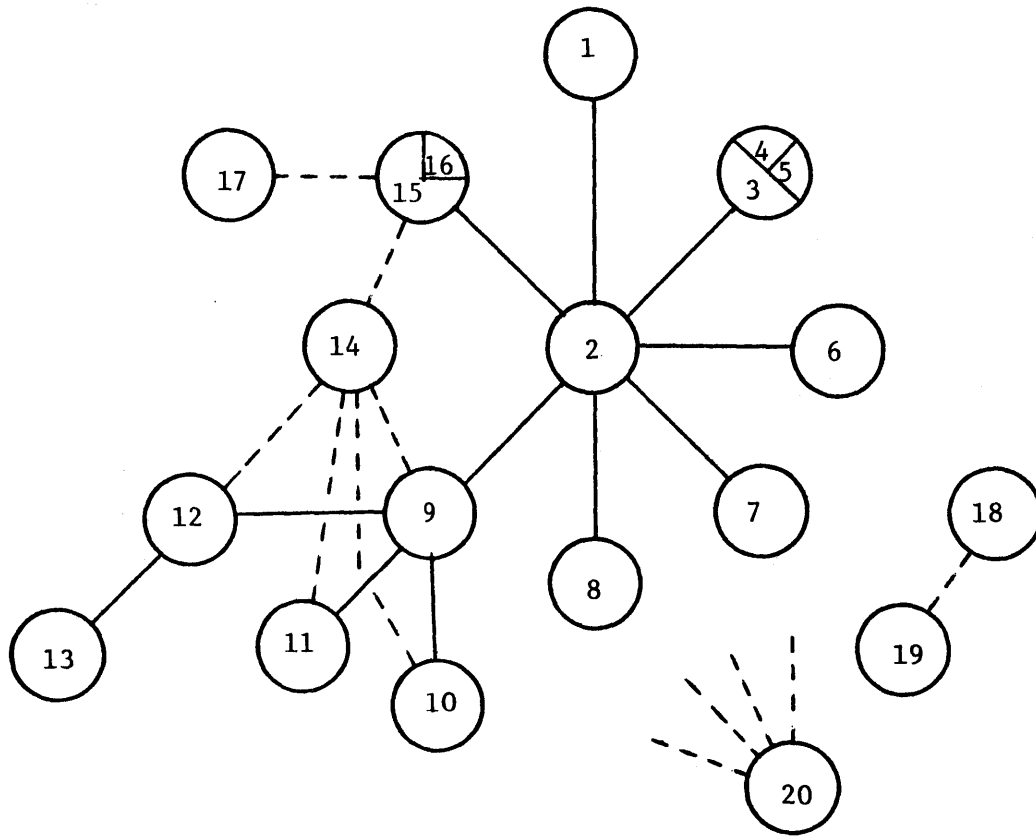
Table 2

FUNCTIONS AND ROLES OF ORGANIZATIONS AS RELATED TO
URBAN TRANSPORTATION PROJECT DEVELOPMENT

Organization	Social Function	Most Frequent Role
1. The People's Assembly	Political	Legitimator of Cabinet actions.
2. The Cabinet	Political	Integrator of the actions of organizations.
3. Ministry of Transportation	Service	Adviser to the organization network.
3a. Transport Planning Authority	Research	Initiator of new projects. Promoter of new projects.
4. Ministry of Local Affairs	Service	Translator for exchange between national and local governments.
5. Ministry of Finance	Economic	Delimiter of overall expenditures on operations and wages/salaries budget.
6. Ministry of Economy	Service	Translator between foreign credit sources and domestic organizations.
7. Ministry of Planning	Economic	Delimiter of overall capital expenditures. Integrator of project concepts.
8. Ministry of Housing and Reconstruction	Regulation	Administrator of implementation activities.
8a. General Organization for Physical Planning	Research	Initiator of new project ideas. Integrator of project ideas.
9. Governorates	Regulation	Administrator of implementation. Promoter of new projects.
10. Cairo Transit Authority	Regulation	Administrator of existing system and implementation. Initiator of new transit project ideas.
11. Implementation Agency for Greater Cairo	Regulation	Administrator of implementation.

Table 2 continued,

	Organization	Social Function	Most Frequent Role
12.	Ad hoc Committees	Political	Integrator of actions.
13.	Construction Companies	Production	Administrator of implementation. Promoter of large road/bridge projects.
14.	Domestic Design Firms	Production	Initiator of large-scale projects.
15.	Foreign Design/ Planning Companies	Production	Integrator of future actions of domestic organizations. Initiator of project concepts.
16.	Supreme Traffic Council	Political	Integrator of actions. Adviser to network.



CODE:

1. People's Assembly.
2. Cabinet.
3. Ministry of Housing and Reconstruction.
4. General Organization for Physical Planning.
5. Implementation Agency for Greater Cairo.
6. Ministry of Economy.
7. Ministry of Planning.
8. Ministry of Finance.
9. Ministry of Local Affairs.
10. Kalioubeia Governorate.
11. Giza Governorate.
12. Cairo Governorate.
13. Cairo Transit Authority.
14. Ad Hoc Committees.
15. Ministry of Transportation.
16. Transport Planning Authority.
17. Planning/Design Companies - Foreign.
18. Construction Companies - Domestic.
19. Design Companies - Domestic.
20. Supreme Traffic Council.

FIGURE 2: LEGAL-RATIONAL AUTHORITY RELATIONSHIPS, URBAN TRANSPORTATION PROJECT DEVELOPMENT NETWORK.

Chapter 4

THE PROCESS OF URBAN TRANSPORTATION PROJECT DEVELOPMENT IN CAIRO

As indicated at the beginning of Chapter 3, this chapter examines project development as a historical process. First, a simple model of the overall project development and implementation process is presented. Following the presentation of the model (and relying on it), the project development process is analyzed as a commodity exchange activity.

A Model of Project Development and Implementation

The development and implementation of a single urban transportation project can be conceived of as a multistage process. The project begins as an idea. The end of the process is identified as the completion of construction work on the project. The intermediate phases are those which permit the transformation of an idea into an artifact. Each project, then, has a development and implementation "history." Based on a composite of the project case studies, a model of such a project history is depicted in Figure 3.³³

The history begins with project conceptualization. The concept is shared, critiqued, expanded, and promoted. At some point in its development, the concept reaches a threshold of acceptance, characterized by its being considered worthy of further development and, ultimately,

³³Note the distinction here--no one of the projects can be considered "typical."

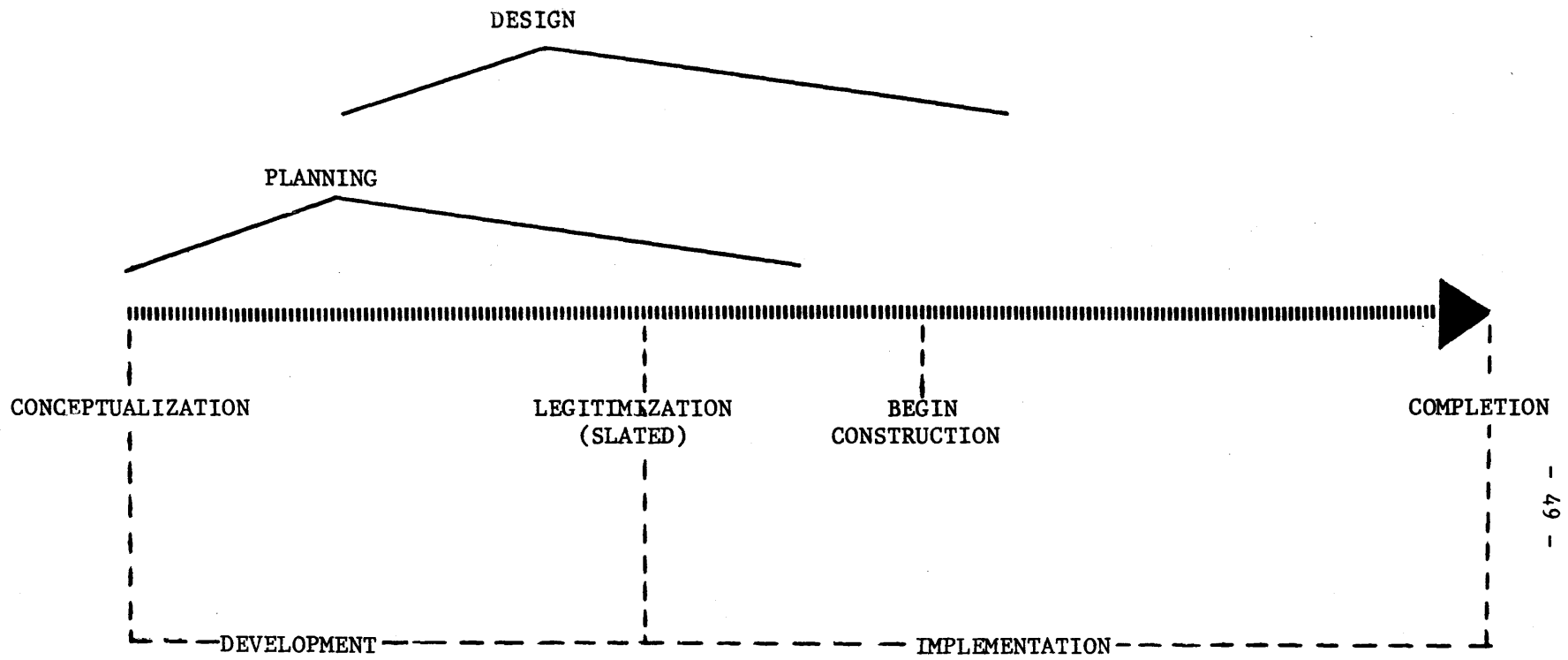


FIGURE 3: HISTORICAL PHASES OF URBAN TRANSPORTATION PROJECT DEVELOPMENT AND IMPLEMENTATION

realization. When it reaches this threshold point, the project is considered to be legitimate. The critical issue in legitimization is the extent of consensus as to its worthiness.

A project concept is cultivated and refined through planning and design activities, which occur primarily prior to the start of construction. A project's development and implementation history is concluded with the completion of construction.

The term development is used here to identify that portion of a project's history which begins with conceptualization and includes legitimization. From that point on, the project is considered to be in implementation.

The term planning is employed to identify those activities of a project's history which involve the definition of the project's function and the determination of the relationship of the project to the physical and social network. Design refers to those activities which pertain to the detailed specification of a physical system to perform the function determined during planning (Gakenheimer).

This model of the history of a single project is, of course, a simplification of a complex activity. First, projects are often developed in a discontinuous manner. A project's development and implementation is subject to delay and even interruption. Second, projects may not have a straight line trajectory, as depicted in Figure 3. Iterative loops may occur as a project moves through development and implementation. Third, the activities may not always occur in the specific sequence diagramed. Planning and design, for example, may

occur in alternating, incremental units. The relative time duration of the activities may also vary; planning may take place over a multiyear period, for example, and design in a time span of a few months. The extent of overlap between activities may vary from project to project. Fourth, not every project (at least as initially conceptualized) has the complete history outlined here. Project concept fatalities exist. Further, as there are a number of project histories unfolding simultaneously, each possibly at a different stage in its development/implementation, these projects are not necessarily on independent trajectories. Their histories influence one another, and activities on one may substitute for those on another.

Project Development As An Information Exchange Activity

A most direct means of examining the flow of information associated with project development (a flow being an aggregation of the exchanges of one commodity) is to trace through a project development history, identifying the information exchange interactions which underlie it.

The study of information has attracted considerable attention in recent years from a variety of disciplines. Confusion persists, however, even at the basic level of defining what the word information means.³⁴ This study relies on an operational definition; that is,

³⁴As an example: People and Information, edited by Harold B. Pepinsky (New York: Pergammon Press, 1970) contains nine articles by social scientists--and nine different definitions of "information." Expanding the defining pool to include engineers and natural scientists considerably increases the variety of definitions.

what does information do?³⁵

Every organization in a network possesses knowledge about itself and its environment. This knowledge is stored in a variety of "representations" (MacKay). These representations (e.g., pictures, sentences, models) are held by the organization in a variety of ways (e.g., written files, computer data banks, individual's memories). Whatever the means of storage, an organization can be considered to possess some aggregate amount of knowledge, stored in the form of representations. Together these representations constitute the organization's "representational construct" (MacKay). This construct is, more colloquially, the organization's perception of reality.

Each organization may also be characterized as being in a certain state of conditional readiness. This state is variable and is directly linked to the organization's existing representational construct. The state of conditional readiness is the context, when conditions warrant, for organizational decision-making. When an organization receives information, it knows more than it did prior to the receipt of that information. There is a change in its representational construct. This change, in turn, alters the organization's state of conditional readiness. The organizational decision-making context is changed.

The linkage between an organization's representational construct and its state of conditional readiness may be pictured as follows:

³⁵ An alternative would be to rely on a structural definition. See: Karl W. Deutsch, The Nerves of Government. New York: The Free Press, 1966, pp. 75-94.

- a. The construct is the totality of what the organization knows.
- b. The construct may be considered to be a framework for perception; it is the organization's expectations about itself and its environment.
- c. The receipt of information alters the construct and so alters the expectations of the organization.
- d. As the organization's expectations change, so does its state of conditional readiness; that is, after the receipt of information, the organization's decision-making context is altered. The result of this alteration is that the organization's future decisions may be different than those which would have been made in the unaltered state.

An exchange of information, and its effects, may be considered in this way. Two organizations exist--X and Y. Each has its own representational construct. Assume that X would like Y to undertake an action which X considers to be favorable to its own goal achievement. X decides to act in a way which it believes will eventually result in Y undertaking the desired response act.

X conveys its desires to Y through an information exchange interaction. This conveying of information is a transmission. A transmission by X requires that: (1) X determine which element of its own representational construct (i.e., knowledge) it wishes Y to know, and (2) X translate this knowledge into coded information which it directs to Y.

Code is an element of representational construct. In transmitting information, X selects a code which it believes is: (1) most appropriate³⁶ for the knowledge to be transmitted, and (2) is an element of Y's construct.³⁷ Transmission is an encoding activity characterized by directedness.

Throughout this exchange, Y maintains a decision-making position. First, it might choose to ignore the transmission. Second, it retains the option of deciding--even in the altered context--which action(s) to undertake.

Transmission is one-half of an information exchange; it is the actions of one of the parties involved (X). If Y receives the transmission (i.e., X has given it the proper direction), recognizes the code (i.e., X has selected a code which is an element of Y's construct), decides to decode it, and is successful in doing so, this

³⁶By appropriate, I mean those characteristics of a code which determine the ease of encoding knowledge. For example, one might consider musical notation to be a more appropriate code for symphony than written words, numerals to be a more appropriate code for statistical data than variations in color, and the Arabic language to be a more appropriate code for Egyptian organizations than Spanish. Codes might be judged to be more or less appropriate on the basis of their efficiency (i.e., the amount of knowledge per unit of code) or effectiveness (i.e., the degree to which a particular code facilitates transmission). It should also be noted that code need not be limited to graphics; an organization may encode knowledge in particular actions which it undertakes in view of the intended recipient of knowledge.

³⁷The intent is to utilize a code which is an element of both its own (X's) and the intended recipient's (Y's) construct.

is a completed exchange. This pattern of activity is communication. Communication, then, requires that the parties share a common code; that one party successfully encodes knowledge into coded information and directs it to a recipient; that the intended recipient recognize the code, decide to decode it, and does so with some measure of success. The end result of communication is an alteration of the representational construct of the recipient (Y).

The intent of X in attempting to communicate with Y is to change Y's construct so that it matches to some degree (i.e., Y gains knowledge previously held by X) X's construct. Recognizing the linkage between an organization's construct and its state of conditional readiness (page 52), it can similarly be seen that by communicating, X wishes to evoke a state of conditional readiness in Y which X believes will lead to action(s) desired by X.

Communication does not itself ensure this consequence. Encoding and decoding need not be a one-to-one correspondence. X and Y may share a common code in varying degrees; and each knows the code within a different overall representational construct. Several factors, then, may interfere with the degree of correspondence between the knowledge X wishes Y to know and the eventual change in Y's construct. These include a differential in the extent to which X and Y know any given code, poor choice of codes by X, inadequate encoding by X or decoding by Y, and differences in the overall constructs of X and Y.

With a change of perspective, the notion of uncertainty may be introduced and clarified. Consider for the moment only organization Y.

Y has decided that circumstances have presented themselves which necessitate an act by Y (a response act). Y is now faced with the decision of how to act. This decision is made in a particular context (state of conditional readiness). The state reflects a certain amount of knowledge possessed by Y.

Recall the earlier assertion that an organization acts in a manner which it believes will contribute to, or minimally obstruct, its goal achievement. Y is now faced with a decision as to how to act, and it makes such decisions in a nonrandom manner (March and Simon). It assesses the response acts which its own action alternatives might evoke. On this basis, Y decides to undertake the action which it believes will evoke actions which contribute to or minimally obstruct its own goal achievement. Y's subjective assessment of the impact on its own goal and achievement of the response acts likely to be evoked by its action(s) can be viewed as the application of a decision-making criteria.

In some instances, Y may possess sufficient knowledge in the form of its representational construct to make the decision a determinate one. In other instances (and observation urges one to say most instances), Y does not have in its construct the requisite knowledge to make the choice of action alternatives determinate.³⁸ The gap between the amount

³⁸It should be noted here that it is conceivable that a decision may not be objectively determinate because the information which would make it so may not exist (MacKay). If the completely determining knowledge does exist, Y may still be faced with the problems of: (1) learning whether or not it exists, (2) learning the extent of the [Footnote continued on next page.]

of knowledge necessary to make a decision a determinate one and the amount of knowledge available to Y (stored in its construct) is Y's uncertainty with respect to this decision.³⁹ The types of information which would alter the representational construct in such a way as to make the decision a determinate one might be of several types:⁴⁰

- (1) information about the decision criteria;
- (2) information about the range, nature, and consequences of action options;
- (3) information about the environment (i.e., extra-organizational factors);
- (4) information about the relationships between the various action options and the environment (Duncan, Skjei);
- (5) information about the condition of any of the incoming information.⁴¹

38 continued
determining knowledge, and (3) securing that knowledge. In any of these cases, Y must temporarily put aside the current decision and make a distinct decision about other knowledge acquisition first. Each of these cases necessitates an information exchange, initiated by Y. In an economic framework, information exchange is costly; it requires time, financial, or human resources. If one assumes some degree of organizational rationality, Y is faced with a problem of valuing uncertainty reduction against information exchange costs.

³⁹ This is a variation on Galbraith.

⁴⁰ (i.e., the sources of uncertainty are a lack of. . .)

⁴¹ Condition is a characteristic of information, here defined as the relationship between knowledge (information) which exists in some objective sense, and the same information after it has been encoded, transmitted, and
[Footnote continued on next page.]

In aggregate, these five constitute the more usual generalized notion of uncertainty: a situation where the probability of the outcomes of alternative events is to some degree unknown. In either instance, a second, widely employed definition of information is implied: information is that which reduces uncertainty.

Stored within X's construct, a project concept has dimension (quantity) and nature (quality). When X attempts to communicate with Y with regard to the concept, the construct-altering information can definitionally be no larger (quantity) nor complex (quality) than the concept stored in X's construct. The information may, at X's discretion, be less extensive or simpler.

Each organization in a network, then, possesses knowledge about itself and its environment, stored in a representational construct. Directly linked to the construct is a state of conditional readiness; a change in the organization's knowledge necessarily alters its state of conditional readiness. Information exchange requires the encoding of particular knowledge by the transmitter and the decoding of the information by a receptor. This set of activities is communication. Communication alters constructs and hence changes states of conditional readiness. These alterations may not, however, be as originally intended by the initiator of communication.

41 continued
decoded. Things which affect "condition" include the nature of the code, the degree of common understanding of the code, the encoding and decoding mechanisms, and the nature of the transmitting medium.

Organizations make decisions. They may not have available to them (or have available to them only at a cost) the requisite knowledge to completely determine the correct/appropriate/best decision option. This gap in knowledge is uncertainty. The information which would close the gap in knowledge may be of one or more types.

Because organizational actions are guided by a goal achievement orientation, organizations assess action alternatives prior to making decisions with respect to action. In their efforts to choose actions which are conducive and/or nonobstructive to their goal achievement, organizations will attempt to reduce the uncertainty associated with a decision. Their interest in making "good" decisions, with respect to their goals, motivates them to exchange information with other organizations as a means of narrowing intraorganizational gaps in knowledge and, by doing so, reducing uncertainty. This drive to exchange information is not unchecked, however. Intraorganizational costs, for example, are a concern, as is the balance of knowledge interorganizationally.

Returning, then, to the model of project development in Cairo, the term conceptualization does not refer so much to the act of mental invention⁴² (Gakenheimer) as to the intraorganizational actions which give an idea form--an identity. The distinction between idea and concept, as employed here, relies on the notion that idea-generation

⁴²This is not to imply that mental invention does not occur, nor to imply its unworthiness for analysis. It is, rather, viewed as an intraorganizational activity, and so, outside the self-imposed limits of this study.

is essentially an individual/small group activity. This activity is followed by a series of intraorganizational information exchanges (e.g., among members of a planning staff, and subsequently, among planners, budgeters, managers, etc.). The culmination of these intraorganizational activities (which may be considered the jelling of an idea through detailing and structuring) is an alteration in the representational construct of the organization. This alteration--essentially internally-generated new knowledge--is a project concept. A concept, then, is an element of an organizational construct which arises from an organization's internal environment. Conceptualization is the activity of generating this new construct element, and a project conceptualizer is an organization within which this activity occurs. This study identifies the beginning of a project's interorganizational history as the culmination of the intraorganizational conceptualization activity. At this point in time, the organization possesses the project concept as an element of its construct.

A review of the project case studies reveals that a variety of organizations have been project conceptualizers: the Cairo Governorate, the General Organization for Physical Planning, the domestic design firms, the Cairo Transit Authority, and the Transportation Planning Authority. The first three of these are most frequently associated with more labor intensive, domestically-based projects, such as bridges and roadways; the Cairo Transit Authority with extensions of its current facilities; and the Transportation Planning Authority with more innovative, higher technology projects which are often linked to foreign

sources of funding and technical advice. These broad orientations most likely reflect the positions of the organizations in the authority network (e.g., GOPP linked to the MOHR; domestic designers associated with construction companies), and more importantly, their internal characteristics (e.g., the educational and professional backgrounds and interests of their personnel).

In the network, conceptualization is closely identified with the notion of proprietorship. The labeling by the organizations of the network of a concept as belonging to one of the network organizations (and coincidentally, that organization's claiming/accepting the project) is an important step in development. First, this activity transforms the concept from one which was previously only intraorganizationally solvent, or perhaps only cautiously and informally discussed inter-organizationally, into a concept open to general scrutiny and detailed analysis in the network. Second, a project concept must be positioned compatibly with the existing interorganizational pattern of funding exchanges⁴³ and organizational functional capacities before it can be considered in terms of potential sources and scale of funding for implementation. Establishing proprietorship accomplishes this.

⁴³The pattern and characteristics of funding exchanges (i.e., the budget making and allocation process) impinges on development in several ways, one of which is mentioned here in connection with the establishment or proprietorship. For a discussion of the budget making and allocation process, see: Ralph Gakenheimer, Mohamed el Hawary, and Martin Michael, Transportation Project Development and Implementation in Cairo, Egypt. Cambridge, Massachusetts: The Research Group of the Greater Cairo Urban Transportation Project, Cairo University and Massachusetts Institute of Technology, 1977 (revised 1978).

The network determination of proprietorship requires that all (or a threshold number--see the following) of the organizations in the network understand the project concept; that is, the organizations must have knowledge of the concept in their representational constructs. This can only be accomplished through information exchanges. None of the project cases examined were without a proprietor; indeed, proprietorship may be viewed as a requisite for further development.

Recalling the earlier descriptions of the authority hierarchy and the organizational functions, the set of conceptualizers and the most common proprietors may be compared and linked. The result is displayed in Table 3. This seemingly fairly well established pattern of conceptualizer-proprietor relationships implies a certain constancy to the labeling activities of the network organizations. Minimal interorganizational information exchange occurs in this case, as the constructs are altered intraorganizationally on the basis of existing internally-stored knowledge. As the initial, basic information on a project concept is interorganizationally communicated, the organizations not only alter their construct in understanding the concept, but also by typing (i.e., categorizing) a concept based on their existing construct (i.e., relying on knowledge of historical conceptualizer-proprietor linkages). This second internally-based alteration is labeling. The almost automatic character of labeling arises because, evidently, the organizations possess very similar knowledge with respect to the typing (categorizing) of concepts.

Table 3

CONCEPTUALIZER-PROPRIETOR RELATIONSHIPS

Project Concepts Developed By These Organizations:	Are Generally Associated With The Proprietors:
1. Cairo Governorate	1. Cairo Governorate
2. General Organization for Physical Planning	2. Ministry of Housing and Reconstruction
3. Domestic Design Firms	3. Ministry of Housing and Reconstruction
4. Cairo Transit Authority	4. Cairo Transit Authority
5. Transportation Planning Authority	5. Ministry of Transportation

Up to this point, the emphasis has been on the developmental history of single projects. In reality, a number of projects are in various stages of development simultaneously. As indicated earlier, their histories impact on one another increasingly as the projects mature historically. With this in mind, the analysis of development broadens at this point to consider this simultaneous development of a number of projects. In doing so, the notion of a set or slate of projects is introduced.

While there is no evidence of a generally accepted plan or program⁴⁴ for the implementation of urban transportation projects, there is evidence that a consensus exists among the participating organizations (the network) as to a slate of urban transportation projects which should be implemented in the near (though undefined) future. The nature of the consensus on the slate of projects has two prominent characteristics:

- a. While there exist differing opinions among the organizations as to what the details of the projects should be (e.g., precise siting or design), these disagreements never appear to lead to a questioning of the validity of a project in its broad outlines; that is, the slate is stable with respect to content.
- b. Once slated, the inherent importance of a slated project is not open to disagreement (i.e., the issue of whether it is a good or a bad idea is no longer debated). The disagreement

⁴⁴ A program being a schedule of resource allocations and a construction timetable for the implementation of projects.

(Cont.) b. which does occur focuses on the order of project implementation (i.e., the prioritization of the projects), not (similarly to a above) on the issue of whether or not a project should be implemented; that is, the slate defines a domain of acceptable disagreement.

These characteristics--a stable, consensual slate with debate only on the order of implementation of its elements--is of particular interest. As indicated earlier, there are a number of organizations which function as project conceptualizers and even more organizations with a direct interest in the development of projects. Recalling that organizations act so as to meet their goals, it can be assumed that each organization at least roughly prioritizes all potential projects on the basis of their potential to assist in the achievement of those goals. In a situation of multiple projects in development and a large number of involved organizations with differing (i.e., conflicting) priorities, the slate serves as a mechanism for narrowing the range of projects for further consideration to a number which will be manageable for future debate concerning detail and order of implementation, while retaining the involvement and support of all the organizations in the network. This is a necessity when the network, as a whole (roughly, the "urban transportation sector"), must not only allocate resources within the network (among the projects), but must also compete with other whole networks (e.g., the agricultural sector) for scarce capital resources, while ensuring that interorganizational disputes within the network over particular projects are not allowed to block the progress of all urban

transportation projects as they develop from conceptualization to construction. More succinctly, the nature of the slate is that it permits the involvement of a sufficient number of organizations so as to ensure the viability of the overall development and implementation process yet also limits the scope of future disagreement.

The slate does not have a material reality, and in fact, the participating organizations very likely do not organize the knowledge of project concepts, conceptualizers, proprietors, etc., in their constructs in the terms of a slate. (The slate should be viewed as an analytical tool for the observer). An organization's construct does, however, have elements which are representations of (i.e., its knowledge of) the project concepts, conceptualizers, and proprietors. Coincident with these elements, the organization has internally generated knowledge of a subjective preferred order of implementation arising from an intraorganization matching of goal and project characteristic knowledge. The interorganizational process of developing and maintaining a slate might be viewed as at least a partial reconciliation of the various organizations' conflicting preferred orders of project implementation. This is a construct modification process. In a simplified manner, each organization's construct of a "most preferred" order of implementation is augmented with knowledge of the preferences of other organizations. In this process of developing projects with the intent of maintaining a slate, the variety of "most preferred" orders of implementation are (figuratively) adjusted and integrated as a means of maintaining a slate sufficiently agreeable to all organizations so as to ensure their future

participation. The slate of projects (that is, the unordered list) may be seen as an interorganizationally shared construct. Each organization also constructs its own preferred order of implementation of the slated projects; the resolution of this conflict lies in the budget making and budget allocation process.⁴⁵

The determination of the slate arises from both interorganizational and intraorganizational information exchanges. Through the dynamic, incremental activity of information exchange and construct alteration, the organizations attempt to maintain a slate of projects which, when implemented, will be as close an approximation as is possible to each of their own preferred orders of implementation. The latter are a reflection of each organization's own goal achievement/ project characteristic construct.

A new project concept, then, is weighed by an organization in terms of the slate construct which exists, that organization's goals, and other developing projects. Each organization continually modifies its construct as new information concerning the current status of slated projects, developing projects, goals, budgets, and the slates of other organizations is received and decoded. As the constructs are under

⁴⁵The determination of the order of slated project implementation is a relatively distinct activity, relying on a highly regularized, institutionalized budget-making and budget-allocation process centralized in the cabinet. For further elaboration of this process, see: Ralph Gakenheimer, Mohamed el Hawary, and Martin Michael, Urban Transportation Project Development and Implementation in Cairo, Egypt. Cambridge, Massachusetts: The Research Group of the Greater Cairo Urban Transportation Project, Cairo University and Massachusetts Institute of Technology, 1977 (revised 1978).

continual modification, so are the serious organizations' states of conditional readiness. Decisions by an organization, and in particular decisions as to its future actions with respect to each project concept, are made in a changing context. As these decisions are made, a project develops, moving from concept to slate or abandonment.

The driving force behind this ongoing process of maintaining a slate has been suggested previously. Project implementation (construction) requires capital funds. Implemented projects represent a fulfillment of organizational function (an organizational goal); capital funds also ensure the continued existence of an organization. Project implementation requires an ordering of project alternatives so that allocations of capital funds can be made. (Funds are not available for the implementation of all projects immediately.) Interorganizational decision making about the order of implementation of projects is difficult when many organizations are involved and many projects are available. As an intermediate facilitating step toward these decisions concerning the order of project implementation, the limited set of projects to be implemented is first determined. This set is the slate.

The information exchange activities which underlie slating/development are fairly regular. First, as each new project concept surfaces and its ownership is established, information of the concept must begin to be communicated to all the organizations in the network. The organizations alter their constructs, both in understanding the concept itself and also by labeling it. Second, each organization analyzes the new knowledge in its altered construct. Analyzing is an

intraorganization activity which essentially consists of further modification of the construct by linking the new knowledge of the project concept to old knowledge of goals and past interaction patterns, for example.

This analysis, while primarily an intraorganizational activity, may be accompanied by secondary interorganizational information exchanges initiated by the organization. These might be undertaken to clarify, for example, the concept; that is, an organization may seek additional information from the conceptualizer or other organizations whose constructs incorporate more knowledge of the concept in question or of similar projects. (In this respect, they may be viewed as "experts.")

The effect of the understanding and analyzing of the concept is an alteration of the organization's state of conditional readiness. This is important for the third step, which is the evolution of a tentative organizational decision with respect to how the organization will act toward the concept. This is one part of response evocation, the other being a decision by the organization that circumstances warrant the communication of this tentative decision to another organization. This need to formulate tentative decisions and to test the response acts they might evoke if finalized is generated by the interdependencies among the organizations with respect to available funds and the authority to implement projects. The tentative decision-making and testing activity is a means for the organization to obtain additional information about the potential future actions of other organizations. This

knowledge is stored in the construct, and again, the state of conditional readiness is altered. The organization's uncertainty as to how to act (i.e., what a final decision should be) is reduced. Finally, the decision is made.

This testing and decision-making is, in reality, more than the simple procedure outlined here; it is a dynamic, incremental, interactive process. One means of understanding this process more easily is to model it very simply as a voting procedure. The question to be voted on is: Should a particular project be slated? Each organization has one vote per project. Assume that criteria for a slating decision are the number of favorable votes cast.

The factors which an organization might consider in deciding on the nature of its vote include its perception (i.e., its construct) of:

- a. the relationship between the construction of that project and the achievement of its goals;
- b. the contents of the existing slate, and the owners of the various contents;
- c. the owners of the project under consideration;
- d. the budget--both past and expected; and
- e. any other project concepts which are likely to be considered in the near future.

On the basis of these considerations, an organization will reach a final decision as to its vote.

There exists a threshold here--the balance of yeas and nays must reach a critical point for a consensus to exist that the project

should be slated. The simple voting procedure outlined here distorts reality; a variety of complications exist. First, voting is not binary; rather a continuum of votes exists, ranging from "very much yes" through "ambivalent" to "very much no." So not only the number, but also the quality, of the votes is significant.

Second, the variety of functions, roles, and states of the organizations involved is not static. Organizations as entities might be observed to have their own histories; this affects their interaction. Interorganizational resource differentials exist and are recognized through information exchanges. Because of this, voting considerations focus down to the issue: Which organization is casting which vote?

Third, all organizations do not vote simultaneously. Organizations may vote early, hoping to evoke a similar type of vote (response act) from other organizations by taking on a promoter role. On the other hand, an organization may stall on voting, attempting to gather more information on the other organizations, and their voting preference actions.

Fourth, the anticipation of additional projects to be voted on in the future creates the bargaining situation hinted at earlier.

This modification of the voting approach to the decision-making process--bargaining--can be abstracted slightly in the form of a game (Schelling) which links project conceptualization and the slate. It should be understood that a clear-cut nonconsensus situation (that is, legitimization is in doubt) locks the organizations into playing this game. In the bargaining game, the promoters hope to achieve

the legitimization of the project, and by doing so, secure scarce funds for its implementation. The project opposers seek to prevent the project from receiving scarce funds which might be utilized on other project concepts, and all organizational participants--promoters, opposers, undecided--may see an opportunity to obtain some return on participation, even if they are unsuccessful in securing their primary interest. This return takes the form of restrictions on the future actions of other organizations (i.e., reduction of uncertainty). Finally, because no one organization can achieve all its goals independent of the others in the network, disintegration of the bargaining game would be potentially disastrous. Participation is a means of organizational survival; slating is a means of network survival.

Bargaining is accomplished through information exchange. Bargaining exchanges respond to one question: What must I give you to secure a certain return? (Or conversely, what will you give me to act in a certain way?) Bargaining is motivated by the desire to reduce uncertainty, in this instance by restricting the future actions of other organizations. In terms of the model, the organizations involved in bargaining are attempting to secure construct-altering information from other organizations. In this situation, knowledge (in particular, knowledge which X possesses and Y does not) can be viewed as an organizational resource. Organizations bargain for and with information, which may be about the environment, about projects, or about their future actions. One result of project development bargaining is consensus--that is, achieving that threshold of yeas which

will legitimize (slate) a particular project. This is a significant reduction in uncertainty, for, as pointed out earlier, it virtually ensures the concept's realization at some point (still undetermined) in the future.

The bargaining activity is incremental in nature and is complicated by the multiple participants in the game. In its simplest, two-participant form, organization X poses the bargaining question to organization Y. This is a response-evocative act. Y intraorganizationally decides on a potential response act (an "offer") and communicates this information to X. X analyzes the offered potential response act (that is, considers what Y has offered to exchange and on what terms). If both X and Y find the terms of the exchange suitable, they will communicate this to one another, and the exchange will be consummated. If one or both find the terms unsatisfactory, this too will be communicated. Subsequent offers may be made or the potential bargain abandoned. Each of these steps entails construct-altering information exchanges which are a prelude to the primary information exchange objective. The process of moving from the initial bargaining overture to a consummated bargaining exchange is usually incremental; mutual accommodation is made in small stages (this can be interpreted as a gradual modification of each organization's construct). This is a consequence of a situation where each participant wishes to maximize uncertainty reduction (securing new information) while retaining its freedom in future decision-making (avoiding extensive future commitments to act).

Retaining the freedom to act in the future by limiting current "outflows" of information is a strategy necessary to ensure the ability

to play the bargaining game in the future. An organization playing the game is in a position of balancing current reductions in uncertainty with the need to retain bargaining resources (i.e., knowledge/information) for future play. Rather than maximizing current uncertainty reduction, the organization in reality attempts to satisfice (March and Simon) by reducing current uncertainty to a tolerable level--a level beyond which it believes any uncertainty reduction will only marginally affect its likelihood of making a correct/good goal-achievement attaining decision. An outflow of knowledge/information reduces the uncertainty of other organizations. In these circumstances, an organization will be motivated to attempt to bargain an outflow of information for an inflow (that is, to establish exchange).

Information is not only explicitly exchanged, as suggested in this simple game, it may be exchanged indirectly through a third party (the roots of "intrigue") or through observations of an organization's actions as a means of detecting its still unrevealed preferences.

The consummation of a bargain is preceded by a decision among the participants that its terms are mutually satisfactory. Deciding is signaled by the nonacceptance of additional information prior to acting (Deutsch), information which might alter the state of conditional readiness. Signaling itself is an exchange of information. The final step in bargaining is the communication interorganizationally of decisions.⁴⁶

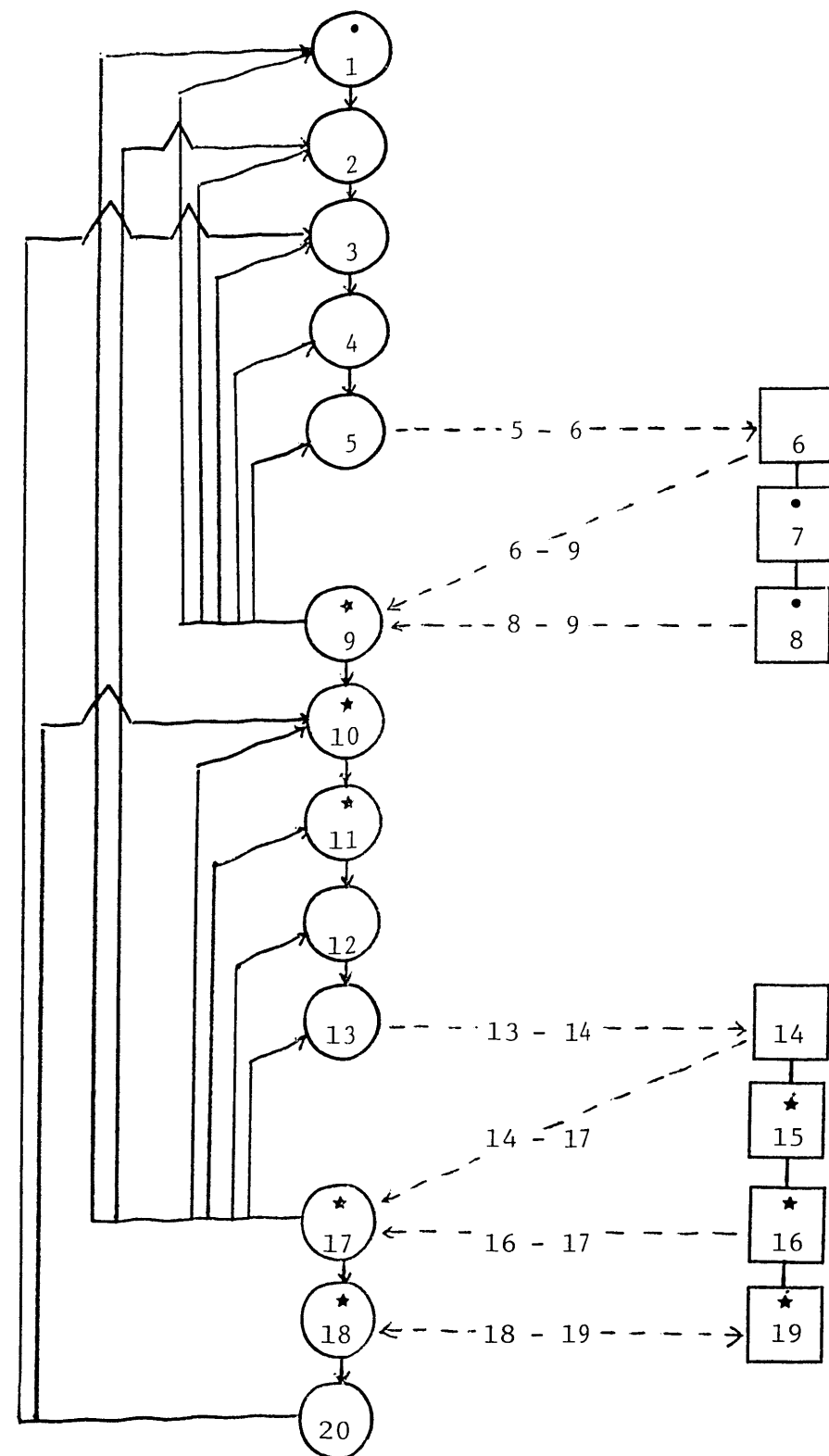
⁴⁶These steps are in reality a subset of an ongoing iterative activity. If the transmittal of decision information is viewed as a response-evoking action, then based on the response act to that information, an organization will make another decision: leave the original decision unchanged or make a new decision.

When the threshold level of decisions is met and communicated (i.e., votes are counted/bargaining concluded with respect to a particular project), a project is either legitimized--slated--or it is not; that is, a certain degree of similarity must be attained in all or some of the various organizations' constructs to determine whether a project is slated or not. When this degree of similarity is attained, voting stops, bargaining ends with respect to the determination of whether or not that project will be implemented. A new level of voting/bargaining/construct alteration is then undertaken with regard to that project; that is, to determine when and at what pace implementation will occur. As indicated earlier, this is the budget making and budget allocating process.

In Cairo, outright rejection of a project concept appears to be the exception rather than the rule. It appears that projects which fail to attain the threshold level of acceptance are figuratively placed on the back burner while other projects are considered. In terms of the model, the focus of bargaining/voting shifts. The information exchanges, while of the same nature as before, are undertaken with the intent of developing a consensus on a different project. The organizations in the network may work through this procedure intermittently, shifting their focus from project to project. Different subsets of the network may also be focusing on different projects at the same time. One organization may be undertaking a series of information exchanges/voting/bargaining with a variety of different organizations, each focusing on a different project. Because the histories of each

of the projects are interlinked, a change in constructs, with respect to one, may present the situation for altering the constructs on another, so the development process continues.

Figure 4 is an attempt to capture, in a somewhat static form, the incremental, interactive information exchange activity which underlies project development. For ease in interpretation, it portrays a simple two-organization network.



This Figure illustrates the hypothetical interactions between an Organization X (a project conceptualizer and promoter; represented in the circles) and an Organization Y (another organization in the network; represented in the squares). The list of numbered activities described below reference to the events depicted diagrammatically by circles and squares in the Figure, as well as particular flows of information (numbers in parantheses).

The initial interactions described illustrate X's efforts to share a project concept with Y; later interactions illustrate X's efforts to slate the project through bargaining with Y as a means of obtainingsupport for the project. Note that in reality the process is multi-organizational, and that X may simultaneously be interacting with several organizations (Y, Y', Y''...) concerning several projects (A, B, C...).

Circles and squares containing black dots are those events which involve construct formation/modification concerning a project concept itself; those with stars are those events which involve construct formation/modification concerning other elements of the environment, such as other organizations.

1. X conceptualizes a project.
2. X determines if the Project Concept is ready for sharing.
3. X identifies a recipient for the Project Concept information.
4. X selects a code for transmitting Project Concept information.
5. X transmits Project Concept information to Y. (5-6).
6. Y determines if the transmission should be accepted and notifies X of its decision. (6-9).
If Y refuses to accept the transmission, X may (see Step 9):
- abandon the effort to share/promote this concept (return to Step 2).
- change the intended recipient (return to Step 3).
- change the code used (return to Step 4).
- attempt once again to transmit, using the same information, same code, and same recipient, with hopes of evoking a different response (return to Step 5).
7. If Y accepts the transmission, Y analyzes the Project Concept information.
8. Y determines if it has sufficient information on the project to "understand" it (form a construct), and so notifies X. (8-9).
If Y's response is negative, X is forced (see Step 9) to select from the list of options presented above in 6, with the addition of these significant new options:
- transmit additional information about the Project Concept to recipient (return to Step 2).
- change the concept (return to Step 1).
9. X responds to information transmitted from Y.

(NOTE that Steps 2, 3, and 4 above may involve preliminary information exchanges between X and other organizations in the network).

If Project Concept sharing from X to Y is successful, then both X and Y possess construct elements with respect to the project, and they exchange information to that effect. This establishes a framework for bargaining between X and Y. Either X or Y may initiate bargaining; assume that X, an active project promoter, initiates this phase.

10. X identifies the recipient (bargaining partner).
11. X determines an offer - the item(s) and quantity to be exchanged in the event of a favorable response.
12. X selects a code.
13. X transmits the offer-information to Y. (13-14).
14. Y determines if the transmission should be accepted and so notifies X. (14-17).
If Y refuses the transmission, X may (see Step 17):
- abandon the effort to bargain concerning this project (return to Step 2).
- change the intended recipient for bargaining (return to Step 10).
- change the code used (return to Step 12).
- attempt once again to transmit, using the same information, the same code, and the same recipient, with hopes of evoking a different response (return to Step 13).
15. If Y accepts the transmission, Y analyzes the information.
16. Y reaches a tentative decision on how to respond to the offer. Y may reject the offer, accept the offer, or propose a counter-offer, hoping to evoke a response from X. In any case, Y transmits its response information to X. (16-17).
17. X analyzes the information from Y concerning the offer.
If Y rejects the offer, X may (see Step 17):
- abandon the effort to bargain concerning this project (return to Step 2).
- change the code (return to Step 12).
- change the recipient for the offer (return to Step 10).
- transmit additional information concerning the offer (return to Step 13).
- modify the concept (return to Step 1).
- change the offer (return to Step 11).
If Y proposed a counter-offer, X may (see Step 17):
- abandon the effort to bargain concerning this project (return to Step 2).
- change the code (return to Step 12).
- change the recipient for the offer (return to Step 10).
- modify the concept (return to Step 1).
- reject the counter-offer and so notify Y (whereupon Y may reconsider its counter-offer; return to Step 15).
- propose a counter-counter-offer to Y (return to Step 11).

If Y accepts the offer, then X and Y have reached an agreement. In this instance,

- 18/19. X and Y exchange information to the effect that an agreement has been reached. (19-20).
20. if the concept is not yet slated (ie, an insufficient number of Y, Y', Y''... support the project), X as a promoter will either:
- attempt to share the project concept with another organization in the network which does not yet share it, as a prelude to bargaining with that organization (return to Step 3); or,
- initiate bargaining with a different organization (return to Step 10).

This project development process ends when either:
- it becomes clear to X that it cannot develop sufficient support for the project within the network, and the project is then dropped (ie, retained in construct in storage, but no longer actively promoted) at least temporarily. At this point, X may chose to develop/promote a different project, or other organizations may do so. As other projects develop, inter-organizational agreements are made which may modify or nullify previous agreements (the context for those agreements no longer exists). That is, while the project concept construct is no longer being promoted, it will not itself be modified; "environmental" constructs may change, however, as other projects develop.
- or, the project is slated.

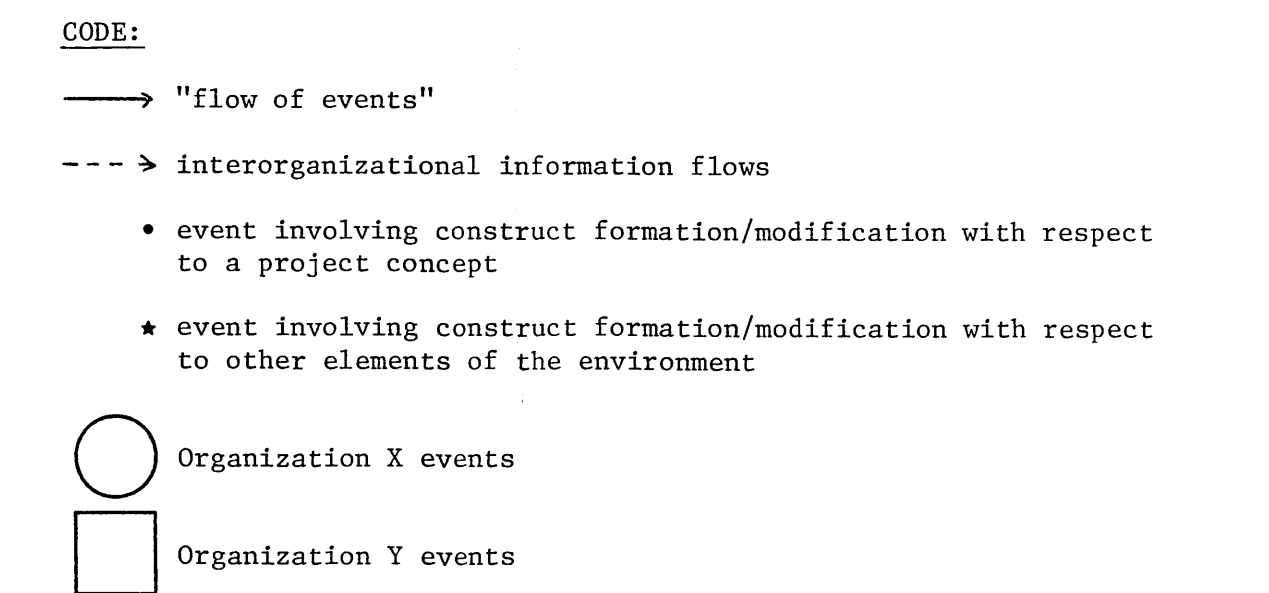


FIGURE 4: INFORMATION FLOWS AND DECISION MAKING IN PROJECT DEVELOPMENT

Chapter 5

CONCLUSIONS

In this study, urban transportation project development in Cairo has been described and analyzed as a structure of interorganizational information exchanges. The flow of information among the participant organizations has been characterized as a bargaining game. The concept of a social network has been employed, its nodes being the organizations involved in project development and its links being the interorganizational relationships which are manifest in the interactions which serve as the basic data for this study. This chapter begins with several observations on the development activity, presents several conclusions, and suggests further topics for research.

It is clear that project development in Cairo is a decentralized network activity in which no one organizational node clearly dominates the others. The process of moving projects from conceptualization through legitimization, called "slating," is characterized by a high degree of interorganizational dependency and is generally a process of uncertainty reduction. While the nature (bargaining) and means (coded information exchanges) of slating are evidently relatively standardized, the content of slating is characteristically highly uncertain; that is, uncertainty arises less frequently from the issue of how the process takes place than from the characteristics of the particular projects and organizations considered in the slating process.

Slating per se, as well as the maintenance of the slating process, are ongoing efforts by the organizations involved to move toward a lower

level of uncertainty within the network. Referring to the Map of Network-Uncertainty Characteristics on page 29 (Table 1), it can be seen that periodic changes in organizational functions, roles, or authority states (e.g., a shift of construction company oversight responsibilities from the Ministry of Housing and Reconstruction to the Ministry of Transportation) and the ongoing project conceptualization activity (i.e., the introduction of new projects for consideration) each push the network toward a "turbulent" environment. The organizations engage in a slating process with the intent of reducing uncertainty, by reducing either factors considered, actors involved, or both. (These are characterized by a movement to the "left" or "up" on the map.) The primary movement appears to be toward a "placid/clustered" uncertainty environment. This is accomplished by efforts to make more static the dynamic nature of project development. Maintaining slating provides a relatively high degree of certainty through shared expectations of procedure. Thus, slating provides for shared representational constructs (and stable relationships) among network participants. Less frequently, uncertainty is reduced by simplification of the decision-making environment. Changing organizational "states" (e.g., evidence of efforts to minimize the impact of the General Organization for Physical Planning on development) are evidence of such movement.

In the introduction to this study, programming, as developed in the United States, was described as having four elements: projects, resources, goals, and methodology. It was also asserted that processes existing in the host environment are the beginning point of a methodologi-

cal development and/or adaptation effort. Thus, to consider the applicability of U.S. programming methods in Egypt, this analysis has focused on the existing project generation process. In the course of this analysis, the characteristics of goal setting have been at least implicitly outlined. Comprehensive, substantive, network-wide goals for transportation are at best general and vague. The actions of the network organizations are guided primarily by their own peculiar goal configuration rather than any overriding network goals. Moreover, organizations are rarely explicit about their goals in the abstract sense. Rather, goal configurations are discernable only through observation of the pattern of an organization's actions.

The absence of network-wide goals and lack of efforts to develop them is both a blessing and a curse. This circumstance represents a source of uncertainty for the organizations involved. But in an environment of scarce resources, the securing of any resources and the realization of projects as indicators of functional requirement fulfillment are of direct importance for organization and network survival. Interorganizational goal reconciliation diverts the network from this primary task. The lack of explicit network or organizational goals also allows the organizations relatively more freedom in their future actions. Goals (or perhaps more accurately, objectives) may be changed as the situation warrants. Flexibility through incrementalism are the bywords here and are consistent with slating maintenance, which is the present primary means of uncertainty reduction. By comparison, programming, as developed in the U.S., would be enormously disruptive,

yielding high uncertainty/turbulence. Major a priori comprehensive goal articulation and project conceptualization/prioritization activities based on those goals is almost the direct opposite of the present system. If "imported" in total, it would require almost total reformulation of the representational construct of the Egyptian urban transportation network and each of its constituent organizations.

What then can be said of the possible fate of adaptation of programming in Egypt?

A basic conflict between present Egyptian practices and U.S. programming methods is the tension of centralization vs. decentralization. Programming, as traditionally practiced in the U.S., is by nature a centralizing activity. As a method to allocate funds among projects in a goal-consistent pattern, programming forces a centralization of information, goal identification, project generation, decision making, and financial resource flows. Because this centralizing tendency of programming is counter to existing decentralized development processes in Egypt, its introduction could generate more, rather than less, network uncertainty.

An alternative to the introduction of programming at the development stage (which has been the focus of this study) would be its application in the implementation stage. The movement of a project from slate to artifact (the budget-making and allocation process) is evidently more regularized and centralized than is the project develop-

ment activity.⁴⁷ However, introducing programming at the implementation stage runs the risk of trivializing programming, making it simply a glorified cost/benefit analysis which serves the role of ordering an already determined slate of projects. It is the case that slating does involve the making of significant decisions concerning alternative projects and that the legitimization provided by being "slated" is a guarantee of eventual realization of a project. But the slating process, by emphasizing the process maintenance aspects, does inhibit the introduction and serious consideration of new, innovative urban transportation solutions in favor of projects which are perceived (intraorganizationally) as likely to be generally acceptable (that is, they conform in sufficient respect with the representational constructs, as to both content and procedure, of network participants). Thus, the breadth of consideration in U.S. programming is presently lost to the somewhat narrower considerations permitted by Egyptian slating.

However, by adopting a different perspective, a form of U.S. programming may successfully be adapted/developed for Egypt. As indicated earlier, the most general intent of the existing development process is to facilitate the realization of urban transportation projects. This is accomplished through uncertainty reducing activities. The aim of the traditional programming concept is not dissimilar. But

⁴⁷ Ralph Gakenheimer, Mohamed el Hawary, and Martin Michael. Urban Transportation Project Development and Implementation in Cairo, Egypt. Cambridge, Massachusetts: The Research Group of the Greater Cairo Urban Transportation Project, Cairo University and Massachusetts Institute of Technology, 1977 (revised 1978).

for a programming methodology to be accepted in the existing context of development in Egypt, it must take a form which the network organizations perceive as beneficial. The primary benefit which can be achieved through programming is the reduction of uncertainty. In order to avoid a direct confrontation with the structure of existing information exchange based relationships, programming adaptation (methodology development) should first focus on intra-organizational behavior; that is, programming should be formed in such a way that it can be adopted by each organization as a means for reducing its own uncertainty. Here, programming is viewed as a means of improving the project-related decisions of any organization which utilizes it. Specifically, programming would be a framework for the building of a construct by an organization. This is accomplished through detailed specification of the types (e.g., certain kinds of cost breakdowns for a project) and extent (e.g., similar knowledge of all available projects) of knowledge/information in project concept constructs. This proposes, in effect, that an organization have a construct (a "standardized" framework) which will guide the building of other constructs (project concepts) so that the latter are in some measure uniform. The programming construct would serve as an internal reference for the organization as project ideas become project concepts.

Because project development consists of interorganizational information exchanges, any alteration of construct formation (knowledge/information "storage") within an organization will have an impact on the interorganizational process itself as the organizations communicate.

This will occur because the information exchanged reflects the constructs of the participants. If the constructs are, (1) more "complete" with respect to each project, other projects (slated and slatable) of that or any other organizations, and the other organizations themselves; (2) intraorganizationally consistent (e.g., each project is represented in a similar construct framework); and (3), interorganizationally consistent (e.g., each organization forms constructs relying on the same framework); then the overall project development process will benefit in the manner implied by programming. The nature of the process itself will be more certain, but more importantly, the content of the process will be more structured than is presently the case. Decisions achieved in slating will be more "rational," formulated on a broader base of more highly detailed information. And finally, implementation (budget allocating), which necessarily relies on the organizational constructs formed during development, will benefit.

In the longer run, this modification of the existing construct formation activity may lead to an alteration of the interorganizational relationships in the network. This structural change may arise as some organizations more quickly or readily formulate constructs and make decisions while others lag behind. If this occurs--if one organization clearly benefits from the adoption of programming--it is conceivable that the other network organizations will at least attempt to respond by adopting a similar construct formation concept. This indicates that a "methodology diffusion" process may occur, and it suggests a strategy for those who wish to undertake project programming technology adaptation.

Finally, it is appropriate to end this study with the question: What are the logical extensions of this research work? One approach, as indicated above, would be to extend the information exchange model to examine in more detail the implementation aspects of the urban project development and implementation process in Cairo. Such an effort would similarly attempt to lay some foundation of knowledge as a prelude to adaptation.

A second extension would be to deepen the analysis of project development presented here. This might take the form of intraorganizational analysis of information flows (to complement this interorganizational analysis), or alternately, a more macro level study, perhaps at the institutional level. Additionally, a shift of focus to other network relationships (e.g., power) might be undertaken.

Third, a comparative framework might be adopted. Project development, as an information exchange activity, might be examined intrasectorally in other sectors (e.g., Egyptian rural electrification projects or industrial development projects) or interculturally (e.g., urban transportation project development in other developing, or more developed, nations).

Finally, one might move into further work with the model itself. Networks, relationships, exchange, information, uncertainty, and bargaining are all concepts worthy of further investigation.

Appendix A

THE DATA COLLECTION PROCEDURE

The social, time-linked nature of the project development and implementation activity directly influenced the procedure utilized to collect basic information about the activity. First, it was evident that reliance on a single information source would be inadequate. Second, it suggested that a historical approach might be most appropriate. It was also clear from our preliminary contacts that the transportation projects themselves were the unifying concern of the array of individuals and organizations which in some manner participate in the activity. We incorporated this into our work. The projects became the focus of our information gathering efforts; and we defined, in an ad hoc manner, the boundary of the work to be all those organizations which are actively involved in urban transportation project development and implementation in the Cairo area.

Following an initial, informal questioning of our counterparts to identify urban transportation projects which (a) had recently been completed, (b) were currently in some stage of construction, (c) had been abandoned, or (d) were currently being considered for implementation, we began to assemble what are essentially project case histories for each project. At first informally, then utilizing a detailed case-study questionnaire format, and then follow-up interviews, a broad range of information was assembled for each project. We drew heavily on the general knowledge of the various projects of individuals in the Egyptian Ministry of Transportation (particularly Engr. Salamawi). But by relying

on the same basic set of questions in interviewing a variety of individuals (many of whom were identified in the initial phases of data collection), we were able to cross-check the information collected to a considerable degree. The formal project history format also allowed us to assume a certain position of neutrality when interviewing. The nature of the questions shifted from a threatening "What do you do?" to "What did you do with respect to each of these projects?"

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