USER MANAGERS' SYSTEMS NEEDS

It appears that tomorrow is here today.
We need to change the rules of the game
and play catch-up ball.

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May, 1980

CISR No. 56

Sloan WP No. 1125-80

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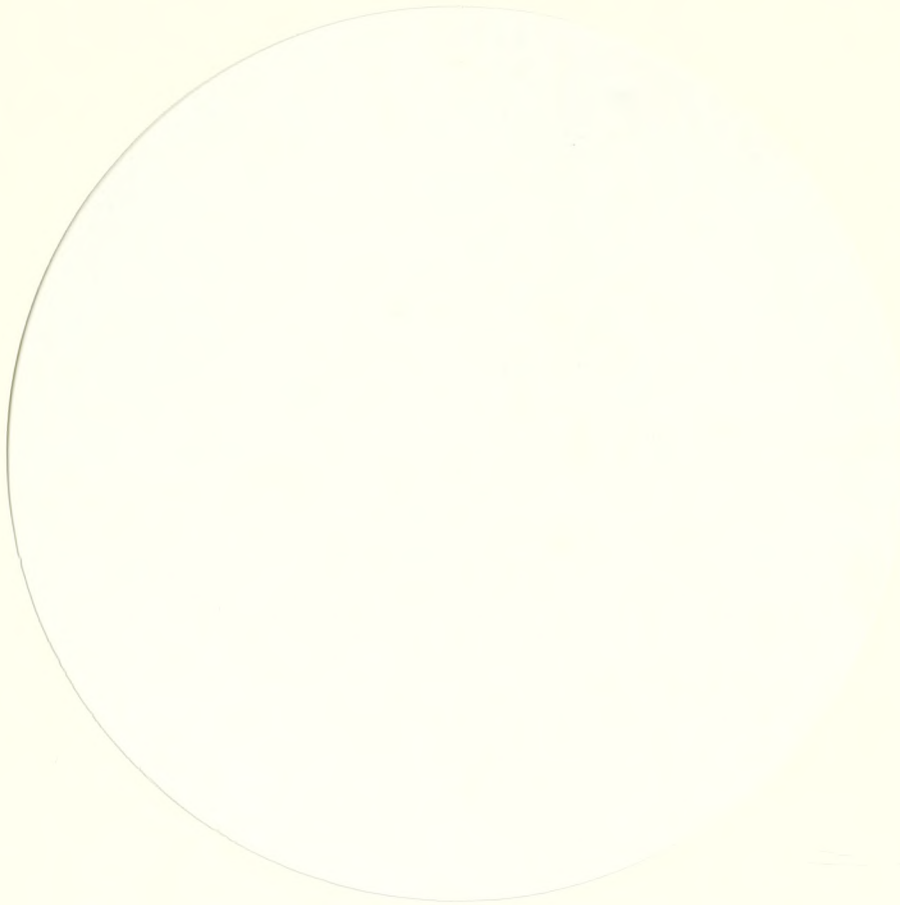

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User Managers' Systems Needs*

Managers need information not computer-based information systems. The latter is a means to the former end. Managers need flexible access to relevant data and the ability to analyze that data. Computer systems are intended to provide the means to make this possible, economic, and easy for managers.

This paper assesses user managers' systems needs, the means, with an eye toward their appropriateness for various managerial ends. We have asked and answered the questions, how many systems do users currently have, how appropriate are those systems, and how many new systems do users want? Systems were classified by type into monitor, exception, inquiry, and analysis.

The results are dramatic. The differences in managerial appropriateness of systems types has already caused a significant shift in users' demand mix by systems type. This presents serious management challenges to both DP and user departments. Moreover, the level of user demand for new systems, for each type and collectively, is simply overwhelming. This increases the managerial challenge; necessitating improved processes and criteria for prioritization of systems needs.

Introduction

As part of a larger research project 114 user and DP managers in six industrial firms completed an extensive questionnaire.[1] A stratified sample of senior, middle, and junior managers was selected from the manufacturing, finance, and DP departments. Exhibits 1 and 2 provide some basic information about the firms and respondents studied.

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*I wish to thank the anonymous companies and managers who participated in this research, Christine Bullen for her management of the data gathering process, Jerome Nolte for his statistical analysis support, and the Center for Information Systems Research of M.I.T. for partial funding.

[1] "User Needs Survey: Preliminary Report", Robert M. Alloway, et al, M.I.T., Sloan Working Paper 1096-79, December 1979.

To establish the base case, user managers listed and classified by type the systems they already have. A straightforward classification of application systems type was used in the questionnaire:

SHORT NAME	DESCRIPTION OF SYSTEM TYPE
Monitor	The system monitors daily detail activity producing standard reports on a fixed schedule (daily, weekly, or monthly).
Exception	The system processes daily detail activity but produces exception reports where the definition of exception conditions is fixed.
Inquiry	The system provides a database with flexible inquiry capability, enabling managers to design and change their own monitoring and exception reports.
Analysis	The system provides powerful data analysis capabilities (modeling, simulation, optimization, or statistical routines) and the appropriate database to support managerial decision making.

The first two types, monitor and exception, fall into the category of applications traditionally called transaction processors. These systems have been the bread and butter of DP, helping to capture, store, manipulate and report the structured, high volume activities of daily operations. Transaction processing systems generate management reports by successive

stages of increasingly summarized detail activity. The lowest level summaries are provided to supervisors and managers directly responsible for daily operations. Successively higher level summaries are distributed to successively higher levels of management. There is an implicit assumption in this traditional approach to management information -- summarized daily activity, which is appropriate for first line managers, further summarized is appropriate for higher levels of management. In general, this is not true.[2] To the limited extent that this is true, transaction processors do provide some relevant information to higher level managers.

Inquiry and analysis systems, however, are more managerially oriented in their intention, design, and use than transaction processors. It is the difference between starting with the data and sending summary reports to the managers most likely to find them relevant and starting with a managers' needs and working down to the data and analysis necessary to support those needs.

Flexible inquiry systems were originally developed to provide ad-hoc inquiry into transaction processing data. They have been enhanced to also provide flexible monitor and exception reporting. They require specialized software (database management system and high level inquiry language), hardware (disks and terminals), and are generally limited to accessing one database at a time (eg., order entry or purchasing) although progress is being made in linking databases together.

Analysis systems include a diverse mix of approaches to supporting judgemental decision-making, from problem-finding and contingency planning to selecting "best" alternatives. They are necessarily customized for a particular set of decisions (eg., financial forecasting or production scheduling) and include flexible access to the required database.

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[2] "A Framework for Management Information Systems", Garry and Scott Morton, Sloan Management Review, Fall 1971.

What Systems do Users have?

Eighty-one user managers in six companies listed the systems which they personally use on a regular basis. They then classified each system as monitor, exception, inquiry or analysis. This provides the breakdown of the installed base of application systems shown in Exhibit 3. There are 277 installed systems in the sample, of which 228 or 82.3% are monitor type systems. In contrast only 3.2% of the installed systems are of the analysis type.

There are no real surprises here; rather there is confirmation of most managers' expectations. The average manager regularly uses 3.4 systems, of which approximately 90% are transaction processors and 10% are managerially oriented. I almost said "only 10%" but it wasn't too long ago that 100% were transaction processors. Improvements in technological capability have been pushing inquiry systems, and improvements in the "DP-literacy" of user managers have been pushing analysis type applications.

Ninety percent of the collective experience of DP and users is in transaction processors. This simple observation of systems mix of the installed base has some interesting implications.

DP's policies and procedures, depth of skills, organizational structure, evaluation/reward criteria, and expertise in developing applications are dominated by transaction processors. Thus, there is a strong tendency for any systems request that goes into DP to come back out implemented as a transaction processor.

Users' perceived use of computers, expectations of systems development procedures, anticipated benefits, and justification criteria are similarly dominated by their transaction processing experience. Thus, there is a

strong tendency for any systems requests that go into DP to already look like transaction processors. The interaction of DP and user biases toward transaction processors has the same effect as a conscious conspiracy -- many inquiry and especially analysis systems needs are implemented as transaction processors instead.

Moreover, in most companies the established standard procedures for needs identification, project selection, and systems development are the result of institutionalized transaction processing experience. This further increases the probability that an inquiry or anlaysis systems need will be implemented as a transaction processor.

The creation and use of inquiry and analysis systems are different from transaction processors. Recognition of this simple fact has been hindered by a superficial appearance of systems similarity -- all four systems types are indeed computer-based. The development of inquiry and analysis systems is adversely affected by the policy requirement to follow established standard procedures which are appropriate only for transaction processors.

Companies have refined their experiences into institutionalized standard procedures and self-fulfilling expectations oriented exclusively to their predominate transaction processing past. Recognition of this as a problem is organizationally difficult and ackward. Reassessing institutionalized standard procedures and expectations to facilitate the development of additional systems types is a true management challenge.

How Appropriate is the Installed Base?

In a separate set of questions, user managers listed their most important tasks or decisions which they felt could be supported by a computer system. The support actually available for these important tasks was then classified by systems type. These results are shown in Exhibit 4. Users listed 229 important tasks or decisions of which 79 or 35% had no systems support of any type.

Clearly the installed base is not appropriate for the 35% which are unsupported. This alone is an important source of demand for new systems and user dissatisfaction given DP's backlog in creating new systems. Monitor systems provided support for 120 or 53% of the important managerial activities although, as will be demonstrated, not necessarily appropriately.

The second portion of Exhibit 4 omits the 79 important managerial activities which are unsupported and re-computes the percent distribution by systems type. This distribution is not very different from the distribution by systems type of the total installed base in Exhibit 2. Apparently whether a system is intended to support a managerially important activity or not makes little if any difference in the type of system which is developed. Presumably, this is because of the institutionalized standard procedures for systems development which reinforces DP and users' biases resulting in transaction processors irrespective of the intended use of the system.

Exhibit 5 compares the total installed systems base from Exhibit 2 with those systems cited as supporting users' important activities in Exhibit 4. Of the 277 total installed systems only 150 or 55% were cited in

conjunction with users' important activities. In other words, while 35% of managers' important activities go completely unsupported, 45% of the systems which are installed do not relate to managers' most important needs.[3]

The 127 installed systems which were not cited are probably necessary for daily operations and fulfill some of the respondents secondary needs. However, to presume all of the 228 installed monitor systems provide management information is apparently in error -- 108 of them were not even mentioned in conjunction with important managerial activities. Transaction processors should be recognized for the valuable functions they do perform and not tarnished by being labeled MIS, a function 47% of them do not even address.

There is a definite pattern in Exhibit 5 by system type. All of the installed analysis systems were cited whereas only 53% of the monitor systems were cited. For important managerial needs, inquiry and analysis systems appear to be more relevant.

This was investigated in greater depth by asking user managers to designate their desired systems type for each important activity they had listed. In Exhibit 6 the systems type is considered to be appropriate when the installed and desired systems type are the same.

Only 46, or 31%, of the systems which support users' important activities are of the appropriate type. In other words, 69% of the 150 currently installed systems which do relate to important managerial activities do so only partially or in an inappropriate fashion -- inconvenient, inflexible or incomplete.

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[3]This is a reality which incites many user managers -- unjustly I think. In fact, if the "managerially unimportant" 45% of the installed base did not exist, many managers' most important tasks would be managing those daily operations which these systems support. These systems have enabled managers to spend more time managing.

Again we see that inquiry and analysis systems fare significantly better than monitor and exception systems. The vast majority of inquiry and analysis systems, 66% and 78% respectively, are considered by their users to be of the appropriate type. In contrast to the low appropriateness percentages for monitor (25%) and exception (11%) systems this makes a very strong statement. User managers consider inquiry and analysis systems to be significantly more appropriate for their important needs than monitor and exception systems.

Exception systems are seen as particularly inappropriate for important managerial needs because, I think, of the fixed nature of the definition of exception conditions embedded in the application software. Managerial re-definitions of exception conditions necessitate software maintenance, thereby constantly involving users in DP backlog delays and red tape in a thankless quest to update inevitably obsolete reports.

Of the 120 monitor systems that relate to important managerial activities the breakout of desired type is shown in Exhibit 7. Thirty of these systems are considered by their users to be of the appropriate type. The remaining 75% should have been a different systems type to appropriately address their users' important needs.

Sixty-four percent of these systems (38% inquiry plus 28% analysis) are of a basically inappropriate type. It is difficult for user managers to consider the projects which created those inappropriate monitor systems to be responsive to their needs. No matter how hard the project team worked, no matter how technically competent they were, no matter the project came in on budget and schedule, and no matter how bug-free and efficient the system; a monitor system cannot behave like an inquiry or analysis system. A well-designed and implemented, but inappropriate, monitor system

contributes to the generally recognized user feeling of DP unresponsiveness to managerial needs. When this occurs frequently the reputation of DP as unresponsive and computer systems as inappropriate to important managerial needs is confirmed and spread.

Exhibit 8 juxtaposes lines from previous exhibits to emphasize their cumulative effect on user managers' perceptions. The difference in managerial appropriateness between monitor/exception and inquiry/analysis system types is dramatic. Of the total base of installed systems 54% are cited in conjunction with managerially important activities. Of those systems which do relate to important managerial activities 31% are of the appropriate systems type. The cumulative effect is devastating. User managers, see only 17% of the installed base of application systems to be appropriate to their important needs.

This does not imply that the remaining 83% of the installed base is inappropriate for other necessary corporate functions. These systems were not necessarily intended to provide support for middle level managers' important activities. This exhibit does not reflect the recent mix of DP system development by type inasmuch as most monitor systems were developed years ago and all inquiry and analysis systems are fairly recent. Moreover, when originally developed, many monitor systems directly and appropriately addressed important managerial needs, such as payroll and accounting, so successfully that they are no longer important managerial needs.

Even accepting this literary of extenuating circumstances, I am still convinced that this is how user managers perceive DP systems and why they believe DP to be unresponsive to their managerial needs. Millions have been spent on developing, running and maintaining existing systems. Only

17% of the installed base is relevant and appropriate to important managerial activities. Although inquiry and especially analysis systems are dramatically more relevant and appropriate to managerial needs, these types are such a small percent of the total installed base as to be considered atypical DP applications. Moreover, 35% of important managerial activities have no systems support of any type.

A search for the cause of user dissatisfaction with DP need go no further than this mismatch between user managers' important needs and the installed base of applications.[4]

What System Types do Users Want?

The preceeding comments foreshadow a shift in user demand away from transaction processors and toward inquiry and analysis system types. The question for many DP departments is when will this shift occur and when should they begin preparing to meet this often predicted mix shift in user demand. The answer, according to Exhibit 9, is last year.

The known backlog of user requested systems development projects already exhibits a dramatic shift in the proportion of system types from the currently installed base. Whereas 90% of the installed base is transaction processors, 40% of the known backlog is requests for managerially-oriented inquiry and analysis systems. The shift in user demand mix has already occurred.

Users are expecting increased implementation of managerially-oriented systems types in the near term and DP should already be able to perceive this shift. If standardized procedures and ingrained transaction processing attitudes result in the implementation of monitor systems where inquiry or

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[4] "Defining Success for DP", Robert M. Alloway, M.I.T., CISR Working Paper 52. March 1980.

analysis systems are needed, requested, and expected user dissatisfaction will surely increase.

The invisible backlog (desired systems not yet requested of DP) has basically the same proportional mix as the known backlog. For the foreseeable future user demand will continue to emphasize analysis and inquiry systems over transaction processors.

The total demand mix summarizes the planning horizon for DP in terms of the relative importance by systems type. This obvious mix shift emphasizes the necessity of modifying historically derived standard systems development procedures. In order to be successful and responsive to managerial needs, DP's attention, priorities, and proportion of effort must be cut in half for monitor systems and increased by a factor of three for inquiry and six for analysis systems.

This dramatic shift in user demand must be matched by an equally dramatic shift in DP procedures and capabilities. Most DP departments are currently perceived by user managers to be managerially unresponsive. To the extent that DP departments have failed to recognize this mix shift in user demand early enough to match supply to demand, these perceptions are well founded.

DP's corresponding shift in supply requires pervasive changes to its internal structure and procedures -- from training programs and personnel evaluation criteria,[5] to project design and procedures for different system types,[6] to defining success and strategic planning for DP.[7] Recognition of

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[5]"Planning Skill Development for Systems Analysts", Robert M. Alloway and Jerome T. Nolte, M.I.T., CISR Working Paper 51, November 1979.

[6]"Temporary Management Systems", Robert M. Alloway, Stockholm School of Economics, Institute of International Business Working Paper, September 1977.

[7]"Defining Success for DP", Robert M. Alloway, M.I.T., CISR Working Paper 52, March, 1980.

the magnitude of change necessary should not induce general paralysis, but rather, the explicit realization of the managerial nature of this challenge, the significant benefits to be gained, and the undeniable necessity for a flat-out effort to play catch-up ball.

What Systems Types will Users Want?

If you will allow me considerable latitude with cross-sectional data to "kludge" longitudinal implications, Exhibit 10 can be interpreted as demand trends for systems types over the next five years.

Implementation of managerially relevant and appropriate systems has triggered a disproportionate increase in demand for these systems. Today's small installed base of inquiry and analysis systems has already resulted in a significant mix shift in demand. As DP departments are successful in fulfilling today's demand the known backlog becomes part of tomorrow's installed base. Tomorrow's demand for new systems will be similarly reflective of the relevance and appropriateness of tomorrow's installed base.

The best predictor available of tomorrow's demand mix are the 35% of the managerially important tasks which are today completely unsupported. The percentage breakdown of desired system type for unsupported important managerial activities was used for tomorrow's demand in Exhibit 10.

The chronology by systems type is thus traced and forecast. The proportion of monitor systems as a percent of the installed base has dropped from 100% yesterday to 82.3% today. Demand for monitor systems is forecast to drop from 40% today to 22% tomorrow. By contrast, analysis systems constituted 0% of the installed base yesterday and 3.2% today.

Today's demand has surged to 20% and tomorrow's is forecast to continue to grow to 40%.

DP used to play a leadership role vis-a-vis users in the application of computer technology to organizational needs. DP has lost this leadership position by failure to shift the mix of delivery capability early enough to meet emerging demand. Today DP must play catch-up-ball just to rebalance delivery capability and demand.

Theoretically it is possible for DP to regain its leadership role by providing a mix of systems types appropriate for tomorrow's demand. However, this is such a dramatic change as to be impossible in the near term for most, if not all, DP departments.

To be practical, DP and users should target their change planning to achieve today's demand mix as soon as possible, yesterday preferably, and to create policies, organizational structures and procedures facilitative of growing into the position to deliver tomorrow's demand mix within 3 years.

How Many New Systems do Users Want?

The previous sections of this paper discussed the proportions or mix of user demand by systems type. This section introduces the quantities of new systems needed to complete the picture of user demand. In Exhibit 11 no attempt has been made to standardize new systems by size or number of man-months required to create them. Just like the installed base of 277 systems, some are larger or more complex than others. The new systems counts also include systems replacements but not enhancements or maintenance.

The known backlog of all systems, 188, is so large (68% of the currently installed base) that it results in the commonly observed 2-3 year backlog in most DP departments. Systems development personnel are already flat-out dealing with this known backlog.

The invisible backlog of all systems, 309, is staggering (164% of the known backlog or 115% of the installed base). The invisible backlog number is not as reliable as the known backlog because these desired systems have not passed the "rigors" of proposal preparation and approval. However, this figure is probably in the right ballpark.

The size of the invisible backlog implies that the known backlog will never get any shorter. No matter how fast DP can create new systems the users will keep the known backlog full. The length of a DP department's known backlog is not an indication of anything other than the users planning horizon and perceived stability of need.

Total demand for all systems, 497, is simply overwhelming -- 179% of the installed base, which, by the way, took 10 to 15 years to create. There is no way that any DP department can actually fulfill this level of demand. Priority setting is as important in determining success as the number and quality of systems developed.

Conversely, user departments will be hard pressed to fulfill their needs even using a consortium of suppliers -- DP, own DP staff, and software vendors (package and custom). Users' prioritization of needs is as important in fulfilling their information needs as the number and quality of systems implemented.

User management must fulfill its responsibilities in prioritizing individual systems, levels of effort, and type mix. It is simply unfair to have DP constantly "play the heavy" in telling user after user that their

needs are not important enough. Moreover, DP should not be forced into the position of indirectly determining corporate capabilities and strategy.

The demand for monitor systems is not growing as rapidly as analysis systems, 88% versus 1077%, however, the installed base of monitor systems is significantly larger. Hence, Exhibit 12 reveals greater demand in terms of absolute numbers for monitor systems than analysis systems.

Two hundred more monitor systems is itself sufficient to keep the entire DP department very busy for the foreseeable future. DP cannot simply stop creating monitor systems in order to meet the dramatic growth in demand for other system types. DP must continue to create monitor systems. It is a question of priorities; how many of the 82 backlogged monitor applications are already committed or in process, how many are necessary foundations for other systems, how many of the 118 invisibles can be obviated by installing inquiry or analysis systems, what priority should be assigned to each monitor system given the demand for all system types?

Demand for exception systems shows surprising growth given their low appropriateness ratings in previous exhibits. At least two explanations are possible. First, for high-volume structured applications, fixed exception reporting systems are considered appropriate by user managers, even though for managerially important activities, where flexibility is key, they are not. Second, user managers may not have realized the lessons of their own experience with fixed exception systems. There is a real difference between the abstract concept of exception reporting for future systems and the actual support provided when implemented. The <u>fixed</u> definition of exception conditions is not emphasized in conceptualizing a proposed system but becomes only too evident in their implemented use. Only 1 of 22 installed exception systems is considered to be relevant to

and appropriate for managerially important activities. Users should seriously consider the implications of this difference in concept and actual implementation -- the delays, frustrations, and resources consumed in revising obsolete exception condition definitions.

The demand for inquiry systems has already jumped by 100% between the installed base and the known backlog. And it shows every sign of exponential growth with the invisible backlog nearly 100% greater than the known backlog. To meet total demand would require over five times the number of inquiry systems already installed.

Hopefully, as this demand for inquiry systems is fulfilled the proportion of DP effort expended on "little systems" (special report requests) and maintenance of exisitng systems will decrease. Flexible inquiry systems have the desireable characteristic of converting users into "programmers" and "maintenance personnel". As users' information needs evolve with respect to an inquiry systems' database, they revise their ad-hoc queries and modify their stored report commands accordingly.

In fact, the general approach of converting users into "programmers" will have to be heavily pursued in any serious attempt to fulfill total demand for inquiry or analysis systems. Total demand for analysis systems is 10 times greater than the installed base. Without "user-programmers" DP does not have the capacity to fulfill even the known backlog of 40 analysis systems while simultaneously developing 82 monitor systems and 36 inquiry systems. With the invisible backlog included there is simply no hope of DP fulfilling demand alone. In addition to DP-developed systems, DP should play a facilitative and supportive role for user-developed systems. Very High Level Languages, access to databases, and relevant training must be provided to user managers.

DP should initiate a major shift in resources, structure and procedures to provide more inquiry and analysis systems. This is necessary but not sufficient. The procedures for creating analysis systems are basically different from the procedures for creating transaction processing systems.[8] DP must change its procedures accordingly to increase the supply of this type of system in its application portfolio.

It is like a company adding a new product line. Changes in customer demand, due to shifts in consumer preference or new technological capability to supply old needs, must be realized for the long term viability of the company. New procedures and departments must be created in marketing, manufacturing, field service, etc. Growth in the new product line must be planned, supported, and protected. Competition between existing product lines and the new product line for resources and management attention must be resolved based upon profit potential.

The necessity for DP to realize and respond to user manager demand for analysis systems should be clear from their high appropriateness ratings, especially for managerially important activities. Failure to respond will leave DP in the unenviable position of being not only unresponsive to users needs but increasingly managerially irrelevant.

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[8] Decision Support Systems, Keen and Scott Morton, Addison-Wesley, 1978.

Conclusions and Recommendations

Two summary conclusions emerge unequivocally from the preceding exhibits:

* A dramatic shift in user demand has already occurred.
* User demand for new systems is simply overwhelming.

Users have recognized the differences in managerial relevance and appropriateness between system types and have accordingly shifted their demand away from transaction processors toward inquiry and analysis systems. The growth rate in user demand for analysis systems is especially high; surpassing the capability of typical DP departments to deliver. The demand for new monitor systems, although declining proportionately, is nonetheless staggering in absolute numbers. The number of new systems required to fulfill the combined user demand for all system types is clearly beyond the capacity of any DP department to deliver.

Individually, mix shift and demand level present a serious challenge to management. Together they confront management with the necessity for basic changes in the company's strategy and structure for fulfilling its information systems needs.

It is very important to recognize the nature of the changes necessary to adequately address the issues raised by these empirical results. Doing more of the same thing, either through increased productivity or increased total expenditures, is not sufficient. The mix of what must be done is different. This requires a fundamentally different approach than in the past. Moreover, new systems development procedures customized for inquiry and analysis systems are required for the success of individual projects and for the volume of demand for these systems. The degree and extent of

change is so pervasive that the strategy and structure of providing information systems must be reassessed.

The recommendations to begin addressing the necessary strategy/structure changes can be divided into four areas:

* all managers must prioritize information systems needs
* DP must modify its approach to information systems fulfillment
* Users must modify their approach to information systems fulfillment
* Senior management, in the form of a steering committee, must recognize, enable, and support the changes necessary within DP and User departments, and in the relationships between DP and Users.

All Managers

The first set of recommendations is obvious -- prioritize, prioritize, prioritize. DP must prioritize its systems development efforts by systems type, by User department, and by application within each type. Users must prioritize their information systems needs by type and by application within each type. Both users and DP must reconsider their policies and procedures for needs identification, prioritization, and systems development. Senior management must recognize as a priority role its responsibility in policy formulation and supporting DP and user departments in their necessary structural and procedural changes.

DP Managers

The first and most fundamental change for DP is to recognize the significant differences between systems types. This is much harder than it sounds. It is a fundamental change in how DP understands its own past, perceives the functional benefits of systems to organizations, and conceptualizes the information systems creation process.

Most DP personnel acknowledge that every system is unique. Contrary to

this belief, they periodically modify their systems development process seeking to improve, meaning tighten, their development procedures. The implicit goal is one right systems development procedure for the creation of all systems. At best, this self-contradictory position is recognized as a practial compromise: all systems are unique but it is impossible to devise a customized systems development procedure for each project.

There is a more realistic and still practical approach. The system typology used in this research clearly distinguishes different trends in user demand. If DP responds appropriately by shifting its supply mix to match users' demand mix, the systems development procedures of the past will be obsolete for 40% to 60% of the new applications. The current standard systems development procedure <u>is</u> appropriate for transaction processors and should continue to be used for them. Two new, additional systems development procedures should be devised; one for inquiry and one for analysis systems.

The point is analogous to introduction of additional product lines in an automotive company. In the past, many different models of cars with V-8 engines were developed, manufactured and marketed. A broad product line varying in body style, engine displacement, and appointments was supported. Within that theme variations like V-6 engines or sports cars were practical. This reinforced automative management's belief that any kind of car could be effectively and efficiently developed with variations on their current process.

Recognition of a shift in customer preference and the fundamental difference in small cars was difficult. Down-sizing was a modification to past procedures with limited success. No matter how hard you try to modify a V-8 engine block transfer line it cannot make 4 cylinder diesel engine

blocks. In the end it was recognized that complete redesign was necessary to add a new product line. This required new development, manufacturing, and marketing approaches. Heavy investment in new plant, transfer lines, and re-tooling was made to produce small cars in high quality, economic volume.

There remains this superficial appearance of similarity -- the old and new product lines are both cars -- but to achieve volume, quality, and remain economic, the production processes are specialized by type. The manufacturing of one type on another's production line would dramatically lower success.

DP is currently trying to develop inquiry and analysis systems with manufacturing techniques developed for transaction processing systems. The entire life cycle of systems development, beginning with needs recognition and proposal preparation, must be re-assessed.[9] Not in order to improve it for all systems but to differentiate it into three manufacturing processes -- transaction processors, inquiry, and analysis.

It will take some time but the biggest delay is in recognition of the fundamental differences between systems types. From this recognition the inevitable necessity of differentiated systems development procedures readily follows.[10] So too, does planning the portfolio of application systems by type, re-structuring DP's organization accordingly, and modifying the desired skill mix of systems development personnel.[11]

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[9] "The Complete Life Cycle of CBIS Projects", Robert M. Alloway, Institute of International Business Working Paper, February 1977.

[10] "Temporary Management Systems", Robert M. Alloway, Institute of International Business Working Paper, September 1977.

[11] "Planning Skill development for Systems Analysts", Robert M. Alloway and Jerome T. Nolte, MIT, CISR Working Paper 51, November 1979.

DP must reallocate it resources to achieve a balance between its supply mix capability and users' demand mix needs. Moreover, DP should achieve today's mix requirements in such a manner as to facilitate achieving tomorrow's demand mix. DP should never again allow itself to fall into the trap of lagging behind users' changing needs by institutionalizing its past mix. Rather, DP should continually reallocate systems development resources to balance its portfolio and regain its leadership position in the future mix.

DP should also help users fulfill some of their information systems needs with other than DP-developed systems. Recognizing the overwhelming number of new systems required, DP should seek to identify those needs which could be successfully met with less burden on DP resources.

Three alternative sources of information systems exist. First, users could purchase software packages or custom developed applications from outside vendors. Second, DP could provide users with access to processing power, databases and Very High Level Languages for "user-developed" systems. Third, user departments could create their own specialized systems development groups.

These alternatives could be pursued simultaneously or different alternatives could be pursued by different user departments. However, all of these alternatives require DP support. DP would have to supplement users' capabilities with consulting, provision of facilities, and technical expertise.

There are several policy and procedure questions to be resolved if any "user-developed" alternatives are to be pursued. How will users' general and specific DP capabilities be sufficiently increased? Under what conditions should non-DP-developed systems be authorized and by whom? What

company standards must be fulfilled by such systems? Should DP be a favored vendor? Who will manage the hardware used to run these systems? And, how can DP resources and expertise be best utilized to help user departments achieve successfully implemented systems?

Collectively, the changes in systems mix, levels of demand, and user relations are so pervasive they constitute a strategy-structure reassessment for DP.[12] General management must encourage and support DP in these traumatic times if this transition is to be successful.

User Managers

The combined effects of several realities present users and user management with serious challenges.

* users' needs and demand for new systems is high
* users' demands by systems type have shifted
* DP cannot supply all the new systems users demand
* users capabilities in even general DP issues is low
* users must initiate and participate in systems development, especially for inquiry and analysis systems.
* users' capabilities in systems development affect the quality and type of systems implemented.
* users' need and desire more general DP training.

Users must change their pre-project procedures -- needs recognition, project selection, and project prioritization. This necessitates changes in internal procedures and working relationships with other user departments and DP. Users must not only accept their responsibilities in

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[12] "Defining Success for DP", Robert M. Alloway, MIT, CISR Working Paper 52, March 1980.

information systems fulfillment but also possess the required skills.

Users need and desire considerably more training in general DP issues.[13] Needs recognition, identification of appropriate systems type, assessment of project risks and organizational impacts, justification of systems development expenditures, clarification of systems functional requirements, and capability to participate effectively in systems development are all user responsibilities. The more capable users are in these managerial aspects of systems needs fulfillment the more successfully their needs will be fulfilled.[14]

Beyond this, users must recognize that DP cannot provide enough systems to meet all their needs. After stringent prioritization of needs, users must seek alternative sources to obtain some of their systems. How successful these alternatives become depends heavily on users capabilities and establishing a new working relationship with DP.

It is the user departments and the corporation as a whole which suffers the lack of information systems, not DP. Users should not be passive, uninvolved recipients of systems. Users' acceptance of their integral responsibility and role in systems fulfillment must be backed by significantly increased capabilities.

Senior Management

Senior management must recognize the increasing impact of information systems on corporate performance. Corporations are enabled or inhibited by their ability to perceive and respond rapidly to environmental change;

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[13] "User Needs Survey: Preliminary Report", Robert M. Alloway, et al, MIT, Sloan Working Paper 1096-79, December 1979.

[14] "User Capabilities and Their Relation to DP Success", Robert M. Alloway and Vivian R. Pratt, MIT, CISR Working Paper, forthcoming.

plan and coordinate departmental activities; and execute functional tasks efficiently and effectively. Information systems are already affecting corporate competitive positions and promise to become significant, although transparent, differentiators of corporate success.[15]

Once this is recognized, senior management must communicate its position. The importance of information systems must be recognized throughout the organization if their potential benefits are to be effectively realized.

Senior management, without an action arm, can only enable. A DP Steering Committee must be created -- an effective one. To have the DP Steering Committee review the progress of individual systems development projects is a mis-use of senior management time. Rather, the critical management issues raised by these empirical results should be addressed by the Steering Committee. The Steering Committee must enable, coordinate, and support the necessary strategy-structure changes in DP and User departments.

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[15] "The Information Revolution: Winners and Losers", Harvey L. Poppel, Harvard Business Review, Jan-Feb 1978, p. 14.

EXHIBIT 1

PROFILE OF INDUSTRIAL FIRMS SURVEYED

FIRM	PRODUCTS	SALES* (000,000)	DP BUDGET* (000,000)	DP/SALES* PERCENT	NUMBER OF RESPONDENTS
1	EQUIP MFG	110	2.2	2.0%	11
2	ANALOG ELEC	50	1.0	2.0%	34
3	DIVERSE MFG	240	2.4	1.0%	16
4	CHEMICAL	65	0.5	0.8%	16
5	AEROSPACE	700	5.5	0.8%	12
6	DIGITAL ELEC	67	0.36	0.5%	25
					114

* DIVISION OR USER COMMUNITY OF DP DEPARTMENT STUDIED

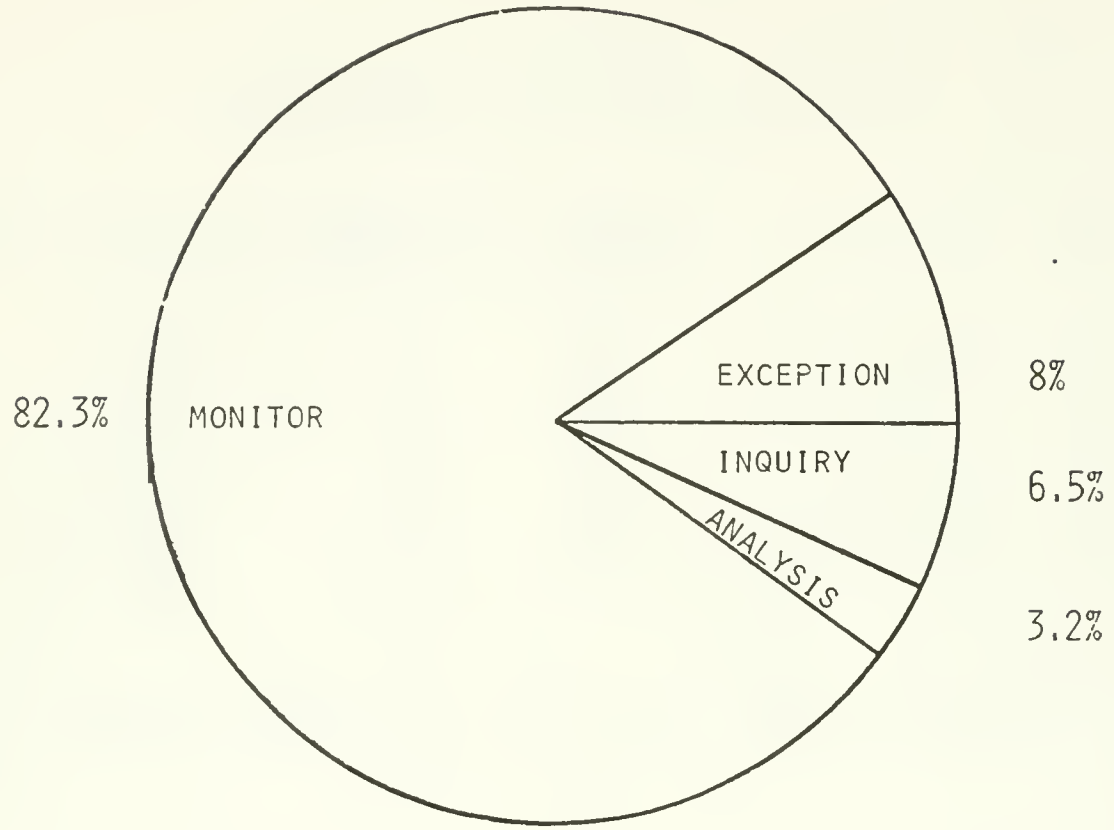
EXHIBIT 2

PROFILE OF SURVEY RESPONDENTS

AVERAGE SALARY (000)	LEVEL*	DP	MANUFACTURING	FINANCE	TOTAL
44	1	6	5	4	15
31	2	3	11	12	25
25	3	9	21	9	39
20	4	15	13	6	34
	TOTAL	33	50	31	114
	RESPONSE RATE	97%	91%	89%	92%

* HIERARCHICAL LEVEL WITHIN DEPARTMENT

EXHIBIT 3



INSTALLED BASE BY SYSTEM TYPE

	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
COUNT	228	22	18	9	277
PERCENT	82.3%	8%	6.5%	3.2%	100%

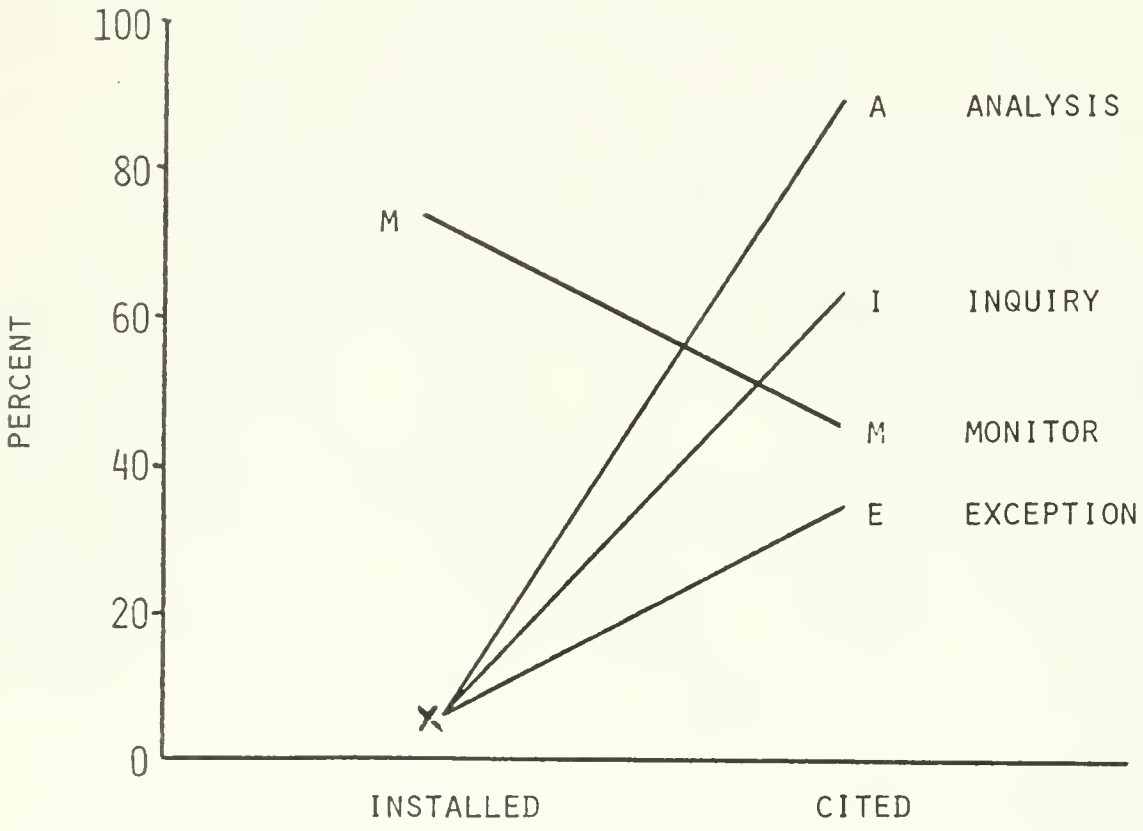
EXHIBIT 4

SYSTEMS TYPES FOR IMPORTANT TASKS

	NONE	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
COUNT	79	120	9	12	9	229
PERCENT	35%	53%	4%	5%	4%	100%
COUNT		120	9	12	9	150
PERCENT		80%	6%	8%	6%	100%

EXHIBIT 5

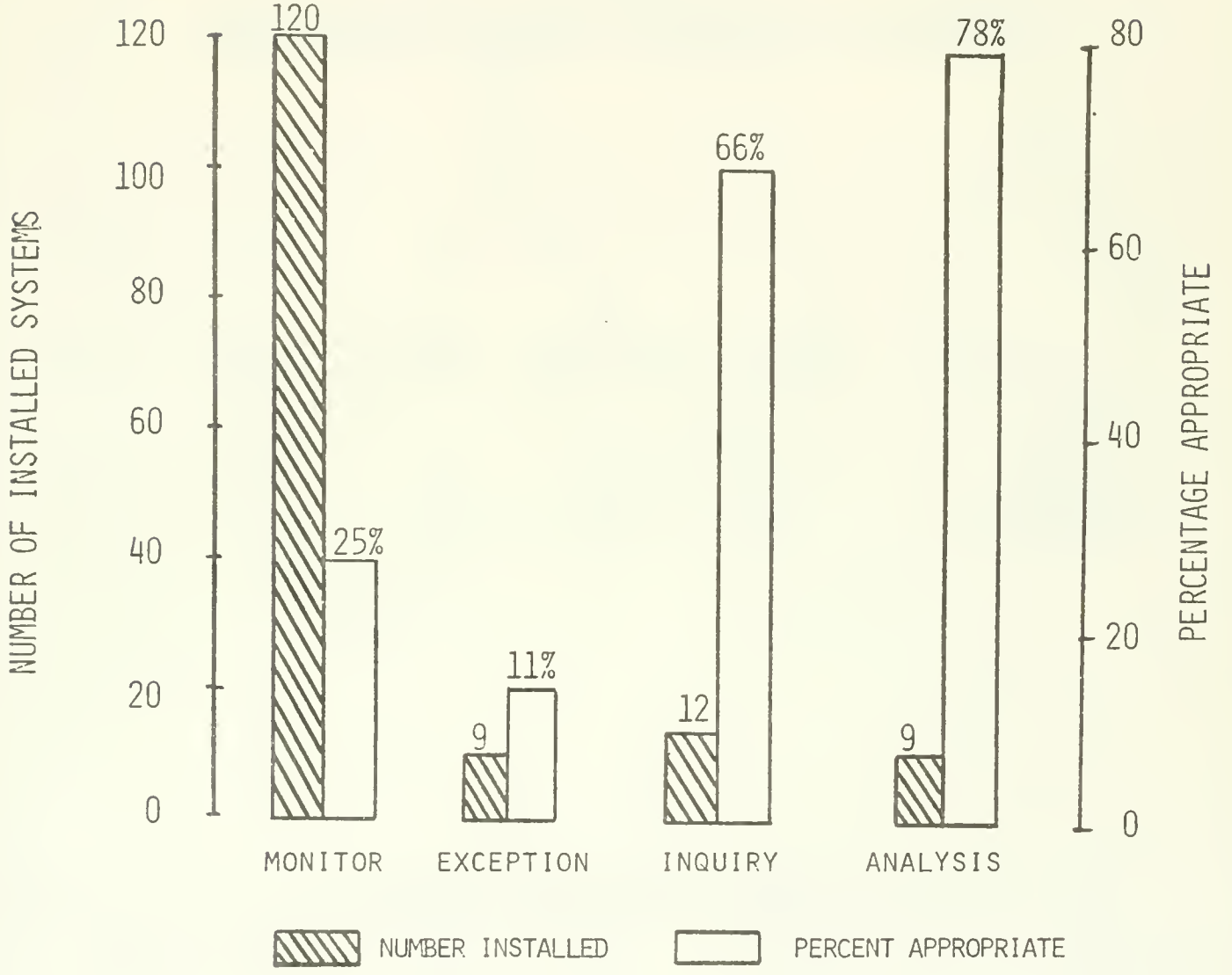
SYSTEMS CITED WITH IMPORTANT TASKS



	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
INSTALLED BASE	228	22	18	9	277
CITED IMPORTANT	120	9	12	9	150
PERCENT	53%	41%	67%	100%	55%

EXHIBIT 6

APPROPRIATENESS OF SYSTEMS TYPE FOR IMPORTANT SYSTEMS



	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
INSTALLED, CITED	120	9	12	9	150
NO. APPROPRIATE	30	1	8	7	46
PERCENT	25%	11%	66%	78%	31%

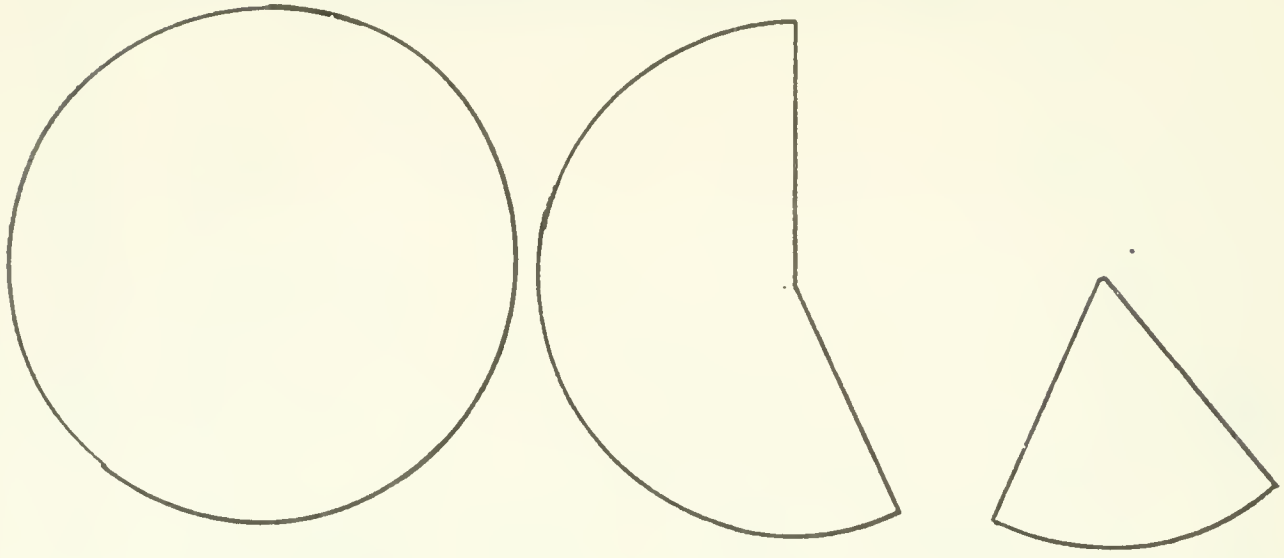
EXHIBIT 7

DESIRED TYPE FOR MONITOR SYSTEMS CITED IMPORTANT

	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
ACTUAL	120				
DESIRED	30	14	42	34	120
PERCENT	25%	12%	35	29	100%
				64%	

EXHIBIT 8

USERS' PERSPECTIVE ON THE INSTALLED BASE



100%
INSTALLED

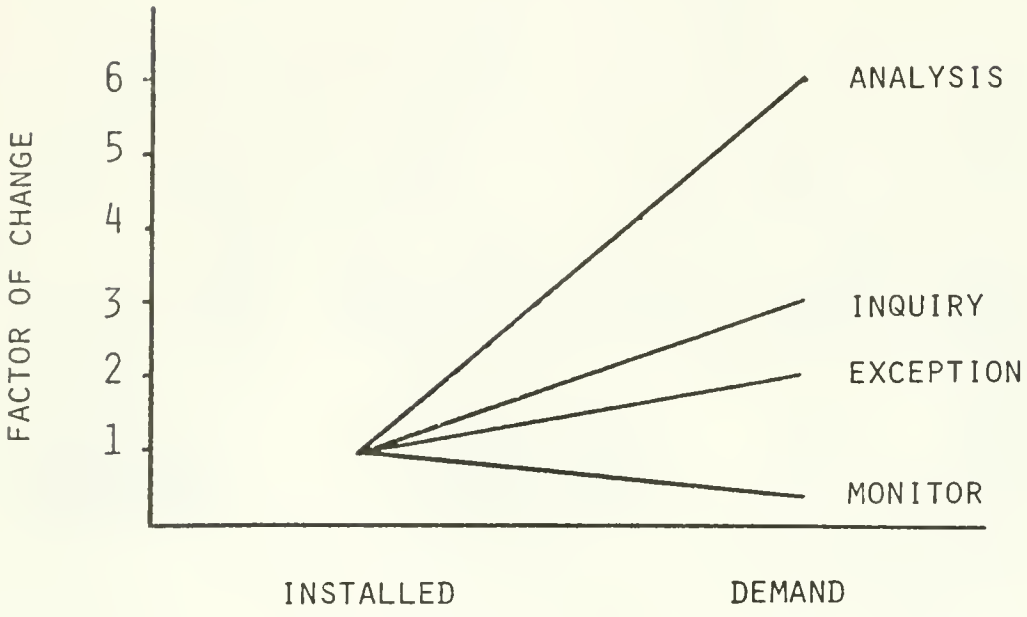
54%
INSTALLED
IMPORTANT

17%
INSTALLED
IMPORTANT
APPROPRIATE

	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL	
INSTALLED BASE	228	22	18	9	277	
IMPORTANT CITED	120	9	12	9	150	54%
APPROPRIATE	30	1	8	7	46	31%
% APPROP/BASE	13%	5%	44%	78%	17%	

EXHIBIT 9

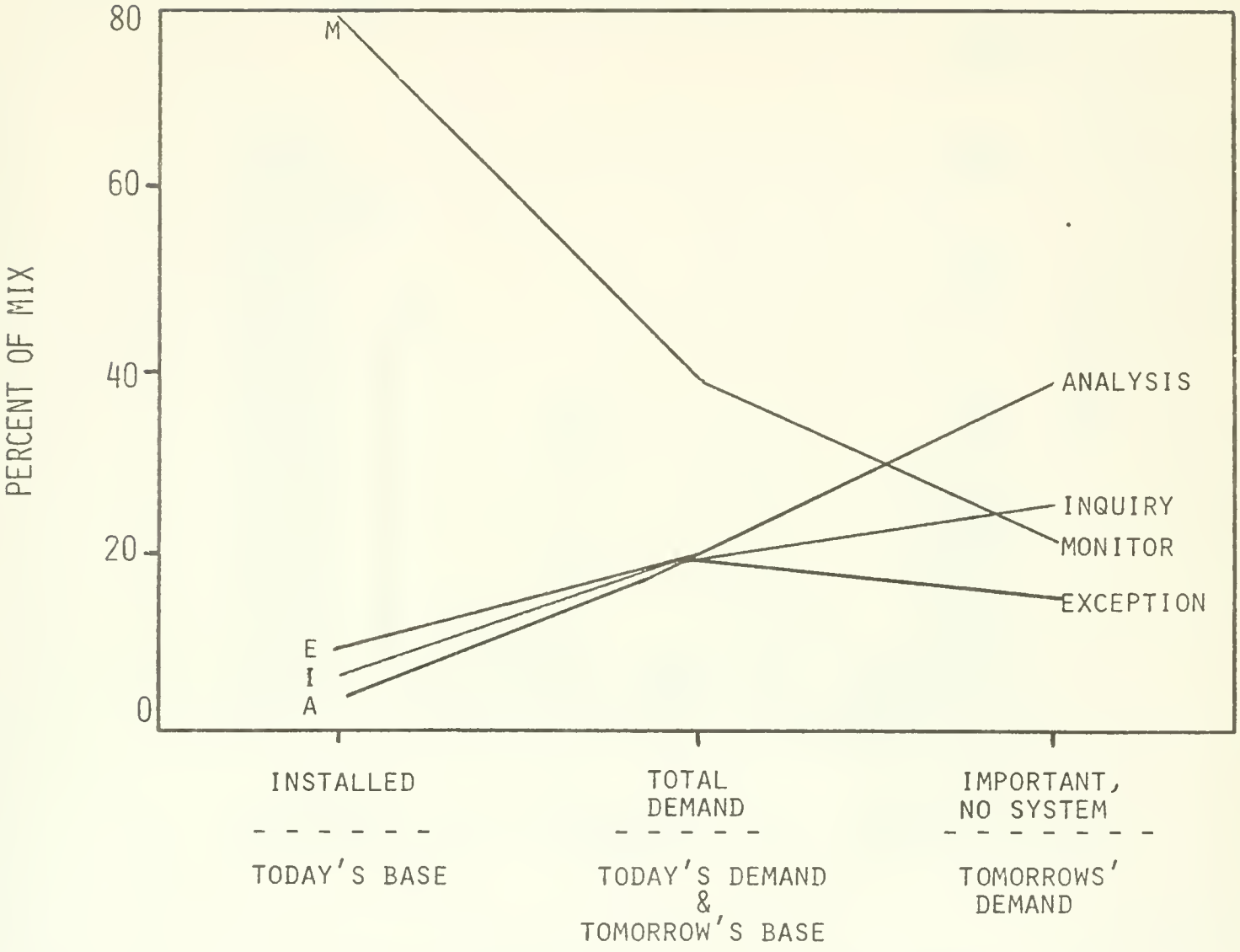
SHIFT IN USER DEMAND (PERCENTAGES)



	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
INSTALLED BASE	82.3	8	6.5	3.2	100%
KNOWN BACKLOG	43.6	16	19	21.4	100%
INVISIBLE BACKLOG	38	23	20	18	100%
TOTAL DEMAND	40	20	20	20	100%
CHANGE	1/2	x2	x3	x6	

EXHIBIT 10

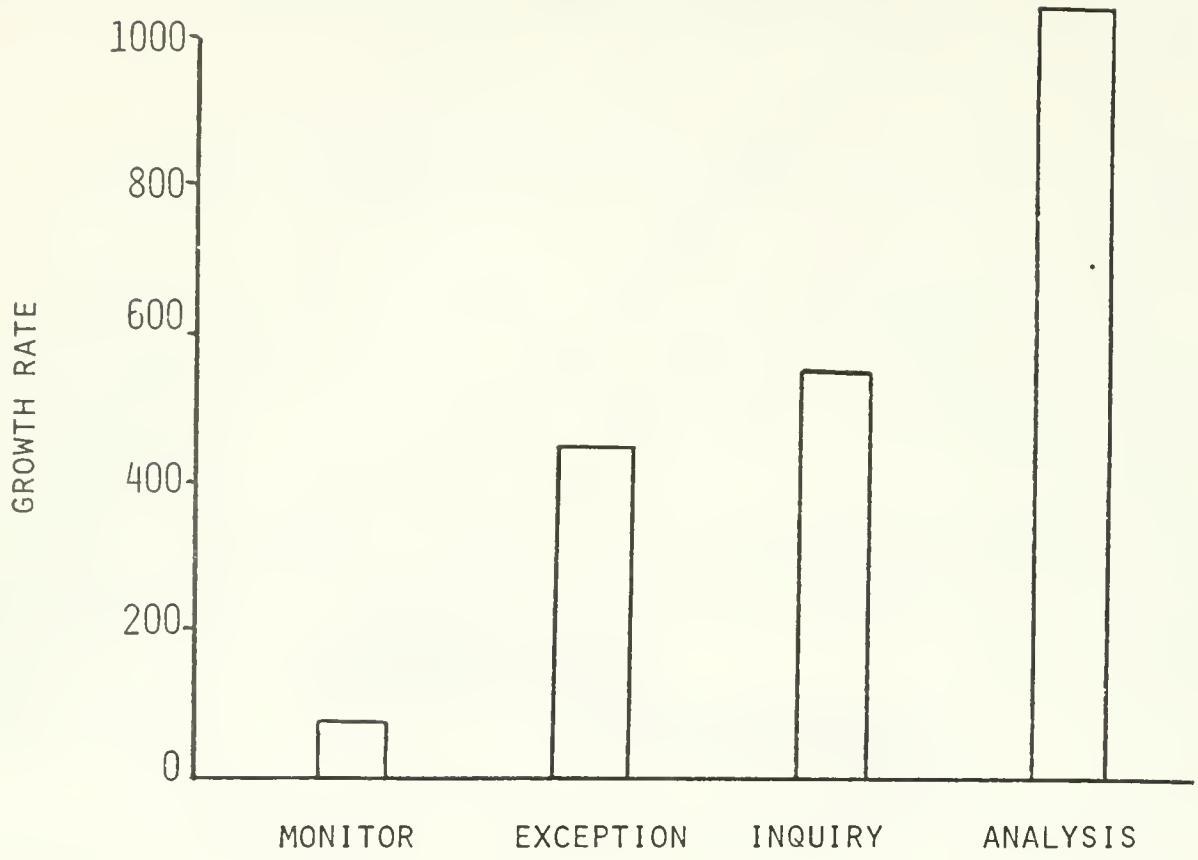
PROJECTED DEMAND MIX OVER TIME



	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL
INSTALLED BASE	82.3	8	6.5	3.2	100%
TOTAL DEMAND	40	20	20	20	100%
IMPORTANT, NO SYS	22	12	26	40	100%
CHANGE (BASE TO IMPT., NO SYS)	1/4	x1.5	x4	x12	

EXHIBIT 11

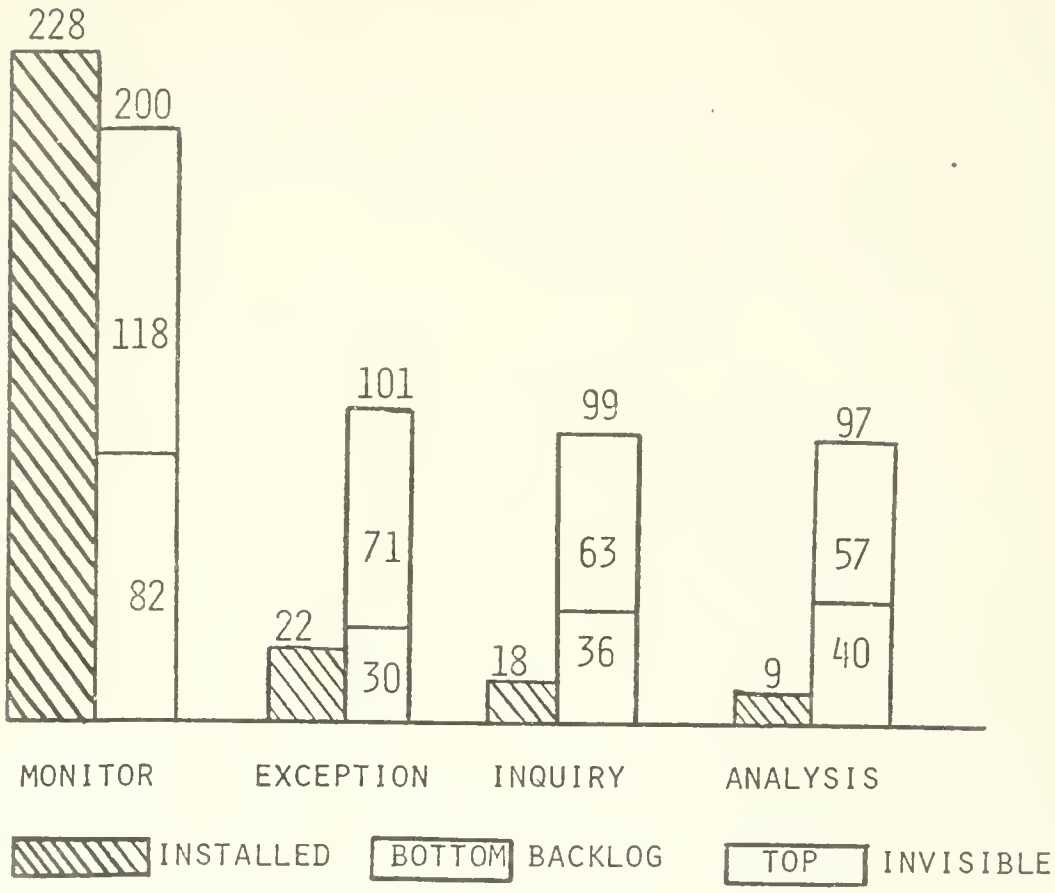
NEW SYSTEMS DEMAND GROWTH BY TYPE



	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL	
INSTALLED	228	22	18	9	277	68%
BACKLOG	82	30	36	40	188	164%
INVISIBLE	118	71	63	57	309	
TOTAL DEMAND	200	101	99	97	497	
GROWTH	88%	460%	550%	1077%	179%	

EXHIBIT 12

VOLUME OF NEW SYSTEMS DEMAND BY TYPE



	MONITOR	EXCEPTION	INQUIRY	ANALYSIS	TOTAL	
INSTALLED	228	22	18	9	277	68%
BACKLOG	82	30	36	40	188	
INVISIBLE	118	71	63	57	309	164%
TOTAL DEMAND	200	101	99	97	497	
GROWTH	88%	460%	550%	1077%	179%	