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Implementation Failure and System Developer Values: Assumptions, Truisms and Empirical Evidence

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ABSTRACT

In the information systems literature the incidence of implementation failures has increasingly been attributed to excessive attention to technical and economic issues, and an absence of concern about the social, political, and psychological (individual) aspects of the system being developed. On an intuitive level this has been explained by assuming a techno-economic value orientation of the system developer. This paper presents empirical evidence in support of the assumption of the dominance of technical and economic values in system developers.

The basis of this evidence is a field study of developer values. These values were measured by adapting a value measurement methodology developed by England (1967). This methodology determines the behavioral relevance of values by classifying them from operative (most likely to govern behavior) to non-relevant (values having no impact on behavior).

The study results show that technical and economic values are the most operative of system developer values. In the social, political, psychological domain, systemic values, and the values relating to the organization and functioning of the development project were found to be operative. However, the study found that the developers considered user job satisfaction related values mostly non-relevant.

Introduction

A survey of information systems literature (Ackoff, 1967; Argyris, 1971, 1980; Swanson, 1974; Hedberg and Mumford, 1975; Lucas, 1975; Kling, 1977; Bostrom and Hienen, 1977a; Hawgood, Land, and Mumford, 1978; DeMaio and Bartezzagi, 1979; Welke, 1979, DeMaio, 1980; Bostrom, 1980; and Zmud, 1983) suggests that implementation failures are widespread and serious. The consequences of such failures are reflected in the nonacceptance of the system by users, the jeopardizing of technical and economic investments in the system, high maintenance costs, and the opportunity costs of unrealized benefits (Zmud, 1983). Furthermore, such failures also tend to build upon one another through their effect on the user attitudes towards the information systems developers. Lucas (1973, 1975) has shown that, in the long run, these attitudes influence the success or failure of future system development efforts.

The advocates of socio-technical and participative approaches to system development (Hawgood, Land and Mumford, 1978; Bostrom and Hienen, 1977b; DeMaio, 1980; Turner, 1981) explain the incidence of implementation failures by suggesting that the designers of computer-based information systems subscribe to overly rational technical and economic design ideals. At the same time they suggest an absence of attention paid to the social, political, and psychological issues in systems development. For example, Hawgood, Land, and Mumford (1978, p. 40) state that "many past failures of computer-based information systems can be directly attributed to—a lack of knowledge of human needs and motivation on the part of technically oriented systems analysts and designers." Bostrom and Hienen (1977a) include the system developer's limited goal orientation, optimizing the technical system and limited frameworks, nonsystemic view with limited focus on decision making and data processing as some of the causes of MIS problems and failures. Turner (1981) suggests that major design decisions are usually made by technical specialists who tend to be guided by machine efficiency considerations. DeMaio (1980) summarizes this reasoning as:

"—the primary cause of problems and failures of computer based information systems is the inadequacy of the conceptual frame of reference of the information system analysts/designers. In
particular such a conceptual frame of reference can be analysed through the — "non-systemic" approach to design, as only variables relevant to technical-economic subsystem are considered, while those relevant to social subsystem are omitted; — the resulting focus is on a limited objective, namely the optimization of the technical-economic subsystem."

Other authors have attributed this orientation of system developers to a technological imperative (Davis, 1971), the new utopian attitude (Boguslaw, 1965), and an overly mechanistic orientation (Zmud, 1983). Kling (1977) states that "the prevailing norms of computer system design are machine-oriented."

The advocates of socio-technical and participative system development approaches go on to suggest that these approaches be used to compensate for the limited techno-economic perspective of the system developers. On the other hand, Hedberg (1980) suggests that the very same limited value orientation of the system developers has been a major obstacle in the adoption of these approaches in practical systems development.

Underlying the preceding discussion is the assumption that the developers of the information system primarily subscribe to technical and economic values and consider the social, political and psychological design ideals non-relevant to the system design process.

Usually this assumption is stated as a truism, though sometimes it is justified in terms of the technical (computer-oriented) background, the rational training, and/or the efficiency oriented reward structure of the system developers (Hedberg, 1980).

The purpose of this paper is to empirically validate (or disprove) this assumption.

System Developer Values—
A Review of the Literature

The issue of values has surfaced occasionally in the literature of management science, systems theory, and information systems. At the theoretical/analytical level, the role of values in systems has been recognized by Churchman (1961, 1968a, 1968b), Kling (1977, 1978), Mattessich (1974, 1978), Klein, et al., (1981), Klein (1981), Sage (1977), Berg, Chen, and Zissis (1976). Though most of these works discuss the role of values in systems development, they do not isolate the values in question explicitly and, therefore, do not attempt to empirically measure the subscription to these values.

At the operational/empirical level there are two previous studies with the stated intent of measuring system developer values. Hedberg and Mumford (1975) measured designer values in terms of their Theory X vs. Theory Y (McGregor, 1960) view of the system users. This study, which reported the designer's pre-disposition towards a Theory X view of system users, has implications for developer preferences for technical efficiency and control oriented information system solutions. Hedberg and Mumford also found that the system designers perceive themselves as having a rather limited role in terms of the system design contributions to the organization. "They see their principal work activities as increasing efficiency through streamlining procedures and providing better information. They do not appear to appreciate the potential of computer technology for improving the overall quality of working life" (Hedberg and Mumford, 1975, p. 50). Bostrom and Hienen (1977a) report similar results from a 1971 U.S. study (Taylor 1971).

Anderson (1978) measured the value orientations of computer science students using a variation of Rokeach's (1973) measurement of terminal values (desirable end-states). These terminal values consist of values such as family security, a world of beauty, world at peace, salvation, mature love, scientific knowledge, etc.; a list which does not have direct implications for the system design process.

In addition to these studies with the stated aim of measuring developer values, there have been some studies measuring developer preferences in terms of their objectives, criteria, priorities, etc. These preferences can be interpreted as the concept of the desirable, i.e., values (Kluckhohn, 1951). Smith (1977) measured developer rankings of ten system control objectives such as materiality, timeliness, security, useability, retrievability, etc., and compared them to rankings provided by system users. Hallam and Scriven (1976) surveyed MIS managers for their EDP objectives. Schussel (1974) measured 200 DP and user executives on the level of importance they attached to fourteen DP performance criteria, such as meeting deadlines, accuracy and completeness, quick response to user requests, budget performance, and control. Alloway and Nolte (1979) surveyed DP executives and systems developers in five firms in an attempt to measure the importance they attached to sixteen analyst skills. The priority attached to such skills as user orientation and behavioral sensitivity could be interpreted as the importance developers attach to these surrogate values.

With the exception of Hedberg and Mumford (1975), the preceding studies were not designed to empirically verify the relative level of importance attached to a variety of technical, economic, and socio-political-psychological
system development values (design ideals). Therefore, the list of values considered in these studies tend to be rather sparse, and do not include the numerous value dimensions which drive systems development. Most studies tend to be localized in the technical and economic items, but their categories are so broad that much of the finer discrimination is lost.

In summary, our review of literature suggests that except for some preliminary evidence found by Hedberg and Mumford (1975), the assertions of techno-economic dominance and the advocates of socio-technical and participative systems development approaches, have, at best, a very weak empirical justification for their assumptions. The remainder of this paper describes a study conducted to more adequately test this assumption.

Research Problems and Method

RESEARCH HYPOTHESIS AND METHODOLOGICAL PROBLEMS

A field survey was conducted to empirically substantiate (or disprove) the assumption that system developers primarily subscribe to technical and economic values, and find the social, political, and psychological values nonrelevant in the context of the development of computer-based information systems. Stated in the null form the research hypothesis was:

H0: There is no difference between the relative levels of importance attached to technical, economic, and socio-political-psychological values by the developers of computer-based information systems.

Testing this hypothesis posed several methodological problems. First was the problem of enumerating a value list which is both relevant to the system development process, and complete and comprehensive from the three perspectives of technical, economic, and socio-political psychological values. An analysis of the definition of value provided a likely starting point. Kluckhohn (1951) defines values as:

"... a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available means and ends of action."

This definition was used to develop a framework for system development values which classified them either as end values (values that influence the selection of the means or the "development approach" employed (Kumar, 1984).

A literature survey was used to identify various objectives and concerns which arise in the course of systems development. These concerns identified the aspects of the computer-based information system which were relevant in the context of systems development. These aspects were associated with attributes, thereby generating a list of end values. The development project analogs of the object system aspects and their associated attributes were identified to determine a possible set of means values. The preceding analysis resulted in a large value list which was reviewed for clarity, completeness, and orthogonality by a panel of system experts (system analysts, experienced system users, managers and directors of systems, consultants, and academics). A final list of 86 value concepts was used in developing an information systems development personal value questionnaire (ISD-PVQ) for measuring system developer values.

The second methodological problem concerned the relationship of professed values to system development behavior. Jick (1981) and England (1967) note that people do not always act on all the values they verbally indicate as important. Hedberg (1980) reports similar findings from his 1975 study of system developer values (Hedberg and Mumford, 1975). This problem was addressed in England's (1967) "Theoretical Model of the Relationship of Values to Behavior." This model addresses the problem by determining the "behavioral intentionality" of values. The model was operationalized by England as a managerial Personal Value Questionnaire (PVQ). England's model and his PVQ were used as a basis for developing our instrument for measuring the value profiles of system developers. The model is briefly described below.

ENGLAND'S THEORETICAL MODEL OF THE RELATIONSHIP OF VALUES TO BEHAVIOR

England's model recognizes four behavioral categories of values. The total value space consists of all potential values. The potential values for a specific group or individual are made up of two classes of values; (1) Non-relevant values (values having little or no impact on behavior), and (2) conceived values (values which may influence behavior). Conceived values are further partitioned into (i) operative values (those that have a very high probability of translation from intended to actual behavior), (ii) adopted values (those values which are less a part of the personality structure of the individual, but may affect behavior through situational factors), and (iii) intended values (values which the individual states as being important to him, but have only a moderate probability of being translated into behavior because of situational reasons). The model is presented in Figure 1.
ENGLAND'S PERSONAL VALUE QUESTIONNAIRE


The development of the PVQ is based on the rationale that the meaning an individual attaches to a carefully specified set of concepts provides a useful description of their personal value system which, in turn, is related to their behavior in systematic ways (Osgood et al., 1957).

England's PVQ determines the behavioral strength of each value concept by measuring it along two dimensions (modes) of meaning:

1. The Importance Mode—Since the general value of an object of an idea is thought to be largely a function of its degree of importance, the primary mode of valuation utilized is an importance scale.

2. The Reason Mode—As the focus of the PVQ is to make operational the behavioral effect of values, it is necessary to make operational the theoretical distinction between the intentionalities of values and their translation into behavior (operative from among conceived values). To the extent that it is possible to determine a consistent rationale as to why an individual thinks certain concepts are important or unimportant, one has a reasonable basis for distinguishing operative from conceived values. The secondary, or reason mode measures the primary rationale (success, right, and pleasant) attached to the value concept.

The overall responses to all the value concepts are used to determine the dominant reason mode (primary value orientation in England' terminology) for the individual respondent. The dominant reason mode is the reason (success, right, and pleasant) most frequently attached to important value concepts.

A combination of the importance and reason modes is thought to be a better behavioral predictor than the importance mode alone. For example, if a manager's dominant reason mode is success (i.e. when he says something is important, he is more frequently apt to see it as successful as opposed to right or pleasant), his behavior would be predicted best by viewing it as a joint...
function of those concepts he thought as important and successful (operative values). On the other hand, those value concepts which are neither important nor fit the respondent's dominant reason mode will be his non-relevant values (i.e. values which are not expected to influence his behavior). In between are the behaviorally less relevant intended values (concepts which are regarded as important, but do not fit the person's dominant reason mode) and the situationally induced adopted values (values which fit the dominant reason mode of the individual, but are regarded to be of average or low importance).

INDIVIDUAL AND GROUP VALUE PROFILES

An individual's value profile can be constructed by analyzing the value questions in the PVQ according to the above procedure in order to determine the individual's operative, adopted, intended, and nonrelevant values.

Such a profile can be constructed for each respondent. It is also possible to derive an overall profile for the respondent group by aggregating the individual value profiles. This aggregation may be used for tabulating the proportion of the group for whom a particular value concept is operative, adopted, intended, and nonrelevant, and for determining the modal value category for the group. The overall value profile will then show a similar categorization for each of the concepts in the PVQ.

While this data is complete, it is somewhat difficult to interpret because of its voluminous nature (number of value concepts x 4 value categories). England, Dhirngra, and Agarwal (1974) have developed a summary index to portray value patterns and their behavioral relevance. This index is called the Behavioral Relevance Score of the value concept, and is the percentage of the total group for whom the concept is an operative value. This score can vary between 0 and 100 for any given concept. A high score for a concept indicates a high behavioral relevance of the concept for the respondent group and, as such, indicates a group value which is very likely to govern behavior.

THE INFORMATION SYSTEMS DEVELOPMENT—PERSONAL VALUE QUESTIONNAIRE

The Information Systems Development—Personal Value Questionnaire (ISD-PVQ) was developed by substituting the information systems development list of 86 value concepts into the PVQ framework developed by 

1 Where "mode" has the usual meaning of the class or the category with the largest frequency of occurrence.

England. In addition to the standard PVQ questions, the questionnaire also included items relating to the demographic attributes of the respondents. In order to maintain respondent interest in the face of a rather lengthy questionnaire, principles of design from marketing research (Dillman, 1978) were used to format the questions. Some sample questions are presented in Appendix A.

The questionnaire was pre-tested on a representative group. In addition, a test-retest was performed with a sample of thirteen accounting and business students. The test-retest reliability coefficients for the primary mode and the secondary mode were 0.89 and 0.84 respectively, which are comparable to the results reported by England, Olsen, and Agarwal (1971) for the PVQs given to educational administrators and naval officers.

Methodology Application and Results

CONDUCT OF THE SURVEY

The field survey was conducted in thirteen Canadian business and government organizations. The organizations sampled included federal, provincial, and city government departments, electric and nuclear power utilities, manufacturing, retail, insurance, and universities. The organizational levels of respondents included vice-president of systems, directors of MIS, MIS managers through to programmer-analysts.

To obtain the sample we contacted the highest ranking information systems executives in various organizations. Of approximately twenty organizations which initially agreed to participate, seven dropped out after the second contact.

In the remaining thirteen organizations, the contact information systems executive was requested to randomly select information system developers to participate in the survey. The information systems executive was also requested to arrange a one hour meeting for the researcher with the selected respondents.

The ISD-PVQ was administered to the respondent group at this meeting. The meeting was opened with an explanation of the purpose of the study (surveying system developer values), followed by instructions on completing the questionnaire. The respondents were encouraged to respond according to their personal preferences by suggesting that there were no right or wrong answers and that the individual responses were confidential. The researcher stayed in the room with the respondents to answer any clarifying questions.
RESULTS

The final sample contained 132 system developers from thirteen business and government organizations. Of the 132 respondents, 34 were found to have a mixed dominant reason mode (i.e., when they said that a value concept was important, they were equally likely to attach the rationale of success, or right, or pleasant to it). These respondents were excluded from further analysis because the intersection data required to classify value concepts can not be reliably calculated for persons having a mixed dominant reason mode.

For the remaining respondents, each person's value profile was determined by classifying each of the value concepts for that person into one of the operative, adopted, intended, and nonrelevant categories. The individual value profiles were then aggregated into group value profiles. Two methods of aggregation, were used to produce the group value profiles; the modal value category method, and the behavioral relevance score.

Modal Category Value Profile

Figure 2 presents the modal category value profile for the technical, economic and socio-political psychological values of the system developers in the sample. To generate this group profile, the individual profiles were tabulated to determine the modal category (i.e., the category with the highest frequency of occurrence) for each of the 86 value concepts in the ISD-PVQ. Each of the values was classified over all four behavioral categories of values (i.e., operative, adopted, intended, and nonrelevant). However, the modal categories in all cases, were polarized into the two extreme categories of operative and nonrelevant. None of the value concepts were predominantly adopted or intended.

Most of the technical values were found to be operative. However, values relating to computer hardware and software, the use of latest technology, and latest system development methodologies were found to be non-relevant.

In the domain of economic values all value concepts, except for the monitoring and control of clerical and operating work, were found to be operative.

In the domain of socio-political-psychological values two different value polarities emerged. At the operative end were values related to the conduct of the project (such as user participation in system design, formal assignment of responsibility for the project, frequency of user reviews, etc.), and systemic values (such as the primary client of the system, organizational goals and objectives, communication structures, etc.). At the nonrelevant end were most of the job satisfaction related values such as the status of the user's job in the organization, the alignment of user salaries to his/her job description, job security for the user, and the variety of tasks in the user job. Also at the nonrelevant end were values related to the analyst's job satisfaction. However, the concept of user job design and the resulting job satisfaction were found to be marginally operative (with 36 percent of the respondents classifying it as operative). In addition, the alignment of the mode of information display to the cognitive/decision style of the users was found to be non-relevant.

Behavioral Relevance Score Value Profile.

The behavioral relevance score for each of the value concepts was determined by calculating the percentage of the group for whom the value concept is operative. Figure 3 presents the behavioral relevance scores for the technical, economic and the socio-political-psychological values for the sample. The figure has been subdivided by horizontal lines to indicate the quartile ranking of the value concepts.

With respect to both technical and economic values, most of the value concepts were found to be clustered in the high (top two quartiles) behavioral relevance score range. In both these classes of values, only a few value concepts (such as values relating to computer hardware and system software in the technical value class, and monitoring and control of clerical and operating work in the economic value class) were found to have low behavioral relevance scores. This indicates that most of the technical and economic values have a high likelihood of influencing the system design decisions.

At the high end of the socio-political-psychological values are those related to the conduct of the system development project (such as user participation and formal assignment of responsibility) and systemic values (such as the status of the user's job within the organization, job security for the user, variety of tasks, and learning, and growth in user jobs) are clustered in the bottom quartile. The values related to the analyst's own job satisfaction are also rated as having low behavioral relevance. These scores imply that the job satisfaction related values have a low likelihood of influencing system development behavior.

Conclusions and Implications

The objective of this paper was to substantiate or disprove the assumption that system developers pri-
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Figure 2
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<td>38.</td>
<td>38. Flow and Consumption of Organization's Resources</td>
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<td>35. Sense of Contribution.</td>
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<td>34. Organizational Structure</td>
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<td>33. Routine &amp; Repetitive User Tasks</td>
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<td>27.</td>
<td>27. User Job's Health/Safety; Analyst's Autonomy on Prod.</td>
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<td>24. Job Induced Mental Stress on User</td>
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arily subscribe to technical and economic values, and find the socio-political-psychological values nonrelevant in the context of information systems development.

The results from the field study give strong support to the assumption of the dominance of technical and economic values. Most technical and economic values are clustered in the high behavioral score ranges. With the exception of values related to computer technology, development methodologies, and the monitoring and control of clerical tasks, all these values are in the operative behavioral category. This implies that the technical and economic value concerns are highly likely to influence and govern system design choices and behavior.

The nonrelevant values in the technical and economic value classes suggest two interesting implications. First, that system developers seem to have outgrown their earlier fascination with the latest and most sophisticated technology (both hardware, software, and methodologies), and second, that there seems to be a move away from the monitoring and control of people-oriented Theory X view of systems.

In the socio-political-psychological domain, values are found relevant as long as they contribute directly to the system development project (such as frequency of user reviews, participation by users, formal and definite assignment of project responsibilities), or are related to systemic goals and concerns (such as the primary client of the system, organization's goals and objectives, communication structure).

On the other hand, job satisfaction and quality of working life values are considered nonrelevant to the design of information systems. These values are clustered in the lowest behavioral score ranges. This implies that they are likely to have very little or no impact on the design decisions made by the system developers.

Information systems development is a complex process with numerous competing objectives. Usually the resources (both time and money) available for the systems analysis phase are limited. This means that only the high priority objectives or value concerns will be accommodated in the design of the new system. Job satisfaction and quality of working life value concerns, with low behavioral relevance (in the bottom quartile), are therefore likely to be ignored by the system developers concerned with bringing the system development project on schedule (behavioral relevance score—62), and within budget (behavioral relevance score—60).

However, the advocates of socio-technical and participative development (Hawgood, Land, and Mumford, 1978; DeMaio, 1980; Bostrom and Hienen, 1977) have suggested that the lack of attention to the job satisfac-
tion concerns is one of the primary causes of the implementa-
tion failures of computer-based information sys-
tems. Sackman (1983) states that "computer professionals	only subvert the development process with their
narrow sectarian concerns—." Therefore measures are
needed to compensate for this lack of attention.

Land, Mumford, and Hawgood (1980), DeMaio (1980),
and Welke (1979) suggest that this lack of attention to
job satisfaction issues can be compensated by the intro-
duction and adoption of systems development metho-
dologies with strong socio-technical and participative
components. However, Hedberg (1980) suggests that
this very lack of attention is a major obstacle in the
adoption of such methodologies. Sackman (1983), and
Hoyer (1980), have indicated that the system analyst's
limited value concerns are major problems in adoption
of participative development approaches.

This means that we may need to go to the root cause of
the problem and attempt to modify the underlying value
structures of the system developers. Courbon and
Bourgeois (1980) suggest that we need "a new breed of
designers, who will be nurturing agents" for the socio-
technical process. We suggest two options for develop-
ing this new breed. First, we should train the aspiring
system developers not only in the technical and eco-
nomic aspects, but also in the human and job design
aspects. Nygaard (1983), through the suggestion for
informatics as an academic discipline, and Land,
Mumford, and Hawgood (1980) through their proposal in
"Training the Systems Analysts of the 1980s," support
this approach.

Second, we can change the reward structure for the
system developers in such a manner that the conscious
consideration and maximization of job satisfaction and
human concerns is rewarded. Hedberg (1980) states:

"Designers design to please those who control
the rewards. They live in a world where technical
constraints, cost budgets, and deadlines are real
and demanding, but where human needs, demo-
cratic organization structures, and user participa-
tion are little but window dressing. Should we
moralize over that they first attend to problems of
costs, timing, and technical functioning—. No,
they act according to the rules of the game they
are in. It is these rules that must be changed.

It is our belief that a suitable combination of the above
three strategies (i.e. socio-technical and participative
methodologies, system analyst training, and a modified
reward structure) will be instrumental in modifying
the system developers' value structure, such that adequate
attention is given to the human and job satisfaction
issues.

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Appendix A

Information Systems Development—Personal Value Questionnaire

Sample Questionnaire Items

Section II: Having decided which aspects of the system to examine and/or develop, the next question deals with the direction in which development should take place (the "norms" of development). This section measures the level of importance you attach to each of these norms of criteria. For each of the items listed below, please indicate:

1. The level of importance you attach to it, and
2. The primary meaning (i.e. success, right or pleasant) you attach to the item.

<table>
<thead>
<tr>
<th>Importance Rating</th>
<th>Meaning</th>
<th>Item Description</th>
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<td>V. LO</td>
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1. Timeliness of information supplied by the system
4. Security of update/retrieval access to information
16. Operating costs of the system
40. Job security for the users
45. Development project on schedule