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IMPLEMENTATION ISSUES IN CRIMINAL JUSTICE MODELING,

(10) Michael W./Lawless

(11) Feb[illegible] 1976

(14) P-5508

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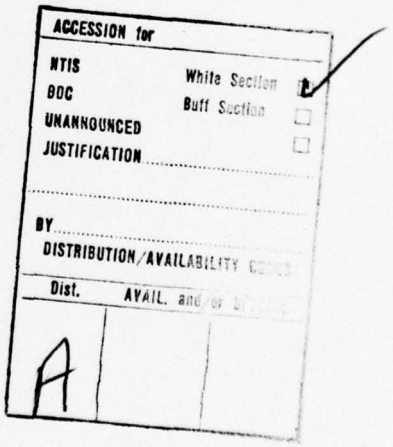
ACKNOWLEDGMENTS

As in many other efforts, I am indebted to Jan Chaiken of Rand and Richard Goodman of UCLA for their helpful criticism and guidance.



ABSTRACT

This paper presents an analysis of the implementation process for computer models in criminal justice agencies. The study was undertaken as part of a larger review of computerized decision models and their use. The purpose was to assist the law enforcement assistance administration to establish priorities for future funding policy.

A survey of 39 cases of model applications is described. Data are presented concerning the means by which the opportunity for model use in the user-agencies was perceived, and by which a particular model was selected, acquired, and introduced.

Criteria for determining the success or failure of implementation are given, and factors in these outcomes are discussed.

Finally, recommendations for future federal policy concerning model building, dissemination, and implementation are offered.

CONTENTS

IMPLEMENTATION ISSUES IN CRIMINAL JUSTICE MODELING

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I. INTRODUCTION

This paper is concerned with the application of computer modeling in the decisionmaking of criminal justice (CJ) agencies. It was undertaken as part of an analysis of CJ modeling performed by Rand for the Law Enforcement Assistance Administration.* The overall purpose was to review and critique the set of available models and to develop recommendations for future federal funding policy.

This is a report on a part of that study which addressed the related issues of the diffusion and implementation of the models. The purpose of this study was two-part. One was to construct a descriptive theoretical framework of the process of computer model implementation in criminal justice agencies from the literature, from previous empirical research, and from data collected in a survey in this investigation. Another part was to examine, in this context, the implementation outcomes for the survey cases, then to develop recommendations for future implementation policy.

The theoretical framework utilizes concepts of innovation, problem-solving, and organizational change which are familiar parts of the organization theory literature. In particular, the analysis is developed using a model called the "implementation sequence" which owes much to the work of Zaltman, Duncan, and Holbek.(2) The conceptualization of the introductory stages of model use relies on Downs(3) and Cyert and March(4) for their discussions of factors conducive to innovation. Included also are some perspectives on organizational search from Simon(5) and Knight.(6) Some ideas are introduced from the literature of research and development, including those of Cleland and King(7) and Radnor and others.(8)

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*For a report on this study, see Chaiken et al.(1)

The following criteria were used for selecting models for inclusion in the study:

- o The model was designed to assist the decisionmaking of line CJ agencies. It had to be usable for experimenting with decision alternatives in predicting and assessing outcomes.
- o The model required computer support. It had to be complex and sophisticated enough to require it to be programmed and used on computers.
- o The model was recently used--this was a flexible requirement for elapsed time between a model's availability for use, or its last use, and the present. Five years is a reasonable approximate upper bound.
- o The model was conceptually developed--a model had to meet broad measures of theoretical soundness and relevance to the substantive problem area. This criterion screened out the most obvious cases of incompetent or irrelevant modeling.

The episode of bringing a model into an organization is recognized as a multi-sided transaction involving the model, its potential users, and mediators--the model builders themselves or "middlemen."

The paper presents a theoretical construct of the transaction which focuses *on the user* for purposes of addressing certain questions posed by the literature of innovation and organization theory. It was expected that these might be important to policy development as well.

- o Why might there be an interest among some agencies in a group that could on the whole be regarded as conservative* and not others? Were some agencies operating under conditions of "slack resources" as described by Cyert and March[10] at the time they looked at modeling?

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*A treatment of this conservatism with some hypotheses regarding causes may be found in Archibald and Hoffman.[9]

- How did the model become known to the user agency? Following the literature, in particular Knight,[11] a fairly complete search, if undertaken in a slack situation, might be expected.
- How was it introduced to the organization? By what means did it become part of routine decisionmaking? Innovation analysts have indicated that particular characteristics of the user organization were important here, among them Radnor et al.,[12] in their empirical studies of R&D and management science implementation.

Further issues, centered on the model--its characteristics, development, and dissemination--are introduced to the discussion of the theoretical construct where they are pertinent, and, importantly, to the final chapters where implementation results and policy implications are presented. Among these are:

- Which features of the model itself were important to implementation success?
- Were particular modes of model development conducive to utilization?
- How could the process of dissemination be described? What was there about it that affected the implementation outcome?

The process of discovering particular *applications** was, in principle, two-part. In one, a survey was performed, as part of our review of all modeling activity in criminal justice, to identify the universe of available models. The search was performed using established contacts in the research community and literature reviews, and produced a total of 34 models.

Another search, for instances of use of these models in the CJ agencies, followed their identification. This took on a branching configuration as we asked model-builders or known model-users for the names of other users. The question was repeated in each interview with both builders and users until the set of known applications was established. This secondary search produced 70 applications.

**Application* is used here in a strict sense to mean a coupling of a user agency with a model, at least to the extent the computer program and documentation are acquired.

To obtain the descriptions of these cases needed to explore the questions and hypotheses given above, interviews were conducted with model-builders, model-users, and third parties with information. These were a combination of structured (in which questions relating directly to our initial interests were asked) and nonstructured (where the respondent was asked, for example, to describe the implementation episode in narrative form). We were able, during a five-month period in 1974-75, to obtain descriptions for 39 of the 70 applications through on-site and telephone interviews. Table 1 details the data base of applications.

Discussion related directly to applications and to the models themselves were obtained from model builders. As Table 2 shows, researchers were contacted for almost half of the 34 models. The total sample has contacts with all "parts" of the justice system, including the police and corrections departments, court administrations, state planning agencies, and researchers.

Table 3 shows, for each of the 17 models in the data base, the source of the description of the implementation experiences. The most frequently accessed source were the model users, who provided over 50 percent of the descriptions; JUSSIM* users make up the bulk of this group, representing 41 percent of all applications with descriptions. Another 25 percent were obtained through discussions with model builders. (Note that there were discussions with this group on topics other than specific applications--e.g., evolution of input/output features.) In 13 percent, both builders and users contributed to the descriptions, and in 10 percent third parties--knowledgeable researchers or administrators--provided the information.

The remainder of the paper proceeds as follows: first to provide a frame for the process descriptions, an *implementation sequence* is described. In the following sections, stages of the sequence are discussed with relevant survey results. There is a discussion of outcome results, then a summary and some recommendations for future policy.

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*A brief description of this model may be found in the Appendix.

Table 1

DESCRIPTION OF DATA BASE OF MODEL APPLICATIONS

Category of User Agency	(a)[a] # Models Examined	(b) # Models with Interviews	(c) Proportion of Models w/Interviews (b)/(a)	(d) # Applications	(e) # Applications w/ Interviews	(f) Proportion of Applications w/ Interviews (e)/(d)
Police	12	6	.50	25	10	.40
Courts and corrections	13	5	.38	8	6	.75
Overall	9	6	.66	37	23	.62
Total	34	17	.50	70	39	.55

[a]The original search produced 46 "models." Twelve of these were dropped for not meeting the criteria of the definition of model imposed for the study.

Table 2

DESCRIPTION OF MODEL BUILDER DATA BASE

Category of User Agency	(a) Number of Models Examined	(b) Number of Models Builders Contacted	(c) Proportion of Models With Researchers Contacted (b)/(a)
Police	12	5	.42
Courts and corrections	13	5	.38
Overall	9	6	.66
Total	34	16	.47

Table 3

MODEL APPLICATIONS BY SOURCE OF DATA

Model (Institutional Developer)	Information on Application Obtained from				Total
	Model Builder	Model User	Both	Other	
Police					
Patrol Simulation (Mathematica)				1	1
Patrol Scheduling and Allocation (St. Louis)				1	1
Patrol Simulation (MIT)	1				1
Radio Car Allocation (NYCRI)			1		1
Radio Car Simulation (NYCRI)			1		1
Hypercube (MIT)	(a)	2	1	2	5
Police Total	1	2	3	4	10
Courts and Corrections					
SIMBAD (USC)			1		1
LEADICS (Notre Dame)	2				2
Court Flow Model (NYCRI)	1				1
FCSM (SDL)	1				1
CANCOURT (Univ. of Toronto)	1				1
Courts and Corrections Total	5	0	1	0	6
Overall					
JUSSIM (Carnegie-Mellon Univ.)	(a)	16			16
CJ Systems Model (Denver)[b]			1		1
DOTSIM (Public Systems, Inc.)	1	0			1
PHILJIM (Govt. Systems and Studies)	1	2			3
CANJUS (Ministry of Solicitor General, Canada)	1				1
Juvenile Justice System (Ohio State Univ.)	1				1
Total Overall	4	18	1	0	23
Total for All Models	10	20	5	4	39

[a] Builder was contacted for data on model not directly related to applications.

[b] Combines JUSSIM with other models.

II. THE IMPLEMENTATION SEQUENCE

In the growing literature of organizational innovation, there are at least a dozen descriptions of the implementation sequence, but differences among them are not substantial.[13,14] Table 4 shows the framework constructed from the cases in our review of criminal justice models. The value of the sequence is not as a steadfast programmatic of implementation, but as a conceptual focus for the elements described below. The sequence proposed here is divided into three stages that correspond roughly to chronological order. Within each stage, however, occurence of the steps can iterate, overlap, and follow varying orders.

Table 4

DESCRIPTION OF THE IMPLEMENTATION SEQUENCE
FOR CRIMINAL JUSTICE MODELS

I. Preliminaries
   - Innovative Temperament
   - Enabling Conditions

II. Introduction
   - Need Sensing and Assertion
   - Acquisition
   - Trial Introduction

III. Implementation
   - Transfer of Support
   - Sustained Routine Use (Repeating); Use in Developing Recommendations That Are Acted Upon (Non-Repeating)

These sequences describe the contacts between a model and the individual user-organizations which recur over its life. Preliminary to the steps shown, however, there may be an initial effort by the model-builder to find a real-life trial for his invention. This start-up initiative might be an extension of the scientific enterprise of model development, rather than an intentional diffusion

exercise per se. In either case, the result is a prototype application from which information can spread to other potential users. Given that a model already exists, the framework shown in Table 4 applies. Following is a brief description of the steps shown in the table.

Stage I is concerned with the presence of infrastructure conditions for the implementation process--ones that provide a foundation upon which following stages can unfold. These are principally of two types: the first relates to the world-views, especially the attitudes toward innovation and modeling, of agency personnel. The two groups that warrant most attention are (1) the managers who control the implementation and (2) those who will use the model in their routine work.

The second involves agency support capabilities *vis à vis* the model itself. These include collecting and supplying data of specialized types and supporting the model with computer hardware. (Importantly, this is a new activity in itself for many CJ agencies.)

Stage II contains three parts that bring the organization from the first perception that there might be a use for a model, through the process of selecting and acquiring one, to the substage where a trial run is performed.

Stage III includes the transfer of a commitment to continue model use from those who have introduced it to those who will utilize it routinely. (These are normally distinct groups, as we shall see.) Finally, "successful" implementation completes the sequence where appropriate criteria are met.

The following sections detail these stages and present observations and examples from the survey cases.

III. STAGE I: PRELIMINARIES

At various stages in the implementation process, some very early, the presence of attitudes receptive to modeling and of other conditions relating directly to its application can enhance the likelihood of success.

INNOVATIVE TEMPERAMENT

In Stage I, a particular set of preconditions present within the organization can help make decisionmakers receptive toward innovation. This favorable temperament for such a new idea usually comes from two states of the organization in terms of its performance levels. First, if its operations are regarded as unsatisfactory, there is what Downs[15] has called a "performance gap." The perception can result from several kinds of phenomena: (1) a CJ agency normally must perform its tasks to the satisfaction of some budget or supervisory bureau. It might slip in its performance, or expectations of the superior agency might rise; (2) demand for the agency's output might rise (through, for instance, an increase in the size of its client group); (3) there may be peer pressure from similar organizations to perform at a higher level. A search for improvement in these conditions is often called "crisis innovation." If, instead, the agency's goals are being attained or surpassed, then Cyert and March[16] suggest there is a tendency to seek higher levels of performance by exploring new ideas and methods. Such an initiative comes from spare resources, and is commonly called "slack innovation."

A hypothetical court administrator's office will provide a simplified illustration of both. Using speed of processing and volume of cases handled as indicators, a performance gap would be perceived if long queues and excessive delays in adjudication were common. This condition might move the administrator to innovate in the hope of bringing about some relief. This is crisis innovation. On the other hand, if queues and delays were within acceptable limits, the administrator might be receptive to innovation as a means of doing even better and of employing spare resources. This is slack innovation.

The latter has the feature that it is not undertaken in response to some pressing need, as is crisis innovation; instead it might replace or improve a process that is generally considered adequate. There is a potential problem here, as we shall see, with obtaining interest and support among decisionmakers later on.

There was one more source for a favorable disposition among managers that is omitted where it is assumed, as these theories do, that the organization has achieved some normal operating state from which it is deviating. This is where the agency is in a start-up condition, and is seeking ways of performing its new tasks.

Table 5, which summarizes the findings of the survey with regard to this organization precondition, shows the importance of this last special category. Of the 39 applications, 19 are classified slack situations, indicating that models were frequently *not* explored as problem-solving devices. Indeed, in only three applications was such a category applicable. On the other hand, nine cases involved agencies that were "gearing up" or searching for technologies to assist them. All of these were state planning units or criminal justice coordinating councils that were taking over the new role of state and regional CJ planning. Among the remaining cases, the dominant sources of interest were an intent to have the model available as a contingency measure for some unknown future use, or to distribute it to potential users in the role of a clearinghouse. In sum, slack situations predominate in CJ agencies that enter model use, followed closely by new and temporary "gearing up" situations which are important because of structural change in the whole system. Regardless of the source, requisite condition to the success of the initiative is an innovative temperament on the part of the managers who will oversee it.

Table 5

MODEL APPLICATIONS BY CONDITIONS PRODUCING AN INNOVATIVE TEMPERAMENT

Conditions	Police	Courts & Corrections	Overall	Total
Crisis	0	3	0	3
Slack	10	2	7	19
Gearing Up	0	0	9	9
Not applicable	0	0	6	6
Unknown	0	1	1	2
TOTAL	10	6	23	39

ENABLING CONDITIONS

In addition to this temperament, there is a need for what might be called logistical enabling conditions. Essentially, these are the elements of an infrastructure that will permit the succeeding stages of the implementation sequence to occur. The processes in Stages II and III require funds and personnel time; and, due to the nature of the models being introduced, some specialized resources including computer hardware, trained personnel to use the program and compatible software systems, and information sources that can provide necessary input data. All these need not be in reserve at the beginning of the sequence, indeed support conditions for the model itself are not required until the trial introduction. The absence of each of these enabling conditions, however, has the potential for causing breakdowns.

The following comparison of two Massachusetts police departments will illustrate the importance of support capacity and managerial attitudes. (17)

Both of these departments were exposed to the hypercube* model developed at MIT. One has integrated it in a relatively complete way into its allocation planning--including provision for its use in annual reviews of procedures. The second has tentatively adopted a model-assisted design of patrol beats, but only under external political pressure, and future use is virtually out of the question.

The openness of the first department to new methods predated this experience; it had used management consultants years earlier to look at the possibilities of modeling. One concrete result of their approach was an automated MIS that could help provide the data needed by the model.

On the other hand, modeling might have gone unnoticed in the second department, except for outside influence. A new assistant city manager was on a temporary assignment in the police department. His observation that crime incidence and patrol were geographically unbalanced--and his search for a remedy--caused the model's introduction. But the department's limited perspective was evident elsewhere: its information system was manual, with data stored exclusively on index cards and the like. Processing consisted solely of aggregating incident counts for reporting to the FBI. In short, there was no foundation on which to operate a computer model. The assistant city manager must bear some responsibility for the model's termination, for in essence, he was piling high technology onto a relatively primitive management system.

The immediate cause of disuse was an infrastructure problem: the lack of computer support. MIT's facility was used during the initial analysis, but because of its own resource limits, this support could not be continued. The town's only computer was controlled by the Board of Education which didn't want to share it.

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*A brief description of this model can be found in the Appendix.

IV. STAGE II: INTRODUCTION OF THE MODEL

Stage II contains three critical parts wherein the user-agency moves from the first perception that there is a use for a model through to a trial introduction. One part is concerned with sensing and asserting a need for models, another with acquiring a particular one, and a third with its trial use.

Need sensing means discovering an opportunity or problem where a model could be used; need asserting means presenting this situation to decisionmakers who will supervise the innovation, and proposing that action be taken. When need sensing and asserting are finished, a role for a model in the agency has been identified and presented for a decision on whether or not to proceed. That decision is normally contingent on the organizational state described under Preliminaries.

In the next part, the acquisition sub-stage, a particular model is selected and its program and documentation obtained. There are several alternative *acquisition mechanisms* by which this activity is accomplished, as we will describe presently.

Finally, there is a trial introduction for the chosen model. This will involve setting up an information system, data collecting, and performing trial runs and analysis. It was normally the case with criminal justice models that they were used occasionally and not continuously. (A patrol sector design, for example, may be performed once in a year.) The initial use, then, is in effect a trial, whether formally called such or not.

THE SOURCE OF THE INITIATIVE TO INNOVATE

Two distinct patterns emerged in the empirical data for the first two substages according to whether the initiative to use modeling originated inside or outside of the organization. These are displayed in Table 6.

If this initiating activity came from within the user-agency, need sensing and asserting were performed by a single person. This *advocate*, as we will call him, is discussed in detail below. Internally sourced initiatives also indicated that a *search* would be the means by which a particular model was acquired.

Table 6

DOMINANT INTRODUCTION MECHANISMS INDICATED BY THE SOURCE OF THE INTRODUCTION INITIATIVE

Introduction substages	Source of Introduction Initiative	
	Internal to agency	External to agency
Need sensing and asserting	Advocate	Ongoing consulting relationship; ad hoc problem-solving study; model research in need of host
Acquisition	Search	Model suggested by outside agent

On the other hand, if the movement to innovate came from outside the user-agency, the need sensing and asserting mechanism took three forms. In one, there was an ongoing consulting arrangement where a continuing stream of technical advice was provided, of which the model was one part. (The New York City Rand Institute, involved in some of the survey cases, is an example: it had a multi-year program to assist the NYCPD.) In another, consultants pursuing *ad hoc* problem-solving studies suggested or used modeling in their work. And in the last, researchers in need of an organization to host their model building presented the suggestion to a user-agency. Where this external initiative applied, the acquisition mechanism was the outside agent itself which followed up the need assertion with the suggestion of acquiring or building a preselected model.

NEED SENSING AND ASSERTING

As Table 7 shows, the initiative was based internally in 20 of the cases, 16 of which involved overall models. Their prevalence is a reflection on their users who were normally planners and analysts (e.g., in State Planning Agencies) aware of applicable management tools and obliged to take a macro view because of their agencies' charters. In police departments, 3 of 10 applications and, in courts and corrections, 1 of 6 followed the same pattern. Notably, this implies, in almost all 16 cases, the applicability of the advocate mechanism for sensing and asserting the opportunity. Table 8 displays the congruence between internal initiatives and the advocate. In all cases which could be distinguished and where need sensing and asserting applied, the advocate performed thse functions. At this point, we will embark on a rather extended divergence to detail this phenomenon.

The Advocate

The advocate has been treated as the prevalent need sensing and asserting mechanism where the initiative came from within the organization. His role is actually much broader. In these 13 cases, a single person saw the need for a model, marshalled the resources to find one suitable to his problem, then set up the trial runs, and generally sponsored the entire project, often with little support from the management.

Table 7

MODEL APPLICATIONS BY SOURCE OF INTRODUCTION INITIATIVE

Source	Police	Courts and Corrections	Overall	Total
Internal to user agency	3	1	16	20
External to user agency	5	5	3	13
Unknown	0	0	2	2
Not applicable	2	0	2	4
Total	10	6	23	39

Table 8

MODEL APPLICATIONS BY TYPE OF NEED SENSING AND ASSERTING MECHANISM

Type of Mechanism	Police	Courts and Corrections	Overall	Total
Internal Initiative				
Advocate	3	1	9	13
Unknown	0	0	4	4
Not applicable	0	0	3	3
Total	3	1	16	20
External Initiative				
Ad hoc problem solving study	0	5	1	6
Model building project	2	0	0	2
Ongoing consulting relationship	3	0	2	5
Total	5	5	3	13

His importance as an early introduction mechanism may be because certain parts of the normal organizational resistance to change can be overcome by an advocate. First, he is a focal point at which all the details of a new project come together; his familiarity with the model is a resource to the rest of the organization; he has chosen to make the investment in energy to overcome the doubts and fears of those in power in the organization. The advocate becomes, in a sense, a self-initiating project manager. As Cleland and King[18] describe the formal position in many project-oriented corporations: "He becomes a source of integrated information concerning his particular project and an interaction point for coordinating the diverse organizational and extraorganizational activities involved. (He is expected to resolve daily operating problems.) Management by exception is the objective."

Unfortunately for implementation prospects, much depends on the judgment and actions of the advocate. Because model support is focused on him, his continued attention and political skills are often crucial. The case of PHILJIM* adoption by the Department of Corrections in Alaska will illustrate these points.

An analyst with the Department of Corrections had some exposure to simulation through a previous job. He saw a potential for its use in the Alaska CJ system and made inquiry with the State Planning Agency (SPA). At the time, the staff of the SPA saw themselves as grant-brokers rather than planners, and suggested Corrections acquire and run whatever model they found appropriate.

A search was performed which, through some published reports on COURTSIM,* led to the discovery of the existence of Blumstein's JUSSIM model.

The analyst reviewed the JUSSIM model, but was not convinced it would work in a real-world political environment. (His view was that it was unproven in such a situation.) Additionally, the JUSSIM people impressed him as interested primarily in new research and not in another application of an established model. They referred him to

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*Brief descriptions of these models may be found in the Appendix.

Government Studies and Systems Corporation--a Mathematica subsidiary --in Philadelphia. The PHILJIM model appeared to have proven itself there, so the Corrections Department let a contract for its installation in Alaska. The model was brought on-line and run with a set of prototype data. However, it never found continued use.(19)

Clearly, there would be small chance that any model would have reached an operational state without this analyst's initiative in perceiving its need and in acquiring it despite the lack of assistance from the planners. In a similar way, this dependence led to the model's present dormant state, as these subsequent events indicate.

1. The analyst's attention turned toward other interests. He thought the SPA would continue PHILJIM after the demonstration period, but they still did not see their role as planners at that point and did not assume responsibility.
2. His grant did not have provisions for running ongoing analyses, and he ran out of money.
3. There were data-base problems. An MIS was in the development simultaneously with his acquisition of PHILJIM. It was originally perceived as a statewide, interagency system, but the consultants who were retained to set it up employed a subsystem approach instead. As a result, much PHILJIM data collection remained manual and difficult.

The importance of the advocate to some applications yet not others, and particularly his dominance in the cases involving planning agencies, pointed out the need for further description of his position in CJ organizations. We proceed with a two-part description: one that briefly profiles persons who assume the role, another that discusses the positions such persons hold.

The personal characteristics of advocates are similar to those of other innovative individuals in the organization theory and sociology literatures. The following inventory matches closely, for example, a set of descriptors in previous studies of initiators of social

change reviewed by Rogers and Shoemaker.[20] Radnor and Neal, in their 1972 report,[21] described a like category of analyst/manager in formalized R&D units as "management specialists." (They noted a shift in the leadership of such units toward this group speculating this might mean a greater emphasis on organizational improvements as the goal of R&D.) The characteristics also follow what Zaltman et al.[22] have called, in composite, "professionalized" personnel. In the descriptions of the advocates in their implementation episodes, our interviewees repeatedly cited two features in particular as having a role in their behavior and the implementation process itself:

- a higher level of education than was the norm in the agency. Most important for our purposes, this included training or experience with advanced management ideas and techniques.
- extra-organizational contacts--a characteristic which connotes a professional rather than parochial career orientation. Again, however, in the present context it means membership in professional organizations, attendance at conferences, and exposure to the professional literature; all of which provide avenues for information on modeling. The importance of these characteristics is emphasized by the condition of information scarcity in this part of CJ innovation.

We can add that the advocate is likely to have a certain detachment from the rules and routines of the agency, either because he has entered his position laterally or has left his line-manager orientation behind through career changes. In short, his perspective is largely based outside the management structure. Because of his education and background, his commitment is more likely to be professional than organizational. And, since his skills are new to criminal justice, his role is essentially innovative. For these reasons, he is less strictured by the prevailing managerial wisdom concerning targets, and acceptable levels, of change.

In all, it is clear that this is a fairly new type of person for CJ agencies noted historically for adherence to the *status quo*. The change

may be viewed as a spinoff of the attention of researchers and policy-makers that has been directed at the structure and methods of the system, mostly since the President's Crime Commission in 1967.

The presence of professionalized persons occurs through several vehicles. In planning agencies, such as Regional Planning Commissions, the tasks virtually demand an analytically oriented staff. In line criminal justice agencies like the police, corrections departments, and the courts, this is not as likely. There are, however, two alternatives:

1. The agency may have a planning department, i.e., institutional provisions have been made to draw on new management technologies. The Office of Programs and Policies of the NYCPD and the Advanced Planning Division of the LAPD are examples.
2. Outside researchers or managers may be present. Most commonly the department has agreed to be a host agency for some research and model development. Cases include the St. Louis and New York City Police Departments, where development of patrol allocation models was done in the sixties.

In sum, a sizable portion of the applications we studied depended heavily upon a single entrepeneurial staff person whose recent presence in the agency was a consequence of systemwide change toward planning and management sophistication.

Returning to Table 7, the initiative to innovate was externally based in 13 cases, with police and courts and corrections heavily represented. Table 8 shows that, of five police applications, three were the result of the consulting arrangement between one research group and police departments. Two others were model building projects hosted by police departments. All five courts and corrections applications were problem-solving studies for courts by consulting organizations. The indication is that researchers and technical consultants currently play an important role not only in developing of models, but in putting them into operation.

ACQUISITION

Following need sensing and asserting by internal initiative is the acquisition, by means of a search, of a particular model. This mechanism obtained in all 20 of the internal initiative cases shown in Table 7.

The search consists of reviews of the literature, visits to conferences and seminars, and investigations of word-of-mouth type leads. It has been suggested by Knight[23] that search in a slack situation will be wide, looking at many alternatives before one is selected. Additionally, given the tenets of rational decisionmaking, which include knowledge of all alternative courses of action and outcomes, it would appear that complete searches would be the *ideal* of potential model users for whom resource and time constraints were not the limiting factors. Thus, it should not be exceptional for an agency to have reviewed several acceptable models in the course of bringing one on board. However, the idea of "satisficing"[24] provides a better fit in almost all applications with a search. It indicates that few solutions will be considered and that the effort will end with the first acceptable choice, rather than looking further to obtain an even better one. For reasons of scarce resources and poor information availability, searches were generally short, and seldom involved more than two alternative models. Assuredly there is a rather limited selection of models available to CJ practitioners. This is particularly true for macro-level planners interested in overall models. Still, in all cases with internally based initiatives save one, *searches did not consider the full range of possibilities, but followed the satisficing mode.*

The possibility must be raised that a more suitable model could have been found if other alternatives were known to the user agencies. The larger issue of information availability should also be mentioned, and will be taken up in detail later.

External initiative cases, the remainder for which source of initiative could be determined, involved no search by the user-agency. Instead, the outside agent built a model in all cases.

TRIAL INTRODUCTION

The final part of Stage II is the trial introduction. In terms of logistics, it is a period of attempting to assemble the necessary support--information systems, computer hardware and programmers, etc. It is also a decision point in explicit and implicit ways. A conscious choice by some manager on whether the results of initial runs with the model warrant its continued use is to be expected. In addition, however, it is also a test of whether the proponents of the model can pull together all of the requisite pieces and make the model work satisfactorily.

V. STAGE III: IMPLEMENTATION

In the final stage, the crucial transfer of support--from agency decisionmakers who were involved with the early stages of introduction to these who will actually use the model in their managerial work--takes place in a portion of the cases. In addition, the conclusion of the episode is reached, and we make an assessment of its success or failure. The criteria for this judgment are presented in this section; the results for the survey cases are discussed in the next.

TRANSFER OF SUPPORT

For the use of the model to become routine in the user-agency, it was sometimes necessary for support to develop among managers who may previously have been uninvolved. This was the case where those who approved of the search, selection, and trial use were not the line managers charged with the decisionmaking the model was to assist.

The importance of this substage lies in its potential for breakdown as managers with no previous investment or other commitment to the project are sought as constituents. Consider, as an aggregate example, the police department where a model for patrol allocation is discovered, introduced, and is given a trial run by the planning unit. It is entirely possible that progress to this point could have been made without the participation of the chief of patrol, or whoever makes allocation decisions. The task, then, is to interest this person in a new method for doing his job--along with the costs in learning the new method and disruption of routine that may be involved--by convincing him of its benefits.

SUSTAINED USE/POLICY USE

Lastly, there is the implementation outcome. Two criteria are proposed here for judging success. These depend on the type of use for which the model was created.

Some models--as it happened in the survey, only those used in courts--were designed for one-time-only, problem-oriented studies. These were judged successful if the policy recommendations that came of their use were implemented.

The remaining models were designed for periodic use. These assist in decisions that recur, as, for example, the patrol allocation which may be reviewed monthly. Such models were judged on their sustained utilization in the recurring decisions.

VI. IMPLEMENTATION OUTCOMES FOR SURVEY CASES

Applying the success criteria described in Section V, we came to the distribution of outcomes presented in Table 9: seven applications were considered successful, seven others were in progress (that is, in stages preliminary to sustained use), and 25 were not adopted.

Table 9

MODEL APPLICATIONS BY STATUS OF MODEL USE

Status of Model	Police	Courts and Corrections	Overall	Total
In use/used in analysis	2	3	2	7
In progress toward installation	3	1	3	7
Not adopted	5	2	18	25
Total	10	6	23	39

CAUSES OF BREAKDOWNS AMONG CASES OF NONADOPTION

Table 10 shows the causes of nonuse for the 25 cases of nonadoption. In four cases, three of them involving overall system models, the acquiring agency was looking to some future need that failed to arise. Usually, a consulting firm or clearinghouse acquired the model anticipating a demand would develop. These "middleman" applications do not reflect the problems of adoption in organizations.

Breakdowns Due to Model Characteristics

Eight nonuse cases involved characteristics of the model. One agency found the overall model it had acquired too complex for its analysts. This was the only such case, and it is important to note that the source of trouble was not in any judgment of its soundness: the users simply did not become fluent in its concept and methods.

In three other cases, the computer language in which the model was programmed was the barrier. In one of these instances, the program

Table 10

APPLICATIONS WHERE MODELS WERE NOT USED BY REASON FOR NONADOPTION

Reason for Nonadoption	Police	Courts and Corrections	Overall	Total
Model acquired for a potential use that did not arise	0	1	3	4
Agency decisionmakers had no interest	2	0	0	2
Agency personnel changes caused shift from support to nonsupport	2	1	4	7
Contract disagreement-unrelated to model	0	0	1	1
User/model match attributes: Too complex conceptually	0	0	1	1
Incompatible computer software	1	0	2	3
Unattainable data requirements	0	0	4	4
Unknown[a]	0	0	3	3
Total	5	2	18	25

[a]In these cases, elapsed time or staff changes had blurred the memory of the process of the model's acquisition

could not be compiled on the available computer system. In the other, there was no staff person with programming skills for operating or adapting the model.

Data requirements were the source of breakdowns in the four remaining cases of implementation failure. The difficulty stems from the need for information available only from diverse and disinterested sources, or for which there was no routine collection system.

These difficulties are usually conceived as model characteristics, and we have continued the convention. In truth, however, if a problem does arise, it is not always a simple matter to determine whether it can be assigned to the model (which, for example, may not be adaptable enough to permit reuse), or the users (who may not make reasonable changes themselves).

We should make careful note, particularly in attributing these difficulties to the models, that other agencies were able to overcome similar problems with the identical models. They are, in fact, assignable to the *match up* of a particular model to a particular user-agency.

Breakdowns Due to Interpersonal Elements

In the development of support for the model among agency decisionmakers, there are many fragile personal interactions. The future use of the model may hinge on certain key actors and their perceptions--not only of the model, but of matters like the position in the agency of its proponents, their political sway, and so on.

As shown in Table 10, 9 of the 25 nonadoption cases ran aground on the lack of interest--or opposition--of agency decisionmakers. These are broken down into two instances where managers were never receptive to the model; and seven where, due to staff changes while the introduction was ongoing, supportive managers were replaced with nonsupportive ones.

Our examination of this process indicated that several factors were reflected in the decision of managers to support the model or not. Radnor et al.[25] give a lengthy list of such elements. From the comments

of those interviewed for this study, however, the following four influenced most decisions:

1. The managers' perception and use of the innovating unit, which can range from neglect to frequent consultation.
2. The importance of the issues addressed by the model. It's safe to say most police departments did not regard patrol sector redesign as a critical issue. There is a variety of more pressing matters for policy administrators to consider, patrol allocation probably seeming the least important. Importance can vary, however, and the application of allocation modeling by the NYCPD shows some exceptions.(26) There are three specific cases in which it has been useful to them:
    a. For review of staffing levels across precincts citywide. This provides a rational means to allocate the graduating class of the Police Academy, and to decide where attrition and transfer will be permitted to decrease staff.
    b. In negotiations over hours, staffing, and other issues with the patroman's union.
    c. In administrative emergencies like cutbacks due to budgetary problems.
3. The impact of changes indicated by the model. Substantial savings in resources or other visible benefits might make model use more attractive. On the other hand, it may threaten familiar and imbedded procedures leading to resistance.
4. The appropriateness of the model as seen by the administrators. That is, whether they think it has a clear need and will help with the tasks it addresses. Included are criteria like the usefulness of the information it provides and its logical fit to the real system. These are largely seat-of-the-pants standards, but ones that test the subjective validity of the model and decide in large part its acceptance.

A project's adoption may be susceptible to changes in these perceptions or the management itself. The Boston Police Department, for example, contracted for acquisition of an early simulation model for patrol allocation. During the course of work to modify the computer program for the department, a new commissioner was installed. Apparently because the simulation was associated in a political sense with the previous commissioner, work was stopped and the model remains dormant.(27) It is clear that interpersonal factors totally unrelated to the model itself can affect the implementation outcome. In seven of the cases, including this example of the Boston PD, changes in the staff of the user agency brought shifts from support to nonsupport in key positions. In two more, there was a failure to make the transition between innovators and decisionmakers mentioned above. The managers who would use the model in their routines never developed an interest in it. Although a number of factors could combine to produce this view, the most crucial was the lack of a perceived need for the change. Recall that, for the most part, these were slack innovation initiatives behind which there was no real problem-solving motivation. As a result, the line manager was asked to change an operation that for his purposes was functioning adequately. Several found the idea uninviting.

FACTORS INDICATIVE OF SUCCESSFUL IMPLEMENTATION CASES*

In a sense, the success of a model-use attempt is a result of its *not* faltering on one of the problem areas we have discussed. Indeed, the actions of model builders, users and others involved in implementation in simply avoiding the pitfalls are a hallmark of the successful cases. Certain characteristics, however, do distinguish completed implementations.

In all of these cases, the models were designed to assist in some decision problem which had currency with agency managers. Three in particular were interested in the model's potential for problem-solving. These were courts applications where the models were used as part of ad hoc studies of specific difficulties.

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*With the exception of the final factor, credit for this subsection belongs to Jan Chaiken. See Chaiken et al.(28)

In the problem-oriented studies, there was close participation by the builders since they were acting as consultants during model use. Although this is not an intrinsic feature of the models designed for repeat use, it was true of the successful survey cases. In each, the researchers interacted with the users until the models were up and running--an indication of the importance of close technical support and access to an understanding of the model.

In addition, the presence of a definite time horizon within which the model was brought on line was a feature of successful applications. Managers were interested in "nuts and bolts" type assistance from modelers on decision issues of fairly high priority to them, where the modeling project was well-planned and structured.

Adequate documentation was another characteristic, one that indicates again the importance of providing the users with the best possible understanding of the model and its operating instructions.

Finally, each had a person who became a repository for information on the model; indeed, this may be the only staff person to interact directly with it at all. He was, in the applications studied, either the advocate or someone who worked closely with the model builders in the early stages and stayed identified with it.

SUMMARY AND RECOMMENDATIONS

The following review of survey results highlights some areas requiring the attention of criminal justice policymakers.

The first stage of the implementation sequence contained two kinds of preliminary conditions: innovative temperament and support conditions. The applications we reviewed pointed, in several ways, to a slowness on the part of CJ agency managers to explore the potential of modeling. With regard to this low level of interest, we note the following outcomes.

First, there is evidence that managers do not rely on models as means of problem-solving. Of 39 cases studied, only three involved attempts to use modeling to help resolve pressing problems. The others were symptomatic of slack resources or the current systemwide change toward more planning and analysis.

Second, there was very little participation by agency managers in the early stages of model acquisition. Of the 33 cases where source of the initiative to model could be determined, the initiative came from outside the agency in 13. In more than one-third of the cases, then, the idea and impetus was external. Of the remaining 20 observations--those with internal initiatives--13 had an advocate: one person, largely without management support, who introduced the model. The advocate has been described as separated from the line management structure, and commonly a newcomer to criminal justice, present only in the last eight years. Additionally, of the 25 instances where the models were not implemented, nine directly involved *nonsupport* by decisionmakers in the user agencies.

In short, the "innovative temperament" discussed in Section III is largely absent from the managements of CJ agencies.

As a result, the other preliminary condition is also behind the state required for smooth adoption of modeling. Agencies that tend toward conservatism are unlikely to have moved very far into automating their MISs or taking on technically skilled staff. In eight cases where the modeling project did not succeed, the breakdown was attributed

to problems on the interface of the model and the agency, to their "matchup." While we have reserved judgment regarding fault, it is clear that the user agencies might have been better prepared had their managers previously tried out some less sophisticated (and more incremental) innovations--MISs in particular. In short, decisionmakers in the user-agencies have neither taken the initiative to exploit modeling, nor even consistently supported such attempts where others have begun them.

The hypothesis that modeling has no place in criminal justice line agencies must be addressed as an explanation of this phenomenon. The general question remains open. However, it is clear from our analysis that a judgment by agency managers regarding the effect of models on their decisionmaking was not a factor in the shortage of model support among our cases.

The problem of effecting this temperament is a far-reaching one, calling for a change in firmly set management approaches, but at least three responses could be useful. They are: (1) to promote training, exposing upper agency managers (police chiefs, court administrators) to the analytic and planning methods available. An expansion of the modeling center idea that describes the activity at MIT and Carnegie-Mellon would serve this purpose (see below). (2) To give these managers experience with the techniques by promoting researcher-host and consulting relationships. The idea is to put more research projects--particularly in the testing and development stages--into line agencies where the work itself and the interaction of managers and analysts might reduce resistance. (3) To increase the number of "advocates" who will be a force for modeling internally. Continued emphasis on planning and analysis in criminal justice in federal funding policy should provide a stimulus for an increased reliance on advocate-types in line CJ agencies.

A second policy area emerged from data on the introduction stage. To the extent that the *ideal* of a complete search is valid (i.e., a better model is likely to be found where more numerous acceptable ones are examined), we have found a behavior that is intrinsically not optimum seeking. It presents an exception to expected "rational" behavior in that satisficing searches were carried out under conditions of slack resources. This applies to 19 of the 20 cases where a search was indicated (i.e., those with internal initiatives to innovate).

Frequently, our cases were typical search situations with the added condition that those with access to the technology could facilitate the process and reduce the cost to users of obtaining information with their actions. The problem in improving the rate and quality of information transfer is that model builders have been in large measure acting alone. And it may reasonably be argued that their involvement should end when the model has had a trial application, since their particular talents lay in the realm of model design. The missing element has often been an agent to look after model application. By analogy to the physical sciences, there are few "engineers" in the field of criminal justice models (i.e., persons who are able to apply generalized technologies to particular situations, making the necessary adaptations and preparations to make both compatible). Given this condition, however, we can look at the ways followed in the past to disperse modeling among users.

The activities of researchers in publicizing their results follow a few predictable courses like publishing articles in journals and making presentations at conferences. While not necessarily aimed at promoting use of the models, such activities spread the word to users as well as research colleagues. SIMBAD,* the USC simulation for use in probation agencies, is such a case: it was exposed through journal articles and papers only, yet a number of inquiries were produced.

More direct efforts are shown by researchers who contacted potential users. The group at Notre Dame who developed the LEADICS* court simulation, for example, tried to interest courts in neighboring states in their model when work in two Indiana county systems was completed.

One exception to this proposition showed promise during its lifetime. This was the New York City Rand Institute, a consulting center that provided research assistance to the city government on a wide range of urban problems. The Institute supplied continuing model-building skills, technical support, and a genuine commitment to promoting the

*A brief description of these models can be found in the Appendix.

techniques among the line agencies. When combined with favorable conditions among users, the Institute did affect many improvements in a varied mix of city agencies.

Another alternative is for computer software firms and private consultants to fill this gap. The record here has few success stories, however. The cause lies in the lack of propensity to try modeling initially. Technical assistance can help a project along, even save one that might otherwise fail, but it is not the demand-creating force that will interest agency managers in modeling. To date, this demand has not been sufficient to keep such firms viable.

At least two "centers" for criminal justice modeling have developed: the School of Urban and Public Affairs at Carnegie-Mellon University with JUSSIM and the Operations Research Center at MIT with various models of patrol force operations. Through effects that are traceable in part to the involvement of researchers, the models developed at these universities have the largest number of applications of all those studied. They are centers in the sense that they distribute information and copies of their models and documentation to users who inquire. In addition, both have periodically conducted their own seminars with representatives of user agencies. To generate interest and familiarize users with the models, these involve lectures on theory and application, comparisons of new and old methods, and the opportunity to operate the programs at the computer terminal. Both have provided technical assistance in the past.

JUSSIM diffusion has been by an interesting combination of media. Many organizations learned of the model through the literature, conferences, and word of mouth. There were also the seminars at Carnegie-Mellon which, if they did not train modelers, sent more aware and interested analysts back to their home agencies. Finally, graduate students from the University passed into user organizations, carrying the message with them. In the latter two instances, generating the interest in using models was conveniently coupled with the important capabilities to operate them and interpret their output.

Efforts should be made toward expanding the number of "modeling centers" and toward making them more effective as clearinghouses or information and support centers for model users.

The last stage, implementation, is an appropriate background against which to discuss the final policy area: directing the features or configuration of the model itself.* This involves putting new controls on the model-building process that will improve both the models and their dissemination. The eight cases of implementation failure due, in part, to model characteristics may have fared better under the following recommendations.

First, proposals for modeling projects should be reviewed, before funding begins, for their fit to previous work as compliments and extensions.

Second, this review should also treat issues of information distribution by planning the timing, vehicles, and audience for dissemination of the result.

Third, before the model is released, another review--perhaps on the order of the refereeing or peer review that is part of the publication of other kinds of professional work--should be performed as a check on the final condition of the project. This could make certain, for example, that the model is generalizeable, and the documentation is adequate. Although it was not a problem in the implementation result, validation and verification were frequently omitted from model building projects. A final review could also address this issue as well.

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*Credit for recommendations concerning model characteristics belongs to Jan Chaiken. See Chaiken, et al.[28]

APPENDIX

DESCRIPTION OF MODELS USED IN EXAMPLES

A few models are mentioned in this paper by name for illustrative purposes. Following are brief descriptions of each to familiarize the reader with names he will encounter.

- JUSSIM is a model of the overall criminal justice system which uses a decision-tree configuration to portray the flow of defendants, resources, etc., among agencies. The current form is called JUSSIM II. It was developed under Prof. Al Blumstein at Carnegie-Mellon University.
- PHILJIM. The JUSSIM model has spawned several adaptations. PHILJIM is one that was developed for the Philadelphia Regional Planning Commission. It contains some changes in the model and its operating mode.
- COURTSIM. Developed at the Institute for Defense Analysis. This model simulates the processing of adult felony cases through the District of Columbia courts.
- SIMBAD is a simulation designed to assist probation decision-making of parole officers. It provides estimated results of decisions regarding the treatment of prisoners and parolees. SIMBAD was developed at USC.
- Hypercube. A spatially distributed queueing model to assist in designing patrol beats and sectors for police departments. It was developed by Prof. Richard Larson of MIT.
- LEADICS. A model that simulates processing criminal cases through the state courts in two Indiana counties with emphasis on identifying the sources of delays. It was designed at Notre Dame University.

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