THE PROBLEMS OF IMPLEMENTATION AND FACTORS RELATED TO THE IMPLEMENTATION

Yrd. Doç. Dr. Cengiz YILMAZ*

ÖZET

Bu makalede, yöneylem araştırması ve işletme biliminde uygulama (implementation) üzerine deneysel çalışmalar özetlenmiştir. Bu çalışmalar uygulamanın, problem çözme ve sistem düzenleme sürecinin ayrılmaz bir parçası olduğunu göstermektedir. Bu konudaki araştırmacılar çalışmalarında çok değişik noktalara eğilmişlerdir. Bazıları eğilim, kişilik ve karar verme stili gibi kişisel davranışlarla ilgili faktörleri incelemiştir. Bağımlı değişkenin seçimi de çalışmalarda göze çarpan ikinci önemli konudur. Bu bağımlı değişkenler genel olarak 6 gurupta toplanabilir. Bu makalede sayılan bağımsız değişkenler ise bu konudaki deneysel çalışmaların bulgularıdır. Bu bulgular, yöneylem araştırması ve işletme biliminde uygulama üzerine yapılan çalışmaların daha organize olması gerektiğini de ortaya koyar.

Over two decades of developmental work has produced a large inventory of operations research/management science (OR/MS) models and systems that have great potential for solving management problems. The actual frequency of use of OR/MS, however, is quite low especially with respect to its potential. This situation has resulted in an implementation gap between what has been developed and what is being used. Therefore the researchers have a «new» research area which is called the implementation of OR/MS.

In every case, our model should be productive. According to John D.C. Little (1975), a model is not productive until people use it and take different and better actions because of it. Experience

(*) Erciyes Üniversitesi, İktisâri ve İdare Bilimler Fakültesi Öğretim Üyesi.

has shown that it takes considerable time to introduce a brand planning model, customize it, calibrate it, build confidance in it, and have it used efficiently. Therefore main thing is the implemen tation of the model.

The study of the implementation of OR/MS models and techniques is a relatively new topic in the field of management and behavioral science. The current trend toward introspective looks at the practice of OR/MS has recently been augmented by research on the problems of OR/MS implementation. But until recently there had not been much empirical evidence on the process of implementation.

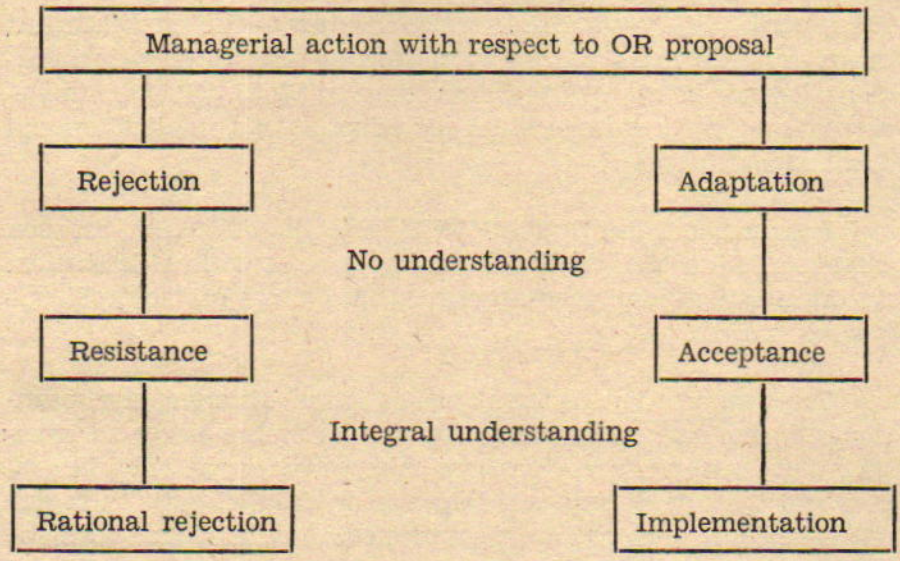
The confusion that exists about the meaning of the term «implementation» is maybe one of the reasons for the slow development in this area.

DEFINITION OF IMPLEMENTATION

Implementation still means different things to different people. And most researchers do not give any clear statement of implementation (Churchman, 1975). For some implementation is a transition process that takes place between succesive stages in a work flow pattern (Radnor et al., 1970). Others define implementation as a process that is continuous along all phases of a project relation between the successive stages in a work flow. Implementation can also be defined as a special case of organizational change or adaptation (Radnor et al., 1970). Thus we have a basic question : What does one mean when a person has stated that the results of an operations - research study were successfully implemented ? To some practitioners it merely represents a retrospective evaluation of an operational period, which indicates that the solution could be reasonable (within assumed restrictions) and profitable as compared to actual operations in that period. To others it may mean that the OR model and recommended procedures are being routinely used by operating personnel and achieving the predicted potential of the optimum solution (Stilson, 1963).

Some researchers, who work on this new area, do not define what implementation is but instead they define what it is not. According them, implementation is different than organizational change, model transformation and adaptation.

Figure 1. Different managerial action with respect to operations research proposal.



Huysman (1970) explains the difference between adaptation and implementation. According him implementation is a subset of adaptation which is a subset of the managerial action with respect to OR proposal (see Figure 1).

The manager can adopt a research proposal without understanding which is adaptation but not implementation. Therefore implementation is adaptation of the research proposal with understanding. According to Huysman (1970) managerial understanding of the research recommendation exists if the distance in the way of reasoning between manager and researcher is zero.

John W. Dickson (1976) explains the difference between adaption and implementation in different way. According him, innovation can be conceived as occurring in five stages; (a) Stimulus, (b) Conception, (c) Proposal, (d) Adoption and (e) Implementation. Therefore implementation is a different stage than adoption or proposal and it is also a different term then innovation.

Francis W. Wolek (1975) defines implementation as a combination of adoption of a quantitative method, systematization —the development of formal procedures needed for use of a new method (Hansman, (1970)— and institutionalization —the establishment of an organizational role for management scientists in organization (Radnor et al., 1970)—. According to Wolek (1975), implementation has three parts which are adoption, systematization and institutionalization.

Reisman and de Kluyver (1975) give the difference between implementation and problem - solving process with a defination. According them implementation is a final phase of the problem - solving process.

Thus we see that different people have different understandings of implementation. One way to clarify the issues surrounding the implementation problem is to consider the OR/MS process and the role of implementation in it. OR/MS activity begins with the confluence of an organization and its problems with the problem - solving skills of managers and researchers. The origin of the activity, then, is problem identification and the concomitant desire for a solution. The output of the OR/MS process is generally activity and specifically projects, models, and solutions. The projects and models can be regarded either as ends in themselves or as the means for influencing the organization's decision processes. According to Schultz and Slevin (1975 a), the notion of influence provides a key to understanding the concept of implementation. At the initial stage of OR/MS activity, the organization had a set of decision processes and a problem. At the output stage, it has a solution to the problem. If the solution is implemented, then the final state of the organization is a revised set of decision processes incorporating the solution. Therefore, implementation refers to the actual use of OR/MS output by managers that influences their decision processes.

IMPLEMENTATION RESEARCH

Because of different definitions of implementation, researchers used variety of variables for their research on the implementation of OR/MS models. This research generally falls into three categories : Implementation is seen as a process of organizational change, as a diffusion of innovations, and as a part of general sys-

tems analysis. Various researchers have examined implementation problems from the point of view of operations research groups, from the model - building process, and from the dimensions of models themselves.

Implementation, and hence implementation research, has been viewed from a variety of perspectives including selling, involvement, mutual understanding, and organizational change (Churchman and Schainblatt, 1965). Selling implies that implementation is a marketing problem and that the product of OR must be skillfully made, packaged, and sold to potential users. Involvement suggests that implementation requires potential users to play an active role in the research process, becoming involved as participants in management science. Mutual understanding refers to a state where the researcher and manager each understands the other's stake in the project. Organizational change describes a view of implementation that focuses on behavioral changes that occur in the process of model acceptance (Schultz and Slevin, 1975 b).

Some writers repetedly stress the need for mutual understanding between the manager and the researcher as a basis for effective implementation of OR/MS in organizations (Schultz and Slevin, 1975 b; Shakun, 1972).

In 1965 Churchman and Schainblatt published their seminal paper, which is a theoritical and philosophical framework of implementation, suggesting that the process of implementation of OR/MS could be viewed as an interaction between the model builder and the manager (Churchman and Schainblatt, 1965).

Empirical papers on implementation can be classified in three categories; (a) Survey research, (b) Case study, and (c) Experimentation (Tablo 1).

Experimentation, despite its significance as a method of causal research, plays a smaller part in implementation studies, because right now we have only a few experimentation research (Huysmans, 1975; Manley, 1975). Case studies are important in implementation research because of their exceptional ability to provide in - depth and organizationally dependent analyses of implementation situations (Gibson, 1975; Mitroff, 1975; Reisman and Kluyver, 1975). The predominant research method seems to be sur-

vey research in the sense that quite a few studies employ questionnaires and other data - gathering instruments to assess facts about implementation, attitudes toward implementation, and other behavioral implementation factors (Duncan and Zaltman, 1975; Sorensen and Zand, 1975; Schultz and Slevin, 1975 c; Bean, 1975; Manley, 1975; Vertinsky et al., 1975). There are also some researchers which combining survey research and case method approaches (Lucas, 1975; Souder et al., 1975).

STUDIES ON IMPLEMENTATION

When you look at the early papers on implementation the first sentences are about the lack of research on implementation. Since 1965 there is a lot of research on implementation, but it is not organized. In one way the lack of organization in research on implementation helped develop this new research area.

Different researchers worked on different related subjects of implementation from different points of view because of the lack of organization. Therefore researchers solved many different implementation problems independently and they defined implementation broadly and gave most of the effective factors of implementation to practitioners. I am not trying to say that we know every thing about implementation. We still know relatively little about how OR/MS implementation is achieved and how the implementation process can be controlled.

Researchers of implementation focused on different points in their studies. The most of the studies focused on Researcher/Manager. I think it is an expected result, because in OR/MS activity, researchers and managers are agents, in other words they are the skeleton of this activity. Other basic focus areas are Organization/project, Organization/OR - MS activity, and Individual user/Model, these are not unexpected results either.

As a focus area, attitudes have an interesting result. There is only one study on this focus area. If we review all other studies we find attitudes as an important point in implementation, but most of researchers used attitudes as an independent variable rather than a focus area.

Several studies, for example, focus on an individual user and on an OR/MS model, these studies are concerned with factors rela-

ted to individual behavior, such as attitudes, personality, and decision style (Tablo 4).

Students of implementation used a variety of dependent variables in their reseach. I chose six of them as a central point and tried to fit the other dependent variables to these six dependent variables;

1. Behavior of users and attitudes toward model builders; ultimate model utilization.

2. Implementation rate —actual use or percent of projects used—

3. Intended use —probability of own use and probability of others' use—

4. Probability of success (success of projects used or implemented project.)

5. Worth and accuracy (the worth of the model or project, and the level of accuracy be expected from the model or project).

6. Researcher attitudes and values.

According to Schultz and Slevin (1975) the dependent variables generally fall into three categories in implementation research. These are attitudes, intentions and behavior. First and sixth dependent variables can be put into their first category, second dependent variable is probably the same as their third category, and the third dependent variable is the same as their second category (see Tablo 3). Their opinion about the probability of success is not clear to me. They mention the difficulty of measuring success in implementation but it can not be reason to omit this variable, even some researchers use it as a dependent variable.

In this study, the independent variables categorized in five groups;

1. Project variables (model charecteristics).

2. Behavioral factors (attitudes).

3. OR/MS group variables (variables related to the researchers).

4. Organizational variables.

5. Contextual variables.

In Powell's study (1976) independent variables have been combined into groups by whether they pertain to (a) the environmental contex of the organization, (b) the organization itself, (c) the relation between the organization and the OR/MS group, (d) the conduct and selection of projects, (e) the individuals involved, or (f) the relationship between managers and operations researchers.

I think, the individual variables and the operations researcher-manager relations can be put into behavioral variables (see Tablo 2). For this reason I combined them and made five large groups which include more independent variables than his classification. Of course this classification is open to discussion because there are no rules in classifying these independent variables.

RESEARCH FINDINGS

We can categorize these research findings in six groups as functions of the dependent variables. Some groups have not been studied extensively, but number of the studies on an dependent variable is not related to the importance of that dependent variable.

In this study the first dependent variable is the behavior of users and attitudes towards model builders; ultimate model utilization. This variable is used as a dependent variable only by Gibson (1975). In his case study in a commercial bank, he suggests that personality type, business history, social history and current social structure, and task pressures influence the perspectives of builders and users and that these in turn determine their behavior towards implementation. We can conclude from his suggestion that behavior of users and attitudes toward model builders have close relations with contextual variables, personality types and task pressures. For example, if an officer held a conservative view on bank strategy he would also be conservative in the use of computers.

Relatively few researchers studied the second dependent variable. There are not many studies in this area, due to the difficulty in measurement of actual implementation rate. Most of the studies in this area are survey research. Only Luces (1975) has a mix – survey and case— study on implementation. In their studis, Lu-

cas (1975) and Vertinsky et al. (1975) find that a number of attitudinal, decision style, personal, and situational variables are related to actual or intended use. Bean et al. (1975) identify a long list of structural and behavioral factors that correlate with implementation rate and with percived success. We have two conclusions from these studies : (I) There exists a positive relationship between organizational variables (e.g. size, structure) and the implementation of proposals (Bean et al., 1975), (2) If high executive levels display interest in the project and believe it has potential pay off, then implementation rate is high (Bean et al., 1975; Lonnstedt, 1975; Lucas, 1975; Vertinsky et al., 1975).

The third dependent variable is found to be easier to measure than the second dependent variable by some researchers. Schultz and Slevin (1975 c), for example ,are among these researchers. In their survey research, they report that such attitude dimensions as performance, interpersonal relations, changes, goals, support/resistance, client/researcher relationship, and project urgency account for most of the varience in intended use, chance of success, model worth, and model accuracy. Similarly, Souder et al. (1975) find that attitudes and particularly the dimensions of model charecteristics, organizational factors, and personal decision variables are related to intended use. Our conclusions from these studies are : (1) When the projects are initiated by top management the probability of implementation is very high (Radnor et al., 1970), (2) The greater the compatibility or fit between the model and the potential user, the greater the probability, other things being equal —namely, the technical validity of the model— (Radnor et al., 1970; Schultz and Slevin, 1975). Most of the students of implementation studied the probability of success. It is difficult to tell why it happened in this way. Probably success is the most interesting subject for human beings. Powel (1976), in his article, gives more than twenty studies which explain the factors affecting success of OR/MS implementation. The empirical work of Sorensen and Zand (1975) reveals that attitudes are related to perceived level of success. The process is explained in social change terms. Using experimental data Manley (1975) finds that top management support, personal involvement, and product relevance are related to the probability of success due to client behavior. Following conclusions are reached from these studies : (1) The success of an OR/MS group is strongly affected by the level of top management support, resources allocated to the group, good relations among the

individuals, communication style, and location of the group in the organization (Ackoff, 1960; Argyris, 1971; Radnor et al., 1970; Rubenstein et al., 1967; Creelman and Wallen, 1958; Hamilton et al., 1969; Little, 1975; Manley, 1975; Sagasti, 1972; Schultz and Slevin, 1975 b), (2) Implementation will achieve greater success when the organization/group/individual involved is more explicit in goals and output (Johnson, 1967; Lawrence, 1977; Lonnstedt, 1975) and more analiytical in reasoning (Huymans, 1970; Neal and Radnor, 1973). (3) In its early stages, a group can not afford to be unsuccessful and will best select manageable projects which can be completed quickly (Rubenstein et al., 1967). (4) Individuals are more receptive to OR/MS innovations who are also more prone to take risks, actively search their environment, and trust potential sources of innovation (Neal and Radnor, 1973).

The fifth dependent variable is only used by Schultz and Slevin (1975 c). In their study, the relationships between the set of attitude factors, and respectively, worth and intended use are found to be empirically quite strong (Schultz and Slevin, 1975).

Researcher attitudes and values which is our sixth dependent variable is used as an independent variable in some studies. Duncan (1974) Mitroff (1975) and Vertinsky (1972) mention that it can be used as a dependent variable, too. Mitroff's (1975) study of moon scientists shows that a researcher's ideas and actions are to a considerable extent dependent upon their prior theories and ideas and upon social and personal relations. Therefore we can say that managerial style, manager's abilities, social change, cognitive dissonance, location of group, social and personal relations, and prior theories have a positive strong effect on to researcher attitudes and values. For example, if social and personal relations are good, the researcher attitudes will be positive (Duncan and Zaltman, 1975; Mitroff, 1975; Vertinsky et al., 1975).

CONCLUSION

This study shows that, in order for OR/MS philosophy to become an integral part of a manager's thinking process, the OR analyst has to change their attitudes and the manner in which they conducts their studies. Souder et al. (1975) find that attitudes, and particularly the dimensions of model charecteristics, organizational factors, and personal decision variables are related to

intended use. For successful OR/MS implementation, the OR analyst must work harmoniously with the managers to evolve a problem solving process that will convince the managers of the unility of OR/MS without threatening their authority. Top management support, personal involvement, and product relevance are related to probability of success due to client behavior (Manley, 1975).

The previous discussion of the OR/MS approach and its practical aspects clearly illustrates that the implementation strategy is in integral part of various phases of OR/MS approaches. Implementation does not start after the solution has been obtained or the recommendation accepted by management. A properly executed OR/MS study would lead to implementation. Therefore, the proposed strategy for implementation is in fact a restatement of the OR/MS approach and the phases of problem solving.

We have implementation difficulties in the following steps (Gupta, 1977).

Identify and Formulate a Problem

Often, the identification and formulation of a problem are conditioned by the OR/MS scientist's knowledge of tools and techniques. Very little emphasis is placed on the understanding of the managerial decision process. Often OR/MS analysts are tempted to construct a mathematical model that they can solve, rather than identifying, formulating and solving the real problem at hand. This threatens the successful implementation of Operations Research in real - life situations.

Construction of a Mathematical Model

OR/MS analyst often jumps to the construction of a mathematical model rather than problem identification and formulation. This causes serious problems. We all know that the abstraction of a reality to an abstract mathematical model requires several assumptions which may have serious problems on the implementation of the OR/MS approach. Unless the problem definitions and formulation are complete, the assumptions will not be clearly stated. The non availability of data required in the mathematical models also is a serious problem. Therefore, the construction of mat-

hematical models should include a methodology and design of data securing systems.

Solution of a Mathematical Model.

Very few problems are encountered in the solution phase, because traditional academic education trains a student principally in this step. However, we should state the assumptions made explicitly; and we should not immediately expound upon the highly sophisticated techniques used to obtain a solution.

Test and Recommend the Solution to Management.

A better approach to make managerial recommendations would be to provide managers with options, so that they can arrive at a workable, if not optimal, decision themselves.

A number of future developments may occur that will benefit both the management scientist and the behavioral scientist. First, a methodology for conducting implementation research is being developed. Second, a number of conceptual models of implementation and consequently conceptual models of organizational innovation are being formulated. Third, there is a significant new tradition of empirical research on the implementation problem. Fourth, a rather accidental but quite significant benefit may be the greatly increased availability of research sites for the study of implementation and organizational innovation. As they become increasingly concerned with the critical problem of implementation and as more people begin to study this problem, the locus of implementation research will be more evenly distributed among academic and professional management scientists (Schultz and Slevin, 1975 b). As knowledge of the processes of implementation and management innovation accumulates, the practice of OR/MS will move toward the realization of its ultimate goal : the improvement of organizational decision making.

REFERENCES

Ackoff, R.L. «Unsuccessful Case Studies and Why», Operations Research, 1960, 8, 259.

Argyris, C. «Management Information Systems : The Challenge to Rationality and Emotionality», Management Science, 1971, 17, B 275.

Bean, A.S., Neal, R.D., Radnor, M., and Tansik, D.A. «Structural and Behavioral Correlats of Implementation in U.S. Business Organizations», In R.L.

Schultz and D.P. Slevin (Eds.), Implementing Operations Research/Management Science. New York : Elsevier, 1975.

Churchman, C.W., and Schainblatt, A.H. «The Researcher and the Manager : A Dialectic of Implementation», Management Science, 1965, 11, B 69.

Churchman, C.W. «Theories of Implementation», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Creelman, G.D., and Wallen, R.W. «The Place of Psychology in Operations Research», Operations Research, 1958, 6, 116.

Dickson, J.W. «The Adoption of Innovative Proposals as Risky Choice : A Model and Same Results», Academy of Management Journal, 1976, 19, 291.

Duncan, W.J. «The Researcher and The Manager : A Comparative View of the Need for Mutual Understanding», Management Science, 1974, 20, 1157.

Duncan, R.B., and Zaltman, G. «Ethical and Value Dilemmas in Implementation», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Gibson, C.F. «A Methodology for Implementation Research», In R.L. Schultz and D.P. Slevin (Eds.) Implementing OR/MS. New York : Elsevier, 1975.

Gupta, J.N.D. «Management Science Implementation : Experiences of a Practicing O.R. Manager», Interfaces, 1977, 7 (3), 84 - 90.

Hamilton, H.R., Goldstone, S.E., Milliman, J.W., Pugh, A.L. III, Roberts, E.B., and Zelner, A. Systems Simulation for Regional Analysis. Cambridge : MIT Press, 1969.

Hansman, F. Operations Research in Production and Inventory Control. New York : John Wiley and Sons, 1970.

Huysmans, J.H.B.M. The Implementation of Operations Research. New York : John Wiley and Sons, 1970.

Huysmans, J.H.B.M. «Operation Research Implementation and the Practice of Management», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Johnson, R.A., Kast, F.E., and Rosenzweig, J.E. The Theory and Management of Systems. Mc Graw - Hill, 1967.

Lawrence, M.J. «An Integrated Inventory Control System», Interfaces, 1977, 7 (2), 55.

Little, J.D.C. «A Marketing - Mix Model; Implementation, Calibration and Case Study», Operations Research, 1975, 23.

Lonnstedt, L. «Factors Related to the Implementation of Operations Research Solutions», Interfaces, 1975, 5 (2), 23.

Lucas, H.C. Jr. «Behavioral Factors in System Implementation», In R.L. Schultz nad D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Manley, J.H. «Implementation Attitudes : A Model and a Measurement Methodology», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Mitroff, I.I. «On Mutual Understanding and the Implementation Problem : A Philosophical Case Study of the Psychology of the Apollo Moon Scientists», In R.L. Schultz and D.P. Slevin (Eds), Implementing OR/MS. New York : Elsevier, 1975.

Neal, R.D., and Radnor, M. «The Relation Between Formal Procedures for Pursuing OR/MS Activities and OR/MS Group Success», Operations Research, 1973, 21, 451.

Powell, G.N. «Implementation of OR/MS in Government and Industry : A Behavioral Science Perspective», Interfaces, 1976, 6, 83.

Radnor, M., Rubenstein, A.H., and Tansik, D.A. «Implementation in OR and R and D in Government and Business Organization», Operations Research, 1970, 18, 967.

Reisman, A., and de Kluyver, C.A. «Strategies for Implementing Systems Studies», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Rubenstein, A.H., Radnor, M., Baker, N. R., Heiman, D.R., and Mc Colly, J.B. «Some Organizational Factors Related to the Effectiveness of Management Science Groups in Industry», Management Science, 1967, 13, B 508.

Sagasti, F.R. «Management Sciences in an Underdeveloped Country : The Case of Operations Research in Peru», Management Science, 1972, 19, 121.

Schultz, R.L., and Slevin, D.P. «Implementation and Management Innovation», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975. (a)

Schultz, R.L., and Slevin D.P. «A Program of Research on Implementation», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975. (b)

Schultz, R.L., and Slevin, D.P. «Implementation and Organizational Validity : An Empirical Investigation», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975. (c)

Shakun, M.F. «Management Science via Situational Normativism», Management Science, 1972, 18, B 367.

Sorensen, R.E., and Zand, D.E. «Improving the Implementation of OR/MS. Models by Applying the Lewin - Schein Theory of Change», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Souder, Wm. E., Maher, P.M., Baker, N.R., Shumway, C.R., and Rubenstein, A.H. «An Organization Intervention Approach to the Design and Implementation of R and D Project Selection Models», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York : Elsevier, 1975.

Stilson, P. «Implementation of Problems in Operations Research», Operations Research, 1963, 11 (1).

Vertinsky, I. «OR/MS. Implementation in Valle, Columbia, S.A.: A Profile of a Developing Region», Management Science, 1972, 18, B 314.

Vertinsky, I., Barth, R.T., and Mitchell, V.F. «A Study of OR/MS Implementation as a Social Change Process», In R.L. Schultz and D.P. Slevin (Eds.), Implementing OR/MS. New York: Elsevier, 1975.

Wolek, F.W. «Implementation and the process of Adopting Managerial Technology», Interfaces, 1975, 5, 38.

Tablo 1 : Distribution of the Studies by the Research Method

Survey Studies	**Case Studies**
Bean et al. (1975)	Ackoff (1960)
Duncan and Zaltman (1975)	Gibson (1975)
Lonnstedt (1975)	Lawrence (1977)
Manley (1975)	Little (1975)
Sagasti (1972)	Mitroff (1975)
Schultz and Slevin (1975 c)	Reisman and Kluyver (1975)
Vertinsky et al. (1975)	
Sorensen and Zand (1975)	
Mix (Survey - Case) Studies	**Experimentation**
Little (1975)	Huysmans (1970
Lucas (1975)	Huysmans (1975)
Souder et al. (1975)	Manley (1975)

Tablo 2 : Independent Variables of Empirical Studies of Implementation

1. Project Variables

101. Formalization of procedures
102. Process for dealing with
103. Impact of project
104. Presentation of technical results
105. Prior experience
106. Internal - external control
107. Equity of outcome
108. Performance expectency

109. Problem limitation
110. Pay off expectancy
111. Cost related to project
112. Quantifiable variables

2. Behavioral Factors

201. Top management interest
202. Top management support
203. Client - researcher relations
204. Personal involvement of user
205. Task pressures
206. Percent of leader's time selling
207. Percent of leader's time administering
208. Performance
209. Managerial style
210. Manager's abilities
211. Social change
212. Cognitive dissonance
213. Decision style
214. Situational variables
215. Personnel variables
216. Attitudinal variables
217. Manager's and researcher's competence
218. Personal objectives
219. Manager - researcher relations

3. OR/MS Group Variables

301. Group size
302. Location of group in organization
303. Social and personal relations
304. Prior theories and ideas
305. Life history of group
306. Resource allocated to group
307. Formalization of group
308. OR Techniques being used
309. Expert status of researchers

4. Organizational Variables

401. Operationality of goals and outputs
402. Rigidness of structure
403. Decision making norms of organization

404. Quality and availability of data
405. Size of budget
406. Level in hierarchy
407. Number of employees
408. Decentralization
409. Communication style
410. Goals

5. Contextual Variables

501. Need for political solution
502. Institutionalization of OR/MS
503. Business history
504. Social history and social structure
505. Environment

Tablo 3 : Dependent Variables of Empirical Studies of Implementation

1. Behavior of users and Attitudes Toward Model Builders; Ultimate Model Utilization
2. Implementation Rate
3. Intended Use
4. Probability of Success
5. Worth and Accuracy
6. Researcher Attitudes and Values

Tablo 4 : Focus Area of Empirical Studies of Implementation

1. Individual User/Model
2. Individual User/OR - MS
3. Individual User/Managers
4. Process/Model
5. Process/Methods
6. Organization/Project
7. Researcher/Managers
8. Organization/OR - MS (and Project)
9. Process/Project
10. Client/Project
11. Researcher/Attitudes
12. Researcher/Methods