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The Integration of  
Information Systems Planning  
into  
The PLEXSYS Environment  
by  
J. Andrew Pettigrew III

A report Submitted in Partial Fulfillment  
of the Requirements for the Degree  
of Master of Science  
(Management Information Systems)  
in The University of Arizona

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## ABSTRACT

The PLEXCenter has developed a number of group decision support tools to enhance the decision making process. This paper proposes a new application for the PLEXCenter tools in the Information Systems (IS) planning environment. Models for organizational Strategic, Theater, and Tactical IS planning are proposed, and frameworks for implementation of the planning models using the PLEXCenter tools are developed. The frameworks make use of the existing PLEXCenter tools and, when a new tool is required, design specifications are presented to meet that new requirement.

*Keywords: Theater, Strategic, Tactical, systems engineering  
for design, integrated information systems (IIS)*

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CHAPTER I  
INTRODUCTION

The field of information systems (IS) planning has been and continues to be the subject of intense study and speculation. A number of frameworks have been developed to help an organization implement IS. These frameworks address the broadest range of systems from a database to a decision support system and are adaptable to a wide variety of organizational IS planning environments.

IS planning is intended to develop automated support for the organizational user. The organizational user can be anyone in the organization from the executive to the customer. Effective IS planning will consider every user, even the chief executive officer, in speculating how to provide the best automated support to a user. There is no doubt that an effective IS will enhance the company's competitive edge but how does the company know where to concentrate efforts (Benjamin, et al, 1984; Cash and Konsynski, 1985). The central question in the IS planning process still remains how best to design and implement an IS to support the user in accomplishing productive



organizational work.

Failure of an IS is determined by the user in all cases and is usually the result of ineffective IS planning. If the system is used, it is a success. There is no other pertinent description for success (Powers and Dickson, 1973). Five common assumptions made by designers of IS which consistently led to system failure are listed below (Ackoff, 1967 and Lederer and Mendelow, 1986). These assumptions are : (1) managers generally lack relevant information, (2) managers need the information they want, (3) decisions will improve when the manager has the information he needs, (4) better communications between managers improves organizational performance, and (5) the manager needs to only know how to use the system. It is very clear that making these assumptions in the IS planning process will encourage a poor system design and eventual system failure.

Navigating through the mine field of IS planning is obviously a difficult task. The planners must have a thorough knowledge of the organization, the internal and external users in the organization, the current capabilities of the organization, and the current industry and organizational environment. Also, the planner must ultimately have a crystal ball to determine future trends in technology and the industry.

The automated support for the organization must be

planned (Ball, 1982). In most cases, IS planning is left to chance or worse yet, to the sole design of the IS department. To compound the problem, system development may also be of an ad hoc nature. These tendencies in IS planning consistently lead to system failure (Lederer and Mendelow, 1986; and Miller and Strong, 1986). IS planning requires the involvement and commitment of users, planners, and technicians at all levels in an organization.

The University of Arizona has developed a decision laboratory known as PLEXCenter (Applegate, et al, 1986). The laboratory uses a number of in-house developed, stand alone tools to aid the planning and decision processes. The main tools available are: Electronic Brainstorming (EBS), Issue Analysis (IA), Issue Consolidation (IC), Voting, Enterprise Analyzer (EA), the Knowledge Base (KB), Policy Formulation, and Stakeholder Identification and Assumption Surfacing (SIAS). There are also several other tools in various developmental stages. Among these are: Electronic Mail, a problem analyzer, a threat/opportunity identifier, and the Knowledge Base Input System.

The stand alone nature of the tools encourages the flexibility often required for effective support of the decision making goals of the various groups using PLEXCenter. In this aspect, the PLEXCenter users can step out of the traditional use of PLEXCenter as a problem solving environment and convert it, through a different sequence or combination of tool use, to create a planning

environment. In reality, the flexibility of the PLEXCenter may encourage a larger variety of usages than presently imagined (Konsynski and Nunamaker, 1982).

The purpose of this paper is to develop frameworks of IS planning using the tools of PLEXCenter. The frameworks developed will apply an existing PLEXCenter tool when appropriate. For example, if a planning framework calls for a brainstorming session, the EBS tool will be specified. In the case where the the tools available do not support the framework, design specifications will be suggested to meet the framework requirements. The design specifications will either propose a modification to an existing tool or the development of a new tool. The frameworks will also describe the sequence of tools used in the IS planning processes. Finally, methods will be suggested to test and refine the frameworks developed through research opportunities.

## CHAPTER II

### PLANNING FRAMEWORKS

An organization accomplishes IS planning at three levels, the strategic, the theater and the tactical levels. The accomplishments of each level are different and targeted to specific functions within the organization. Each planning level also involves different groups of planners. The three levels, although quite distinct as presented in this paper, are less distinct in small organizations and well defined in larger organizations. For example, a small organization may see no need to perform the theater IS planning that is required in a larger organization. This characteristic of IS planning will become clear as the three levels are described. Figure 1 shows the overall IS planning process. Figure 2 shows the data flow in the IS planning process. These two figures will serve as the basis for further discussion.

Three levels of IS planning are supported in the literature (Ball, 1982; Crescenzi, 1982; and McLean and Soden, 1977). Described is an overall planning process that first looks for opportunities outside the organization that

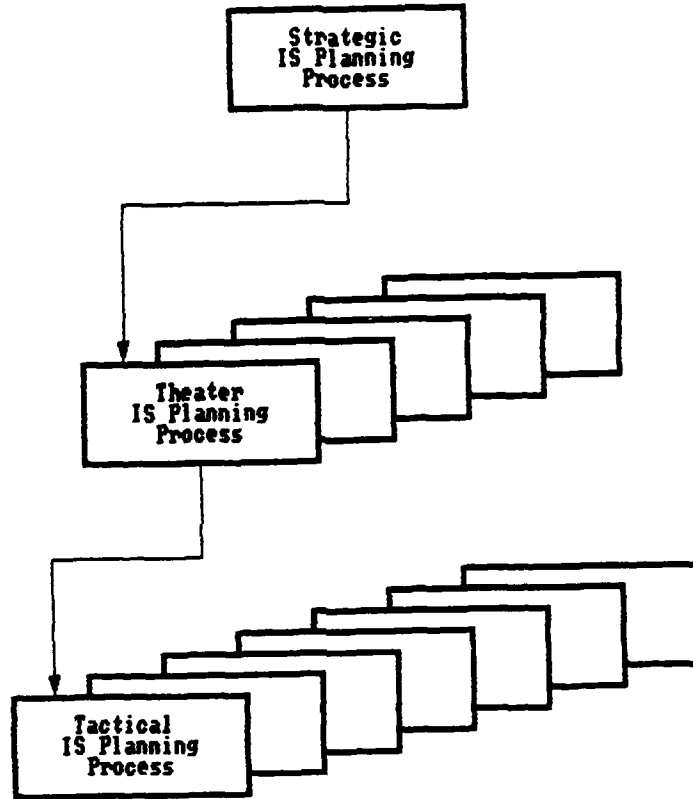


Figure 1. The IS Planning Process

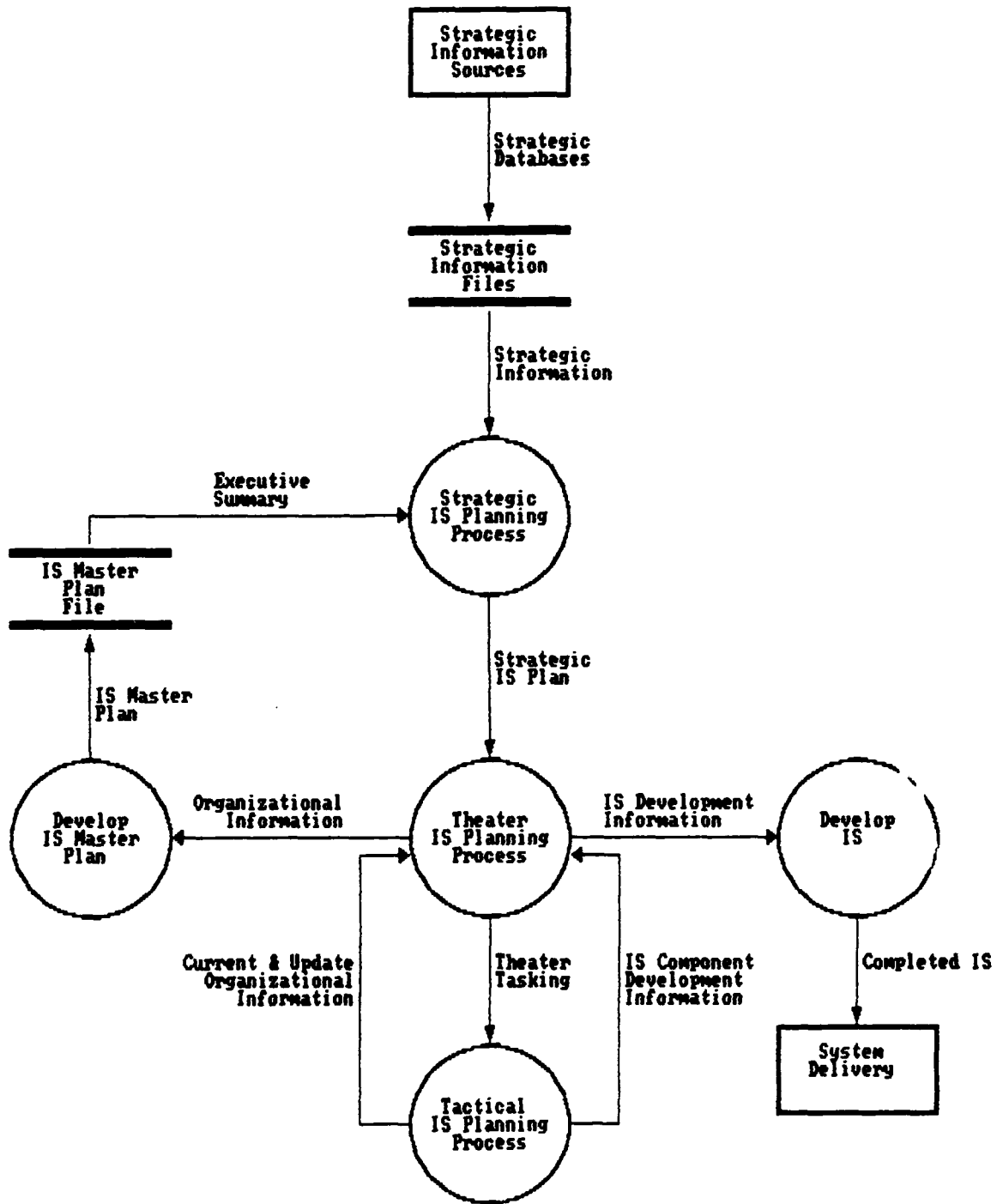


Figure 2. Data Flow in the IS Planning Process

may be valuable to the organization. This step in the planning process is universally labeled as the strategic IS planning process, and is best described as opportunity analysis.

The IS planners next work to develop an integration scheme to take advantage of the opportunities identified in the strategic IS planning process. This second process is defined with many labels, some of which are managerial control level, tactical control level, organizational information requirement analysis, strategy formulation or resource development. In this paper, this planning level will be referred to as theater IS planning. The term is borrowed from the concept of the military operations theater of battle planning. In this context, theater refers to an intermediate sized field of operations.

In the third and final planning process, the strategic opportunities are integrated into the organization at the tactical IS planning level. This third level is also known as operational control level or resource allocation level. Again, the tactical label was borrowed from the military term which refers to the smallest or local field of operations.

The relationship among these three planning functions was shown in Figure 1. From a top down perspective, each planning process will spawn lower level processes. From a bottom up perspective, each planning process is one of

several processes supporting a higher level process. Therefore, the Strategic IS Plan will spawn several Theater IS Plans, which in turn will each spawn several tactical IS projects. This model of the overall planning process can easily support the entire IS planning needs for any organization.

The IS planning process is tailorable to organizational needs through modification of the theater IS planning process. This modification does not diminish the importance of theater IS planning functions, it only diminishes the formality of the IS planning process. The strategic and tactical planning levels are fairly discrete and provide, the direction and the working level of the overall process, respectively. There is inherent flexibility in the IS planning process because of the ability to collapse processes and eliminate the theater IS planning level. For example, the theater IS planning process can be absorbed by either the strategic or the tactical process to shorten the entire IS planning process. In this manner, an organization can quickly implement a new system with minimum planning. Conversely, if an organization feels the need to accomplish an IS Master plan, which will be described later, the theater IS planning process can be carried out to the fullest extent and made a permanent part of the IS planning process for that organization. In a third alternative, the theater IS planning process is treated as a special project. The organization can develop the IS Master Plan through the



theater planning process and, upon completion, the responsibilities of the theater level can be collapsed into either the strategic or the tactical level. This alternative activates the theater level when needed, and then eliminates it when the project is completed. Organizational and project size are the main determinants of the number of planning levels in the IS planning process.

Each of the individual IS planning processes will now be discussed in detail. Also the framework for that process will be presented and explained. As stated earlier the frameworks have been developed to be implemented using the tools available at PLEXCenter. These frameworks were developed with the existing capabilities of PLEXCenter in mind. If the planning process was not completely compatible with the available tools, design specifications were developed to meet the requirements. Those new tools or modifications are discussed in the later section and the specific design specifications are found in the appendices of this paper.

#### II.1. Strategic IS Planning:

Strategic IS planning is the highest IS planning level in an organization. This level evaluates the internal and external influences that will effect the IS strategy that will be implemented by an organization. The strategic planners will have and receive a wide spectrum of information that will be used in the planning process. The

most vital information for the strategic planner is first, knowledge of the organization, and second, knowledge of the technological capabilities of the organization and the industry. This information is essential for effective strategic IS planning.

Strategic IS planning involves scanning the internal and external environment to discover opportunities for implementing IS technologies in the organization. Strategic IS planning must be sensitive to the organizational goals and support organizational objectives. Therefore, an extensive knowledge of the organization will help improve the effectiveness of the strategic IS planners. For these reasons, the strategic IS planning staff should be made up of the organization's top executives.

The ability of the organizations top executives to judge the impact of information technology is an obvious point of concern. These executives by themselves are not able to adequately evaluate the broad subject of information technology. The decisions made by the strategic IS planning staff will have an organization wide and potentially an industry wide impact. This concern is definitely valid considering that technology decisions of this nature may be seen as a function of the IS organization. However, there is no group of individuals better positioned to make these types of decision than the organization's top executives. Considering also that the strategic IS planning staff has the research and recommendations of the IS organization and

the Strategic Business Plan in hand, the staff can take advantage of these favorable circumstances to make effective strategic IS decisions.

Strategic IS planning begins with the organizational goals and objectives as determined by the organization's executives. The organizational goals and objectives serve as a base from which the strategic IS planners develop guidance for the developmental efforts of the IS organization. This guidance is contained in the Strategic IS Plan and is used to develop lower level IS plans.

The most valuable document to the strategic IS planner is the Strategic Business Plan for the organization. The Strategic Business Plan will contain the organization's mission statement which clearly states the business of the organization. The document should also contain the business goals of the organization and priority for accomplishing those goals. There will be a wealth of information in this plan that is invaluable to the IS planners in developing IS goals for the organization. Specific guidance for the IS organization may also be found in this plan. Armed with the Strategic Business Plan, the strategic IS planner is well prepared to begin development of the Strategic IS Plan. This plan will serve to focus current and future IS development efforts within the organization.

The main problem encountered in the strategic IS planning process is its potential disconnect with the

organization's goals and objectives. This can happen when the strategic IS planners do not have those goals and objectives in hand. This is not just a problem to the IS organization, but to the entire organization because the planners may develop an IS strategy that does not support the business. It is therefore imperative that the planners obtain the Strategic Business Plan for the organization.

Another issue in strategic IS planning is the awareness of the technological trends in the industry. This awareness can be facilitated by the IS organization. The IS organization can be tasked to assess the current technology and future trends which may impact the industry and the organization. The IS organization can then provide recommendations to the strategic IS planning team to help determine the strategic IS goals and priorities. The process demonstrates the bottom up development capability of the IS planning process. The strategic tasking to the IS organization drives a feedback loop which reaches the user level through requirement analysis at the theater and tactical IS planning levels. This feature will become apparent through discussions of the lower planning processes later in this paper.

Several authors describe a pre-planning orientation for strategic IS planning. The orientation is intended to acquaint the strategic planners with important internal and external IS opportunities and considerations (Hayes, 1985; Benjamin, et al, 1984; Crescenzi, 1982; Camillus and

Lederer, 1985; El Sawy, 1985; King and Cleland, 1975; King and Cleland, 1977; King, 1978; King, 1983; and McLean and Soden, 1977). The orientation can take the form of a strategic database, position paper, expert briefings, or any other format designed to provide information to the strategic IS planners. Since the IS organization is best qualified to research and appraise current and future IS technologies, it should be the focal point for developing the IS technology orientation information.

The strategic IS planners must also avoid the tendency toward blue-sky planning in the development of the Strategic IS Plan. Unrealistic planning can hamper the real growth of an organization (Shank, et al, 1973). A balance of creativity and practicality emphasizes the development of manageable strategic IS programs for the organization. This is important because too many IS organizations are bogged down by overzealous plans. These overly optimistic plans may cause the IS organization to become overburdened with projects and unable to effectively meet the ad hoc needs of the IS user. This in turn may project a poor corporate image for the IS organization as a do nothing organization, always behind schedule and unable to provide service to its' customer.

A balance of creativity and practicality must be established at the strategic IS planning level to help curb overoptimism. The planners must work within budget, operations, marketing, and all other business constraints.

The planners must recognize that a bottom up orientation for project development that meshes with the top-down approach for project identification will better match organizational capability with strategic expectations. Finally, strategic IS planning must be done within the scope of the Strategic Business Plan to support the business objectives.

A well developed Strategic IS Plan will not only provide a basis for effective support of the existing business strategy, but will also provide a means to create new business opportunities (Rockart and Scott Morton, 1984). This is an important concept for business planning. There are numerous examples where a business has gained a strategic advantage over its competitors through an innovative application of IS technology. The most commonly cited examples are: an airline reservations system, a financial planning system, and a hospital supply system (Benjamin, et al, 1984; Ives and Learmonth, 1984; and Rackoff, et al, 1985).

The phenomenal success of the above examples highlight the potential competitive advantage that a well conceived Strategic IS Plan can produce. The "five forces" model is used to identify strategic business opportunities in order to improve the competitive advantage for the business. The five forces must be evaluated in the strategic IS planning process. (McFarlan, 1984 and Vitale, 1986). The model poses five questions to the IS planners. These questions are: 1) Can IS build barriers to entry? 2) Can IS build switching

costs? 3) Can IS change the basis of competition? 4) Can IS change the balance of power in supplier/customer relations? 5) Can IS generate new products?

Another consideration often overlooked by strategic IS planners that contributes to the failure of a system is accurately judging the long range impact of a new technology. This misjudgment often results in a weakening in the organization's market position and, if the organization was the innovator, this weakening can be in equal or greater proportion to the initial strengthening experienced by the implementation. The following is an example of one failure (Vitale, 1986).

A bank developed a new account reporting procedure for their customers. The new procedure generated a comprehensive account report that allowed the customer to analyze the various accounts held with the bank. The customer could determine from the report the best way to consolidate the accounts to gain the best interest rates and the lowest banking service charges. The system, from the customers standpoint, was very favorable. The bank experienced a growth in new customers and the new and old customers chose the less expensive and more profitable accounts. The result was that the bank was now paying more interest to her customers and not receiving the service charges it formerly earned. This incurred a profit loss to the bank. By giving the customers more information through the account report, the customers were better off but the

bank was losing earnings. The strategic IS planners in the bank failed to properly assess the long range impact of the new technology.

Finally, the strategic IS planning process requires iteration through periodic review and/or update. The process may be repeated yearly, biyearly, or at whatever frequency deemed necessary to keep the plan current with the technology and the changes in the strategic direction of the organization. Currency is an important basis of the competitive edge of an organization.

In summary, strategic IS planning will provide the organization with the direction for IS development. The planners must be among the organization's top executives, and with the help of the IS organization, must be aware of the current and future technologies available to the organization. They must moderate blue-sky thinking with the organizational constraints. They must watch for strategic opportunities for the implementation of IS technologies, and they must discover the long range impact of those new technologies. The strategic IS planners, with the help of the IS organization, will determine the strategic IS goals.

#### II.1.1. The Output:

The output of the strategic IS planning process is the Strategic IS Plan. This document notifies the organizational executives and the IS organization of the strategic IS priorities for the organization. The plan



contains policy statements and guidance for IS development. The time span of the plan may well extend into the future to accomplish the strategic goals of the organization. This plan should be flexible enough to allow contingencies with that flexibility accomplished through an effective review and update process.

The Strategic IS Plan provides the starting point for subsequent IS planning processes. As Figure 3 shows, the strategic goals contained in the strategic plan can provide the necessary guidance to develop either a theater or a tactical IS goal. The size and scope of the proposed project will determine the IS project developmental path. If the strategic goal requires a search for new system development, an IS Master Plan and a Theater IS Plan will be developed through the theater IS planning process. If the strategic goal provides clear project guidelines, a tactical IS project will be developed and the theater IS planning process will be adsorbed by the strategic and tactical planning processes.

The Strategic IS Plan is given to the IS organization for further action regardless of which IS project development path is required. The Strategic IS Plan serves as a guideline in the application of IS technology throughout the organization. The IS organization is the controlling and implementing organization for the Strategic IS Plan. This is required for the controlled growth and the effective development of IS capabilities in the

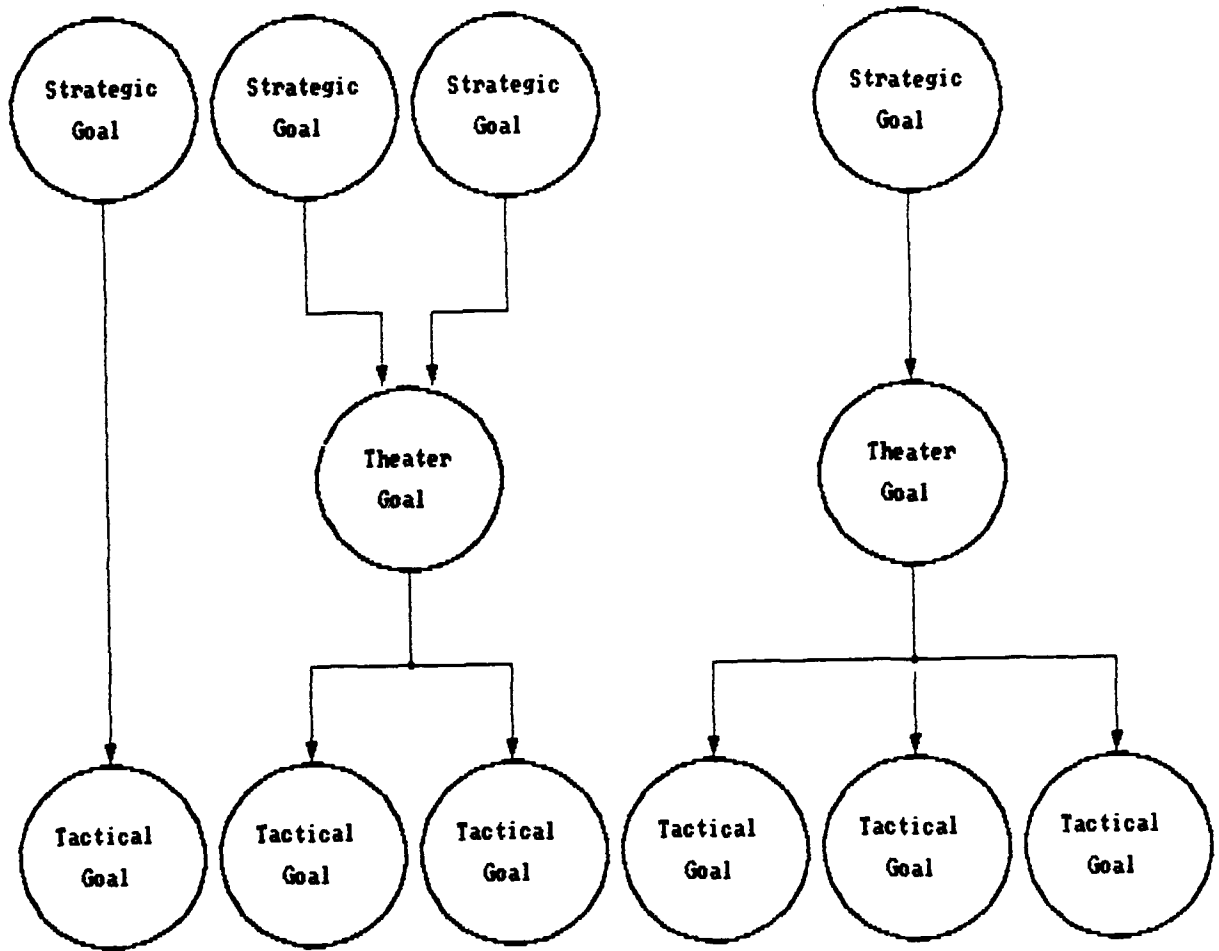


Figure 3. Strategic goals drive the creation of other goals.

organization. Uncontrolled growth in any area creates an internal control problem in the organization. Additional control measures are provided by the planning process itself through upwardly directed inputs to higher level plans. Therefore, control of the planning process occurs both externally through the Strategic Business Plan and internally through the lower level control processes. In summary, the Strategic IS Plan provides notification to the organization and activates control measures for the overall IS planning process.

#### II.1.2. The Process:

The process of developing the Strategic IS Plan begins with the selection of the planning team members. As described earlier, the team members are selected from the top executives of the organization. Selection of the team members should be done by the chief executive officer. Pre-planning orientation information which is made of strategic business and technological information, is gathered and presented to the planning team for evaluation. In the final step of the process a Strategic IS Plan is developed and presented to the organization. This description of the process is intentionally brief in order to show the obvious simplicity of the planning process. An automated procedure to support this process will consequently be simple to design and require only a few of the PLEXCenter tools.

The planning process for strategic IS planning is best illustrated in an article describing the determination of IS needs of a small business (Taylor and Meinhardt, 1985). Although the process was specifically developed for a small business, the generalized steps are also applicable to the strategic planning process for larger organizations. Figure 4 is a process flow chart adapted from the model of the Delphi method for determining information needs and generating a request for proposal (Taylor and Meinhardt, 1985). The chart illustrates the flow of the strategic IS planning process. The process begins with the selection of the planning team followed by the discovery of strategic business and technical information for the planning process. Development of the main points of the plan are determined through discovery and synthesis based on the strategic information gathered for the process. Next, each of the main points are individually discussed and analyzed according to business and technological constraints. When a main point has been thoroughly analyzed, a consolidated position on that main point is developed. An analysis is accomplished for each main point until all points have been considered. The result of this iterative process is a set of policy statements developed around the main points which were derived from the information gathered at the beginning of the planning process. These policy statements will form the skeleton of the formalized Strategic IS Plan.

This planning process has several advantages. First,

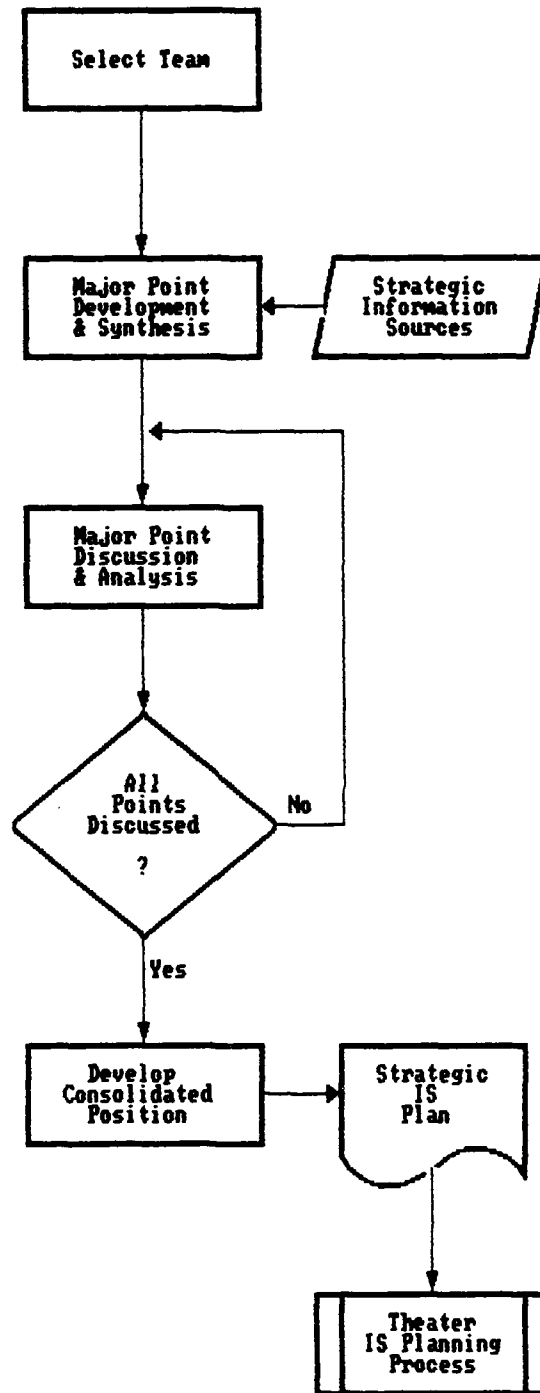


Figure 4. Flow of the Strategic IS Planning Process

the planners have, at the beginning of the process, access to important business and technical information. The planners will develop from that information the main IS issues facing the organization. This step helps assure organizational and technological issues are considered from the start and encourages a balance of creativity and practicality in the planning process. Another advantage is the consolidated position developed by the planners through the discovery and synthesis of issues surrounding each main point. In light of the composition of the strategic IS planning team, this step will help unify the organization's support of the Strategic IS Plan. Finally, the iterative process helps assure a thorough examination of each main issue developed to help determine the long range implications of the issue.

#### II.1.3. The Framework:

The framework that implements the model for strategic IS planning into the PLEXCenter environment is shown in Figure 5. The framework applies five of the tools available in the planning laboratory. These tools are Issue Analyzer, Issue Consolidation, Electronic Brainstorming, Voting and Policy Formulation. These tools are used in a specific order to best support the objectives of the strategic IS planning process developed above.

The planning process at the PLEXCenter begins with the development of pre-planning orientation information for the

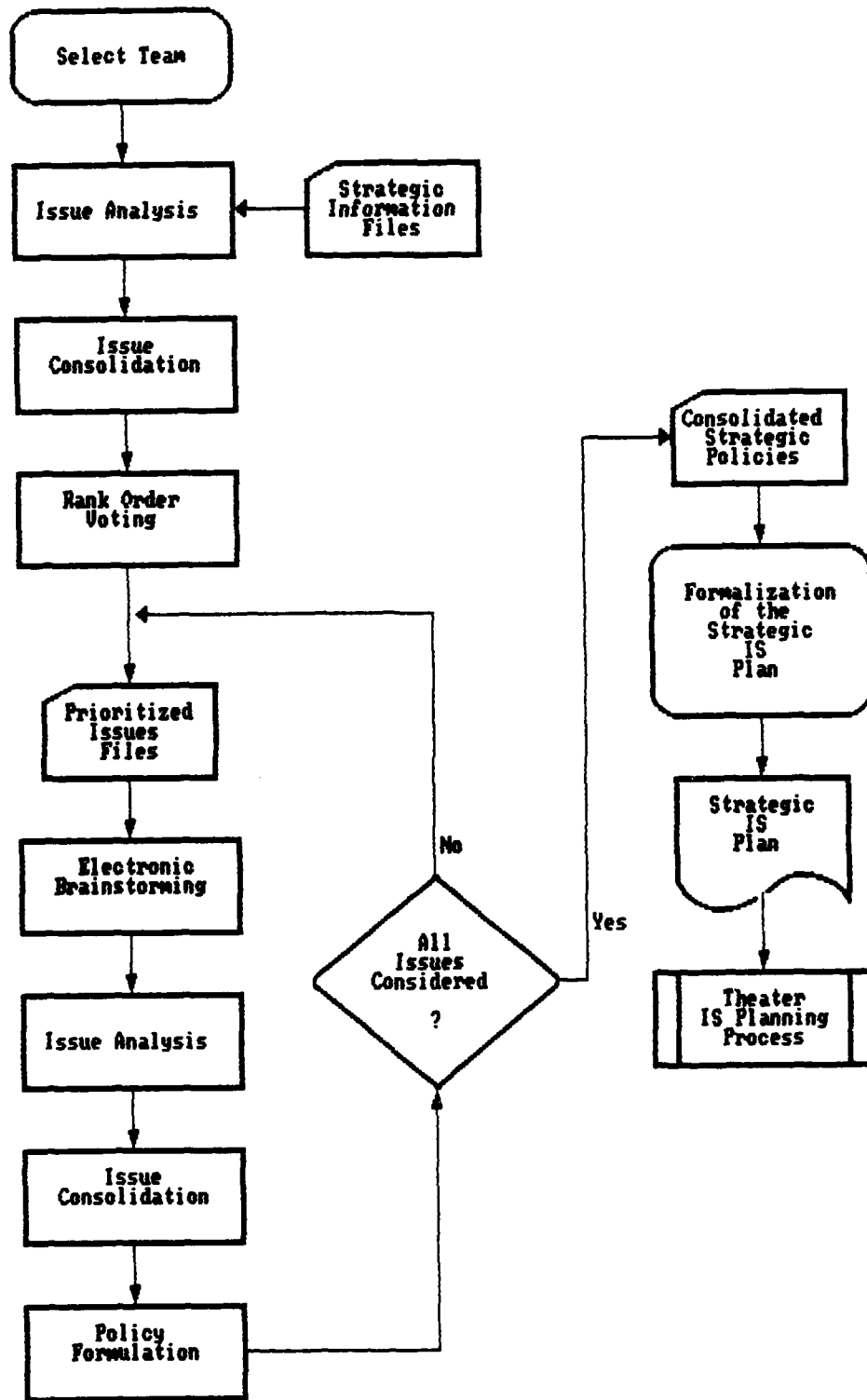


Figure 5. Framework for the Strategic IS Planning Process Using PLEXCenter Tools.

initial Issue Analysis session. This orientation information includes the Strategic Business Plan, the most current Strategic IS Plan, current and future trend in IS technology that may effect the Strategic IS Plan, recommendations from the IS organization, strategic business considerations for budget, government regulations, etc., and/or any other information necessary for the team to develop the Strategic IS Plan. The orientation information may be made available to the planners in either of two forms; electronically created text files or information briefs.

The text files may be built using any means available, but should be in a format that is compatible with the PLEXCenter tools. For example the recommendations from the IS organization may be developed through a PLEXCenter problem solving session. This process will be discussed further under the tactical IS planning framework. The Strategic Business Plan may be developed in a similar manner. The development of the Strategic Business Plan is a standard procedure at the PLEXCenter and will not be discussed here. Current and future trends in IS technology are developed through research conducted by the IS organization. This research can be a part of the theater IS planning process or the result of a special project activity and developed on another electronic media. Currently, the PLEXCenter tools can convert ASCII text files into an appropriate form.



Alternatively, any or all of the required information may be presented as briefs. Briefs are either formal briefings to the planners or position papers prepared for the planners. The purpose of the orientation information is to assure that enough information is provided to fully support the strategic IS planning process without causing information overload to the planners.

The orientation information will be the basis of an IA session. Here, the session facilitator should emphasize the thorough generation of issues and allow the planners as much time as necessary to complete the task. The purpose of the IA session is to generate as many potential issues as possible based on the orientation information and the planners corporate experience. Also IA should not concentrate heavily on developing supporting rationale for each issue generated because it will be carried out in a later step.

The next step in the process is consolidation of the generated issues. This step can follow the normal usage of IC as described below. Consolidation is a group effort which shrinks the combined number of issues to between 10 and 20 total issues. This effort will help the planners focus attention and develop a manageable list of main issues to be considered later in the planning session. In this process, the facilitator should emphasize consolidation of similar issues and elimination of clearly extraneous ones. Supporting rationale may be added to explain any obscure

consolidation of issues, but again, this is not the central aim of this step. Rank order voting may follow IC to help the planners determine an order to tackle the issues in the next phases of the planning process.

In the subsequent steps, each issue will form the basis of an EBS question. Each issue will then be analyzed using the traditional pattern of tool usage at PLEXCenter. The traditional pattern of tool usage best supports unstructured problem solving. The aim of this step is to solve the problem of identifying a strategic IS goal. The following is considered the traditional pattern for problem solving. The planners will first analyze the issue in an EBS session. The ideas generated from the EBS session will be presented to the group for IA and IC. The supporting rationale is an important ingredient at this point because the consolidated issues and rationale will be used as input to the policy formulation process to develop the strategic IS goals and objectives.

An alternate process for the step above involves the use of the Threat/Opportunity Identifier tool under development at PLEXCenter. In this process each issue is examined for threats to and/or opportunities for a strategic IS goal. An output file is created for use by policy formulation. This process does not encourage the thorough examination of an issue allowed by EBS. It does however, focus attention on the effect of the issue to the business. Another drawback of this process is the lack of an

individual Threat/Opportunity Identifier tool. Currently this tool is used as a group discussion tool. An individual Threat/Opportunity Identifier tool would offer the advantage of the EBS tool, namely, a time savings and enhanced idea generation through anonymity. This capability for the tool is already under consideration at PLEXCenter. A combination of the EBS and Threat/Opportunity Identifier tools may provide a strong analysis option to be considered in the more difficult planning issues.

The output files developed from the analysis of each main issue are then made available to the policy formulation tool. This tool will develop the wording of the strategic IS goal statement. The analysis files will provide a basis from which each planner will develop the wording of the individual goal statements. An output file of all the individual goal statements developed in policy formulation is then returned to the planners for consolidation into a single statement. This capability must be developed for the policy formulation tool. The design specifications are discussed in Appendix A. The facilitator must take an active role at this point to help the group establish the precise and unanimous wording of the single goal statement. This action will speed up the subsequent planning process. Once the wording of the goal statement is established, it is added to an output file. When goal statements have been developed for each of the major issues, the output file containing those goals is prepared for rank order voting.

The purpose of voting at this stage is to determine priority for the goals.

The prioritized list of goal statements for the Strategic IS Plan is now ready to be transformed into the Strategic IS Plan. This can be easily accomplished through an administrative function. The administrative function will take the list of goals and any other appropriate product of the strategic IS planning process and develop the wording of the plan. This function is responsible for document preparation and distribution to the effected internal business organizations. These organizations include the strategic IS planning staff, the strategic business planning staff, the IS organization and other interested organizations.

With the exception of the initial IA session, a strict time constraint should be imposed on the planning process by the facilitator. EBS should be no longer than 25 minutes. This time limit may also be appropriate for the subsequent IA, IC, and etc., sessions. Time limits will speed the development of policy and help the group to focus on the task at hand. The time limits are of course flexible and at the discretion of the facilitator.

The output of the strategic IS planning process, the Strategic IS Plan, is now available for the remaining planning processes and serves to provide the top down guidance necessary for effective IS control in the

organization.

## II.2. Theater IS Planning:

The theater IS planning can consume the largest portion of the time and personnel resources available to the IS planning process (Sprague and McNurlin, 1986). This expenditure of resources is easily justified since the process will produce the backbone of the organization's IS strategy and will therefore have a significant influence on the strategic IS goals for the organization.

The theater IS planning process will develop several different documents, the IS Master Plan, the Theater IS Plan, and several summary documents. Each document has a special purpose and are each necessary to effective IS planning in the organization. The IS Master Plan influences both the Strategic IS Plan and the tactical IS planners. The IS Master Plan serves as the consolidation of all IS strategies and information within the organization. Where consistent review and update of the Strategic IS Plan is necessary as was shown in previous sections, a current IS Master Plan is essential to the overall IS planning process. The second output of the theater IS planning process is the Theater IS Plan. The Theater IS Plan is a document used to control the implementation of the Strategic IS Plan at the tactical IS planning level. The last set of documents produced by the theater IS planning process are the summary documents. These documents are executive summaries and are

directed at the strategic IS planning staff and contain the pre-planning orientation information that was described earlier as part of the strategic IS planning process.

The IS Master Plan is the result of traditional IS planning. This was the first type of plan that an organization accomplished and uses the most fundamental planning methods available to the planner. The plan is geared to the identification and analysis of user requirements and will produce a snapshot of the organization's IS capability and needs. This snapshot of the organization, if not updated with the changes in the organizational IS structure, will eventually prove to be a liability to the overall IS planning process. A current IS Master Plan can facilitate a quick assessment of the organization's IS capability. For this reason, IS Master Plan update is important to allow planners to analyze the current systems to make accurate recommendations to the strategic IS planners. This can be in response to a proposed strategic IS planning goal or merely as a reply to an ad hoc question.

The Theater IS Plan is derived from the Strategic IS Plan as was shown in Figure 1. The Strategic IS Plan may generate several Theater IS Plans which support the goals described in the Strategic IS Plan. Further, each Theater IS Plan may generate any number of tactical IS projects. The Theater IS Plan also allows the IS organization to control the resources of the tactical IS planners. The plan

also allows the IS organization to direct the efforts of the tactical IS planner. Through these capabilities, the Theater IS Plan aligns IS development work with the Strategic IS Plan and allocates the resources of the tactical IS planners.

Theater IS planning is intended to meet the overall needs for IS development control, system analysis, and requirements definition in an organization. When an organization begins the theater IS planning process, it is committing to an extensive, organization wide study of the current systems and the projected IS needs of the organization. Second, it is making a long term commitment to updating the plan when changes in the organizational IS structure occur. Finally, the theater IS planning process can be bypassed in some instances to shorten the IS planning process. This point has been discussed previously.

The main problem facing the theater IS planner is the need to thoroughly understand the user's requirements and expectations. This is not only the main problem but it is the main task for the theater IS planner because the user is the key factor in IS development. Regardless of the type of system to be designed, the success of the system is in the hands of the user. The many ways available to analyze the users needs all have a common feature. Each method recommends a series of interviews with the user. As can be expected, this step traditionally takes the most time in the theater IS planning process.

Another problem faced by the theater IS planner is getting the support of top management. Failure to accomplish this is a strategic threat to IS success. If the boss doesn't actively support the project, it will never be accepted. Through the planning process described in this paper, high level management acceptance and support of the IS effort is developed from the start. The top-down orientation of the process requires the initiation by and participation in the IS planning process by the organization's top executives. The IS initiatives are derived from the Strategic Business Plan and passed to the theater IS planners in the form of the Strategic IS Plan. Top down management support is developed through the successive analysis of the strategic goals at each IS planning level.

Theater IS planning serves as the interface point for both top-down and bottom-up concerns in IS planning. In this planning process the business concerns are matched with the user requirements. Conflicts between the two points of view are resolved and direction to the lower level planning process is developed. Here is also found major justification for a thoroughly developed IS Master plan. With the user information contained in the IS Master plan, matching the business initiatives contained in the Strategic IS Plan with user interests in the IS Master Plan becomes a very easy task for the theater IS planners. This work will result in the development of the Theater IS Plan.



Business concerns will sometimes conflict with user needs. This implies that some user requirements will not be met and further implies that business concerns outweigh the user needs. This statement is not as alarming as it may appear on the surface. This may seem to be a contradiction to the criteria of success of a system. This contradiction is resolved by the theater IS planner as stated above. The theater IS planner is the interface between tactical and strategic IS planners.

The theater IS planner is the source of technological information for the strategic IS planner and therefore recommends strategic business initiatives to improve the organization's competitive edge in the marketplace (Ives and Learmonth, 1984; King, 1978; and Rackoff, et al, 1985). The tactical IS planner is part of the IS organization and collects user requirements. The theater IS planner, who is also part of the IS organization, receives the user requirements from the tactical IS planner and provides a second recommendation to the strategic IS planners. This recommendation is a prioritized list of IS interests developed from user requirements. Through this, the users' needs are presented to the strategic IS planners (Hayes, 1985). These two recommendations are the IS organization's input to the strategic IS planners who are directing the company's IS strategy and who will decide what initiatives will best support the goals described in the Strategic Business Plan. With this information in hand the theater IS

planner can temper both the technological and the user interests recommendations to best support the organization.

The theater IS planning process also serves as a shield for the strategic level from tactical IS development. This shield translates IS technology into a language that can be understood and analyzed by strategic IS planners and top management. This translation also encourages stronger support for IS organizational initiatives. The theater IS planning process also shields tactical IS planners from the strategic IS planners. This helps to focus tactical efforts into productive areas by translating strategic IS goals into appropriate tactical level taskings. The shielding provided by the theater IS planners takes the forms of the IS recommendations to the strategic IS planning process and the Theater IS Plan to the tactical IS planning process.

Several methodologies have been developed to describe and support the theater IS planning process. Two of the more prominent ones are IBM's Business Systems Planning (BSP), and Business Information Analysis and Integration Technique (BIAIT) (Carlson, 1979; IBM, 1975). Newer techniques that are being integrated into a planning environment include Critical Success Factors (CSF) (Crescenzi and Reck, 1985), Quick Environmental Scanning Technique (QUEST) (Nanus, 1982), and Creativity Assessment (Shank, et al, 1985). Each of these techniques explore different aspects of the business environment to discover internal capability and external opportunities to implement

new technologies. These techniques emphasize the importance of analysis at the theater IS planning level.

The analysis process is the most prominent activity in theater IS planning. This process involves extensive information gathering and assimilation and produces the IS Master plan. The planners interview every potential user of a system or proposed system and also those users who may or may not have a need for a system. This comprehensive effort is necessary to provide the planners with information to create the best picture of the organization. A familiar tool used in this process is the data flow diagram (DFD). The DFD serves as a basis for information representation methods. The DFD is converted into system information for analysis by the theater IS planners (Paige-Jones, 1980). Analysis also involves the synthesis of the mass of information gathered about the organization into a meaningful product that can be used by both planners and implementors. The analysis must therefore be both upward and downward oriented in regard to the organization, considering both the strategic and the tactical interests.

The theater IS planning process must be concerned with several issues. The first, as in strategic IS planning, is to be sensitive to the needs of the business. A solid business orientation will lead to a well developed set of system priorities. The appropriate priorities will develop effective tactical IS project plans and proper emphasis on the user's needs. It is therefore clear that the Theater IS

Plan is the focal point of the integration of the business objectives as relayed in the Strategic IS Plan and the user needs as identified through analysis process of the theater IS planning process itself.

#### II.2.1. The Output:

The output of the theater IS planning process is the IS Master plan, the Theater IS Plan and a series of summary documents. Each document has a specific purposes. The main document, the IS Master plan, is the compilation of the information gathered in the analysis process of the theater IS planning process. The Theater IS Plan is the synthesis of the Strategic IS Plan and the IS Master Plan, and provides direction to the tactical IS planning process. The summary documents are directed at the strategic IS planners and top management. These summaries are derived from the IS Master Plan and contain the IS organizations recommendations for input to the strategic IS planning process. The outputs of the theater IS planning process serve to describe the organization and provide a flow of information to the other IS planning processes.

The IS Master Plan is the IS profile for the organization. It is used by the system designers to assess current capability and identify future IS requirements. The requirements can be summarized and provided as recommendations to the strategic IS planners in response to strategic concerns or expanded to provide tactical planners

with the beginnings of a prototype system. The IS Master Plan is the theater IS planner's starting point for both upward and downward directed system planning

The IS Master Plan contains organizational structure, organizational mission, industry information, user information, system descriptions, data information, and all other relevant information used to describe the organization, and the current and planned uses of IS. The plan is a powerful planning tool because it is, as described earlier, a snapshot of the organization and the central plan in the overall IS planning process. The theater IS planners will use the IS Master Plan to develop all other theater IS documents. This will be discussed in the following section where the theater IS planning process is described.

The IS Master Plan is necessarily a very dynamic document. It is highly effected by the growth of the organization. Thus, whenever a new capability is added or a system reconfigured, the IS Master Plan becomes outdated. This results in a constant need for review and update of the Plan. Further, the plan cannot be updated just before the call for inputs to the strategic IS planning process either. The IS Master Plan both effects and is effected by the strategic IS planning process. Therefore, in relation to the Strategic IS Plan the IS Master Plan must be updated both before, to account for system changes, and after the strategic IS planning process, to include the new strategic IS requirements.

Further the IS Master Plan effect and is effected by the tactical IS planning process. User needs are first identified at the tactical IS planning level. The tactical IS planner will, with the help of the user, define new IS requirements. Once these are documented at the tactical IS planning level they are passed up to the theater IS planning level where these requirements are analyzed in the framework of the theater IS planning process and possibly included in the IS Master Plan.

The Theater IS Plan is developed when the IS organization receives the Strategic IS Plan. The flow of information used to develop the Theater IS Plan was shown in Figure 2. The theater IS planners analyze the Strategic IS Plan together with the relevant information from the IS Master Plan and develop the Theater IS Plan. The Theater IS Plan contains a synthesis of the strategic tasking and directs the tactical IS planners to begin work. The Theater IS Plan may contain prototyping information, user information, or system information that is necessary for the tactical IS planners to implement a proposed IS. The Theater IS Plan may also be used to direct the tactical IS planners to accomplish research work to either plan a new IS or improve an existing IS.

The Theater IS Plan has a direct influence on the IS Master Plan. The Theater IS Plan eventually results in an updating of the IS Master Plan through the responses to the Theater IS Plan provided by the tactical IS planners. This

result is necessary because of the importance of the IS Master Plan to the organization. Therefore, the Theater IS Plan implements, updates and revises the IS Master Plan through taskings to the tactical IS planners who accomplish the work.

The review and update work associated with the theater IS planning process is necessarily ongoing because of the above influences. At the theater IS planning level, more than at any other, planning and documentation are nearly continuous processes. The output cannot be static because the organization is in constant change and the IS Master Plan is looked to for recommendations and guidance by all IS planners.

#### II.2.2. The Process:

The development of the theater IS planning documents begins in the IS organization. As described above there are several methodologies available to assist the planners in the development of these documents. The process that will be described follows the BSP method (IBM, 1975). The BSP method was chosen for two reasons. First, there has been a tendency to use the BSP method as a basis for most IS planning methodologies. BSP develops basic procedures that are common to all planning methods. The second reason is that PLEXCenter planning tools have been designed to support the basics procedures of the BSP method. The prime example of the influence of the BSP method is the development of

Enterprise Analyzer and the Knowledge Base Input System. A third tool has been developed which has a broad applicability and will be very useful in the theater IS planning process. This tool is the Knowledge Base and, in the IS planning application, is used as a storage device for the model of the BSP method for system analysis (Chen and Liu, 1987). These tools support the development of the organizational matrices, organizational structure diagrams and various reports that support organizational IS analysis. For these reasons, the BSP method is used as the basis for the theater IS planning process.

The theater IS planning process is shown in Figure 6. The process uses, as in the strategic IS planning process, a guiding document as the basis for planning. Here, that document is the Strategic IS Plan. The Strategic IS Plan provides direction to the IS organization. The IS organization will initiate the planning process along the guidelines of the BSP process. These guidelines are well described by (Sprague and McNurlin, 1986), and are listed in Table 1.

The beginning of the theater IS planning process is seen when top management asks questions about how information systems can help the business. These questions usually surface in the organization after office automation has shown benefits. The company enjoys the efficiency of the automation in place and begins to wonder what other business advantages may be realized. At this point the



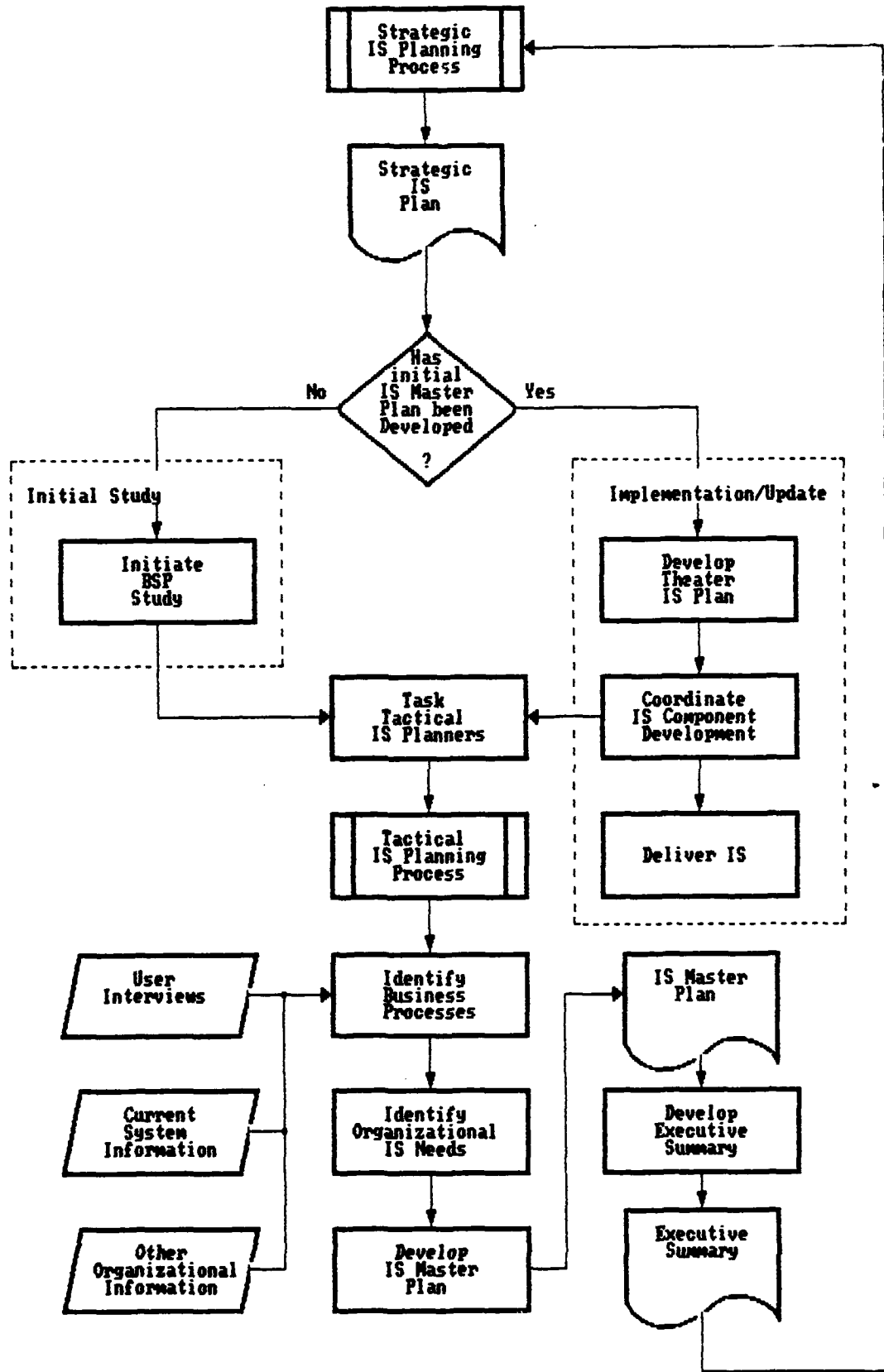


Figure 6. Flow of the Theater IS Planning Process

strategic business planners may ask the IS organization to assess the current capabilities and make recommendations for further integration of IS technology. This is the starting point for IS planning in the organization. Note that no formal process for IS planning is in place.

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Table 1. Steps in a BSP Study.

1. Gain Commitment from Management
  2. Appoint a Study Leader and Prepare for the study
  3. Assemble the Study Team and Start the Study
  4. Define the Business Processes
  5. Define the Business Data
  6. Define the Information Architecture
  7. Analyze the Information Architecture
  8. Link Analysis to Business Objectives and Problems
  9. Report Findings and Conclusions
  10. Determine Developmental Priorities
  11. Review IS Management Practices
  12. Develop Recommendations and IS Master Plan
  13. Deliver IS Master Plan
- 

The IS organization has previously had no formal planning function and has mainly reacted to requests for service from various user groups within the organization. To answer top managements questions, the IS organization must start a BSP study of the organization to get adequate information to make an analysis. The tasking from the strategic business planners is an initial opportunity for the IS organization to capture management support.

The study initiated by the IS organization follows the steps identified in Table 1 to progress through the two BSP stages of identification of the business and definition of

the IS requirements. At the finish of the identification phase of the BSP study, the IS Master Plan is produced.

The involvement of other organizational functions should be developed throughout the identification phase of the study. This type of involvement will enhance the IS organization's ability to gather important analysis information. Also, the formation of the strategic IS planning staff will strengthen the information gathering and coordination ability of the IS organization during the study and throughout system implementation. Formation of the strategic IS staff will begin the formal IS planning process.

The final recommendations contained in an executive summary and derived from the IS Master Plan, are presented to the strategic IS planners along with a request for a decision to proceed. A decision to proceed may be in the form of either a Strategic IS Plan or formal approval to proceed. This decision, in either form, causes the generation of a theater level guidance document, the Theater IS Plan. The Theater IS Plan is the final product of the BSP study, and contains the IS initiatives for the organization and guidance for the implementation of those initiatives. The Theater IS Plan is the guiding document for the tactical IS planning process.

With the development of the Theater IS Plan the initial BSP study is completed and a new round of IS planning at the

theater level begins. This new round is necessary due to the change to the organization that the strategic IS decision caused. A new system may now be under development and the organization must be reexamined for its effect. This does not involve a completely new BSP study, but does require that the original information discovered in the identification phase of the initial study be updated and reanalyzed. The theater IS planning process will create a new set of IS recommendations and priorities which are to be considered in the next strategic IS planning cycle. Thus, once the theater IS planning process is set in motion through the initial BSP study, a consistent effort must be made to keep the IS Master Plan up to date and usable by the IS organization.

#### II.2.3. The Framework:

The framework for implementing the above model of theater IS planning process is shown in Figure 7. The framework calls for the use of several of the available PLEXCenter tools and includes a computer conferencing system that is not currently available. The use of this new tool will be discussed later in this section and the design specifications will be presented in Appendix B. The PLEXCenter tools that will be used to support theater IS planning include the traditional decision tools of EBS, IA, IC, SIAS, and Policy Formulation. The main tools to be used in this process are the Knowledge Base and the Knowledge Base Input System. These two tools will be the workhorses

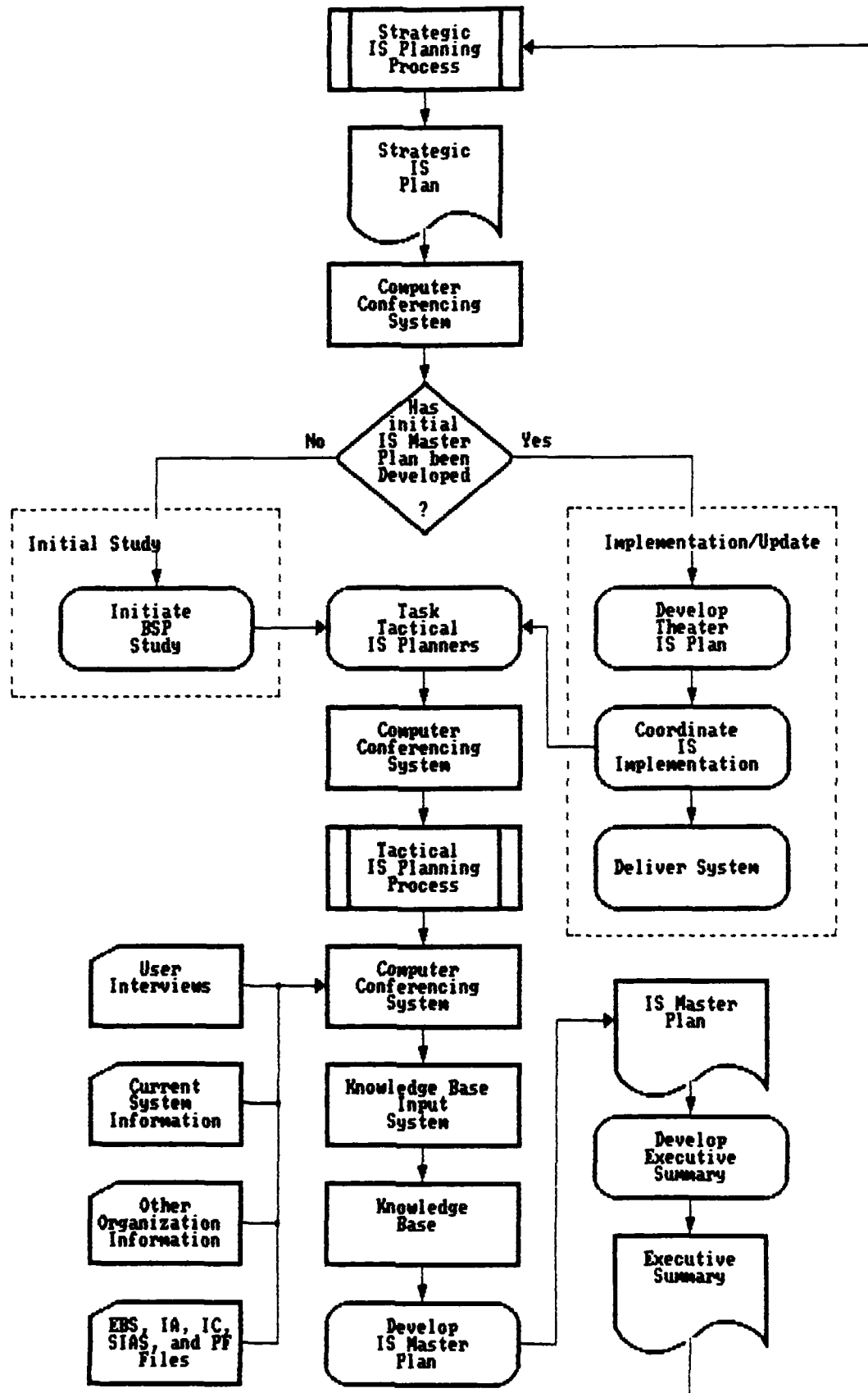


Figure 7. Framework for the Theater IS Planning Process Using PLEXCenter Tools.

in the theater IS planning process.

At this point in the framework discussion, it is assumed that there has been no BSP type study accomplished for the organization and the Strategic IS Plan requires that a study be accomplished. Also it is assumed that a formal IS planning structure is in place. This structure includes all IS planning levels. This point neglects the evolution of the organizational IS planning process, as described in the previous section, which would lead to an initial BSP study. These assumptions were made to streamline the discussion of the theater IS planning framework.

The theater IS planning process using the PLEXCenter tools starts with the transfer of the Strategic IS Plan to the theater IS planning staff. From the basic assumptions defined above, the initial BSP study begins. Also, the initial study team members may eventually be reformed later as the theater IS planning staff for subsequent IS planning activity. The team will begin by reviewing the taskings contained in the Strategic IS Plan and devise an appropriate study strategy. Organizational information will be collected by whatever means necessary, and the computer conferencing system will serve as the repository for the collection and distribution of that organizational information.

There are many techniques and PLEXCenter tools available for information gathering. The study team should

use the most effective means possible. For example, the team may decide that an EBS session is the best information collection method for a particular organizational entity. The results of the EBS session and the following IA and IC sessions will produce a text file that can be transferred to the conferencing system for later analysis. This transfer serves to establish electronic continuity between the two tools and supports the IS planning framework.

One of the major activities of this phase of the study is the interview of organizational IS users. These interviews are intended by BSP to elicit the business and user IS requirements which are important factors in the effectiveness of the study. One way to collect this type of organizational data may be through the electronic Delphi tool under development at PLEXCenter. Again, the output of this tool can be electronically transferred to the computer conferencing system, maintaining the electronic continuity mentioned above.

All organizational information is initially stored in the computer conferencing system. This information must then be transferred to the KB tool to be prepared for analysis. This can be done by transferring the information either directly via a batch loading of the formatted data or through the use of the Knowledge Base Input system currently being refined at PLEXCenter. Both methods require the translation of information gathered and held in the computer conference system into the language used by KB. The

translated information is processed and prepared for analysis by KB. At this point the KB creates a series of reports defining the current IS posture of the organization. The KB can also produce reports on the planned IS for the organization. These planned ISS are identified from the user requirements gathered by the tactical IS planners. The reports generated by the KB are analyzed by the theater IS planners who will develop the IS Master Plan.

The IS Master Plan is produced and maintained by the IS organization and will serve as a baseline for future planning activity. An executive summary, which is derived from the IS Master Plan, is sent to the strategic IS planners for consideration. At this point the IS Master Plan is complete. The BSP process, however is only half done. When the strategic IS planners make a decision on the theater IS planners recommendations, the second phase of the BSP process begins. This second phase provides the framework for the continuing theater IS planning activity.

The second or definition phase of the BSP study is similar to the first in many ways. There is another information gathering process, an analysis process and three documents are generated. The three documents are an updated IS Master plan, the associated executive summary for the strategic IS planners, and finally, the Theater IS Plan which provides guidance to the tactical IS planners. This phase will make use of a computer conferencing system to gather and disseminate information.



The definition process also begins with direction from the strategic IS planners. The Strategic IS Plan calls for the implementation of specific parts of the recommendations contained in the executive summary. A Theater IS Plan is developed from this Strategic IS Plan and provides the direction to the tactical IS planners. Design information is developed at both the tactical and theater levels and analyzed by the theater IS planners. This analysis process is similar to problem solving sessions and needs the same type of electronic support. This support will be discussed further under the tactical IS planning process. The analysis establishes, at the theater level the program management control for system development. System development information is shared between the theater and tactical IS planners via the computer conferencing system and collected at the theater level. The information gathered at the theater level is next used to update the IS Master Plan and produce the next input, the executive summary, to the strategic IS planning process. At this point the process described by the definition phase is in place and will become the formal theater IS planning process.

This phase of the theater IS planning process is very closely linked to the tactical IS planning process. Information is gathered from the tactical planners and is used to update the IS Master Plan. The IS Master Plan is updated with tactical IS information, organizational inputs

and new technology inputs, following each generation of a Strategic IS Plan. Additionally, as shown above, a Strategic IS Plan is generated from an updated IS Master Plan. The theater IS planning process is necessarily reiterative, and very dependent on the strategic and tactical IS planning processes for input.

The theater IS planning process using the PLEXCenter tools is very straightforward and simple. The new computer conferencing system serves as a collection point for planning information. That planning information can be gathered using any combination of the PLEXCenter tools needed by the theater IS planning team. All information is analyzed by the team and is used to generate the IS Master Plan. This simple automated support scheme does not do justice to the complex activity necessary in the theater IS planning process, however, this simplicity reveals a new method of use for the PLEXCenter. This framework takes the tools out of the traditional PLEXCenter environment and makes them distributive decision support systems with a new requirement to support the individual, as well as the group, decision makers. This new concept is carried on in the framework to support the tactical IS planning process.

### II.3. Tactical IS Planning:

Tactical IS planning is the third and final level of IS planning to be considered. It is also the lowest organizational planning level. Tactical IS planning

develops tools, systems, or gathers information as specified in the Theater IS Plan. This function was shown in Figure 2.

Tactical IS planning is both a developmental and information gathering function depending upon the requirements specified in its guiding document, the Theater IS Plan. In smaller organizations where formal theater IS planning does not take place, some of the necessary analysis activity will be accomplished by the tactical IS planning process. This does not mean that all aspects of the theater process are taken over by the tactical process when a Theater IS Plan is not developed. Nor does this mean that these functions are taken over by the strategic IS planners. This means that the information gathered is related to the tactical task at hand. The strategic IS planners will provide the guidance and divide responsibilities for control and documentation of the IS project according to the current organizational structure. In organizations where a theater IS planning activity is present, information would be gathered by and/or for the IS Master and Theater IS Plans as directed by the theater tasking. As shown previously, the determinants for the existence of a formal theater IS planning process is first the size of the organization and second the size of the IS project. The remainder of this discussion will assume that there is a theater IS planning activity.

Tactical IS planning is much smaller in scope and is focused on a specific target. The tactical IS planning process is akin to project management and follows the problem solving framework originally developed by Simon and specified by Huber. The steps in the problem solving framework are shown in Table 2 (Huber, 1980).

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Table 2. Steps in Problem Solving.

1. Explore the Nature of the Problem
  2. Generate Alternative Solutions
  3. Choose Among Alternative Solutions
  4. Implement the Chosen Alternative
  5. Control the Solution Program
- 

The basic approach to the tactical IS planning process is to get to know the user. This is important in each of the IS planning processes but the tactical level is where the success of a project will be realized. Original system specifications are discovered by the tactical IS planners from the user requirements. These specifications will be analyzed and prepared to be passed up the planning ladder for analysis by the higher level planners. Approval to meet the user requirements will come from the theater and strategic analysis, and will be based on the business constraints that were discussed earlier.

The tactical IS planners can be called the IS organization's system analysts. These are the planners that, as said above, will interface with the users to find opportunities for IS implementation. They are the ones who

explore the frontiers of IS technology to discover the potential uses for IS within the organization. They are the workhorses in the overall IS planning process.

The tactical IS planning process is as dynamic as the organization itself. The process will respond to the changing user requirements through identification, documentation, analysis, and implementation. The user of course can be any entity within the organization from the Chief Executive Officer to the customer. The dynamic characteristic of the tactical IS planning process leads to many problems, the biggest of which is, obviously, keeping up with the dynamics of the organization. User requirements can change from the time they are first specified to the time work begins on the project and finally to the time the project is finished. These problems are the classic ones faced by any project manager and are an integral element in the tactical IS planning process.

Another problem faced by the tactical planners is the shifts in emphasis placed on a potential project. This can be demonstrated by an overview of the IS planning process. In an initial attempt to implement IS support to an organization, the theater IS planning process must perform the baseline study. In the initial study, the theater IS planners will task tactical IS planners to specify user requirements. These requirements will be collected and analyzed at the theater level and passed to the strategic level. The flow of user requirements is therefore, from the

lowest to successively higher IS planning levels beginning at the Tactical level. The decision on the projects will flow back down through the formal IS planning chain described previously. This cyclical process is constant in the organization because of the existence of the planning levels. Thus the tactical planners can face a cyclical pattern of expanding and constricting focus in the emphasis attached to IS project identification and implementation.

The tactical IS planner can take on the role of either an analyst or an implementor depending on the requirements of the theater tasking contained in the Theater IS Plan. The Theater IS Plan will describe the overall project goal. The direction to the tactical planner is derived from the various requirements of the system development effort specified in the Theater IS Plan. From the specific direction provided by the Theater IS Plan, the tactical IS planner will set up the project management guidelines and begin work.

The tactical IS planner, in the role of the analyst, will work within the guidelines of the theater tasking to gather the required information for preparing or updating the baseline BSP study. The planner will gather cost data, developmental requirements and any other information required to adequately aid the higher level planners in effectively evaluating the tactical project.

The tactical IS planner, in the role of implementor,

will accomplish tasks in a manner similar to those of the analyst role. Once a project has been identified by higher level plans as a target for implementation, the tactical planners will work with the theater IS planners to begin implementation. The theater planners will serve as program managers and the tactical planners will work as project managers. Information will be gathered and compared to the original baseline requirements. The differences identified will be reconciled and verified with the user. The tactical IS planner will verify cost data, development requirements and any other information needed to begin the project. The project begins with notification to the user and the theater IS planners of the project management and implementation schedule and requirements.

In summary the tactical IS process is alternatively a discovery process and an action process. The tactical IS process follows a project management format for control of the project activity. The process is very user oriented and the success of the project is determined by the user. This subjective assessment of success is a criterion for success at all IS planning levels but is most influential at the tactical IS planning level.

#### II.3.1. The Output:

The output of the tactical IS planning process is the completed portion of the system development work prescribed by the Theater IS Plan. The process will produce either an

analysis of user requirements or the implementation of a user requirement. The process also outputs documentation of the project which is submitted to the theater IS planning process to accomplish the completion or update of the baseline BSP study to develop or update the IS Master Plan. This aids the theater IS planners in the next cycle of inputs to the strategic IS planning process. The tactical IS planning process itself creates several by-products associated with the project management effort. These include milestones, requirements, gnatt charts, and etc.

The by-products of the tactical planning process are used to control the flow of project activity. They are used to formally and informally notify the higher level planners of the status of the ongoing project effort. This information aids in the control of the project and helps assure planners that the project goals are being met.

#### II.3.2. The Process:

The process used in managing the activities of the tactical IS planning process is shown in Figure 8. Activity is initiated by tasking from the theater IS planners and may require either an analysis or an implementation effort. Regardless of the nature of the theater tasking, the tactical planners uses project management techniques to control the activity of the project. The essence of the work at the tactical IS planning level begins first with assembling a project team and acquainting them with the



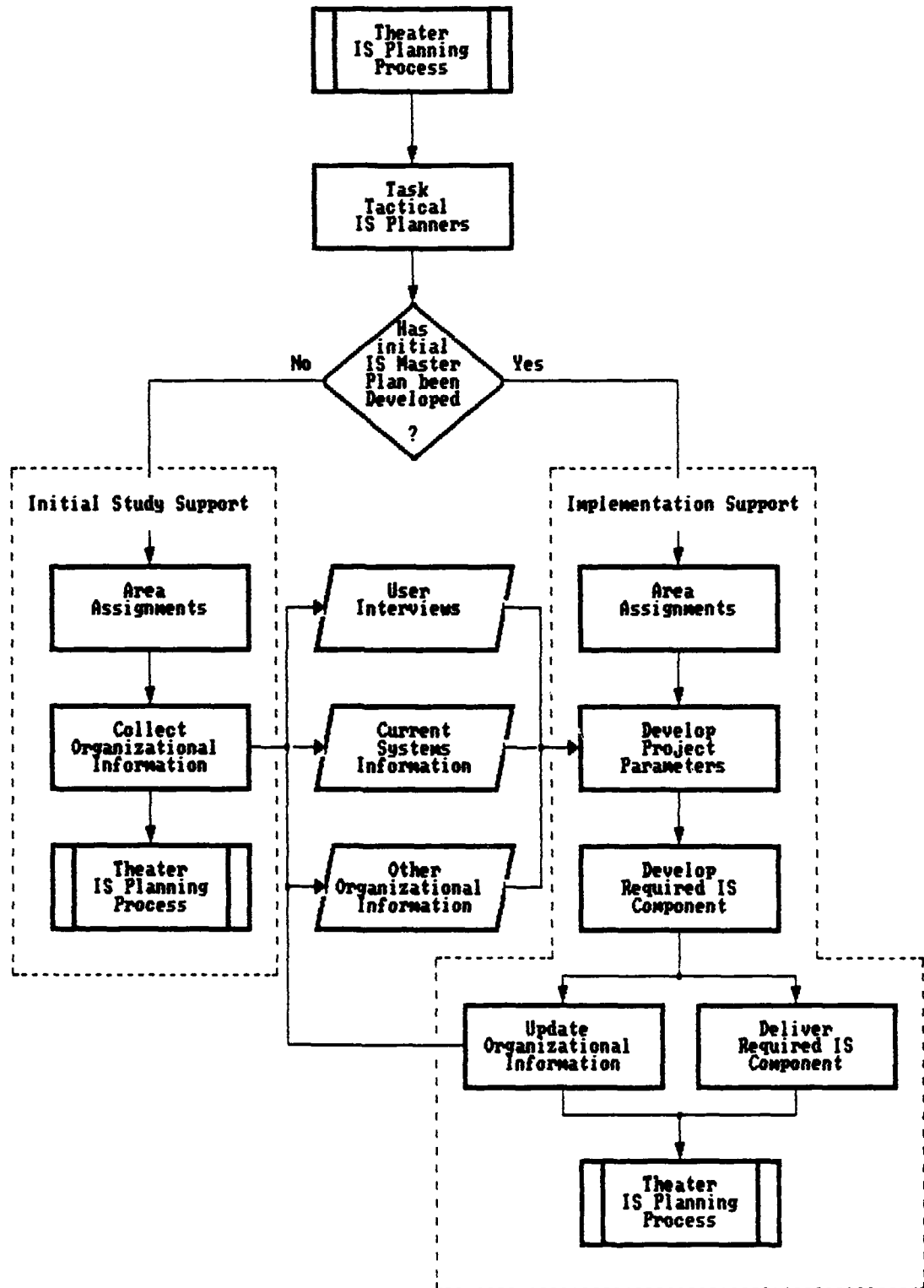


Figure 8. Flow of the Tactical IS Planning Process

project requirements. The tasking will be explored by the planners to determine the various requirements for completing the task. Once all the requirements of the tasking are identified, work can begin. An output is developed and presented to the theater IS planners and the project team is disbanded.

The simplified tactical IS planning process described above follows the problem solving scheme previously described in Table 2 (Huber, 1980). The process is designed to fit both types of tactical IS projects that may be tasked by the Theater IS Plan. Both types of tactical IS project will follow the general steps described above, but will require different specific types of support from the project manager. Those specific differences in the project management support provided will be discussed below.

The process to support the initial baseline BSP study, the analysis project, is a more discovery oriented process. The team is interested in collecting and establishing requirements for IS planning considerations. After assembling the analysis team, the project manager will assign areas of responsibility to each of the team members. These areas are determined from either the inputs received from the potential organizational users or as tasked by the theater planners. The team will consolidate the information and analyze the data to determine recommendations, priorities, and other pertinent information needed by the theater planners. The output of this process is a report of

the study conducted and is provided to the theater IS planners.

The process to support a development effort, the implementation project, will be a definition oriented process. This is different from the discovery oriented project because the team members will be interested in establishing parameters to implement the information developed through the discovery process of the baseline study. Again the project manager will assign areas to each of the team members based on the requirements of the project. The milestones and resource requirements of the project will be determined. The output of this process is the synthesis of the product described in the Theater IS Plan and by the user requirements relayed to the project team during the analysis project. Also the process will provide inputs to the theater process to update the baseline study to create a new IS Master Plan.

The two types of tactical IS projects are very similar. The same process can be used to describe both projects. This similarity will be used later to simplify the framework for the tactical IS planning process using the PLEXCenter tools.

### II.3.3. The Framework:

The framework for Implementing the above model of the tactical IS planning process is shown in Figure 9. The framework calls for the use of two new PLEXCenter tools, a

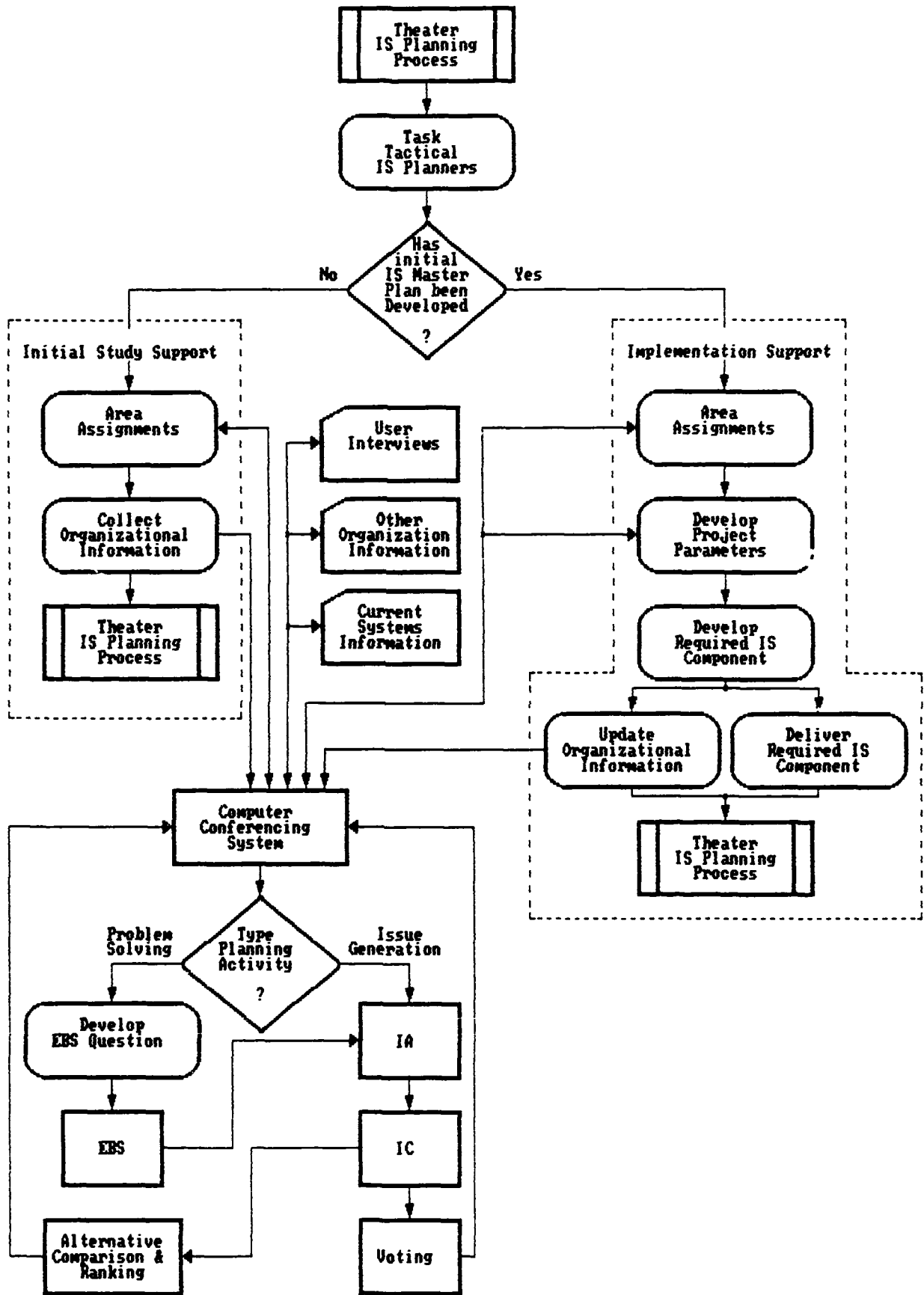


Figure 9. Framework for the Tactical IS Planning Process Using FLEXCenter Tools.

computer conferencing tool and an alternative comparison and ranking tool. The computer conferencing tool was first required for the theater IS planning process and is described in Appendix B. The second new tool required in this process is an alternative comparison and ranking tool. This tool will be discussed later in this section and the design specifications will be presented in Appendix C. The framework also shows a need for the individual use of certain problem solving PLEXCenter tools to support the distributed planning environment.

The framework described for the tactical IS planing process is designed to meet the broad requirements of project management. As such the framework is intentionally cumbersome to allow the fullest possible elaboration of project management activity. Although the framework does not specify tools to monitor milestones and other similar requirements, these project management aids are available through commercially available software packages; Superproject for example. These packages have a place in project management and it is recommended that a suitable compliment be used to augment the project managers work. These software packages will not be discussed here. Instead, the focus of the framework will be on the problem solving support tools available at PLEXCenter. The framework supports an ongoing IS planning process and begins when the Theater IS Plan is passed to a tactical IS planning project manager. As described earlier, the same planning

framework is used regardless of the nature of the theater IS tasking.

Information is first presented to the tactical IS planning process as a tasking from the theater IS planners. The tactical IS planning process can be enhanced if the theater tasking is passed in an electronic form, although this is not necessary. The computer conferencing system can be used to make an electronic transfer. The project manager will next contact his team via the computer conferencing system and explore the tasking using the conferencing system. As shown earlier, the strength of the computer conferencing system is the gathering and dissemination of information (Hiltz and Turoff, 1981 and Hiltz, 1984). At some point in the exploration process, the project manager may wish to examine the theater tasking through EBS, IA and IC. Further, the individual team member may wish to explore a specific area using the individual EBS, IA, and IC tools. The outputs from these sessions can be put into the the computer conferencing system. This involves transferring the EBS, IA and IC files to a conference on the conferencing system. In this way the team can continue to examine and explore the ideas and issues generated in the session in an off-line manner.

With the Theater IS Plan well explored, the project manager is ready to assign individual taskings to the team members. To thoroughly determine the extent of the tasks required in the IS planning effort, the Project manager may

wish to convene another EBS for the express purpose of identifying specific tasks. The EBS session may be augmented by the use of a computer conference on this subject. The files generated by EBS and the computer conference can be made available to the IA tool and followed by an IC exercise. The major thrust of this step should be the identification of specific tasks and therefore the most time should be spent in issue analysis. Only a few minutes need be spent in EBS because the computer conference will have identified several tasks in conferences to explore the theater tasking and the specific task in the theater tasking. These files will present sufficient information to enhance the IA that EBS should generate only impromptu ideas.

The consolidated list of tasks from the above process can be ranked to establish an order for accomplishment. This rank ordered list can then be used by the project manager to control the flow of project activity. At this point, the project manager may wish to use a commercially available project management software package to provide more effective control of the project.

As in any project, there are many ways to accomplish a given task. The usual way to accomplish a task is to identify the alternatives and chose the best alternative. Current PLEXCenter tools can be used to generate alternatives and the same tools can be used to generate the criteria to chose among the alternatives. There is,

however, no means to electronically apply the criteria to an alternative. The alternative comparison and ranking tool is designed to fill this need in problem solving. The tool is specified as a tool for the tactical IS planner, but, as with the computer conferencing system, it can find usage in many PLEXCenter applications. The use of the tool by the tactical IS planners is discussed below.

When the list of tasks to accomplish the tactical IS project is completed, each task can be used as an EBS question or topic to generate a list of alternative methods to accomplish the task. The consolidated list of alternatives from the above actions must next be rated and ranked on some agreed upon criteria. EBS will again play an important part in determining the criteria to judge the alternatives generated. The project manager may use both a computer conference and an EBS session to determine evaluation criteria for the alternatives. The EBS session will be followed by IA and IC.

The output from the alternative and the evaluation criteria generation sessions will provide input to the new tool, alternative comparison and ranking. The tool will present the alternative generated and the criteria for evaluation on the same screen and allow the participants to rate how well the alternative meets the criteria. The tool will consolidate the ratings on each alternative and present a rank ordered list of the alternatives.



Armed with a rank ordered list of alternatives for each task, the project manager is now able to begin the action required by the theater tasking. It is important to again note that other commercially available project management tools are needed for the project manager to effectively manage the project. The sequence of steps described above will help in the problem identification, alternative generation and alternative selection process in the problem solving model described in Table 2. The above sequence is intended to be flexible to meet the largest variety of taskings and project management requirements, since the nature of the theater tasking may be either study or development oriented.

The final requirement of the tactical IS planning framework is that the problem solving tools be available to the individual planner. The framework described above described use of the PLEXCenter tools in a group and a distributed group environment. To fully support the tactical IS planner these tools need to support the individual environment. This requirement and the tools that are effected are described in Appendix A.

#### II.4. Conclusion:

With the completion of the tactical IS planning effort, the IS planning process is completed for a single iteration. The output of the IS process is the goal of the Strategic IS Plan as translated into the theater IS goal which was inturn

translated into the tactical IS goal. At each successive level the goal was described in greater and greater detail until at the tactical IS planning level, the goal is defined at the greatest level of detail. The finished products are combined at successively higher levels to finally fulfill the strategic goal as was shown in Figure 3. The products developed at the tactical IS planning level are combined to make up a theater IS product. The theater IS product are combined to make up the strategic IS product which meets the original strategic IS goal. With the development of a new strategic goal the process becomes reiterative.

CHAPTER III  
NEW PLEXCENTER TOOLS

Two new tools were described in the IS planning framework using the PLEXCenter tools. These were a computer conferencing tool and an alternative generation and ranking tool. Also, certain modifications to existing PLEXCenter tools were described. The design specifications for these tools are presented in the appendices to this paper. The two new tools can find unlimited usage in other applications at the PLEXCenter.

Although a computer conferencing capability is available through an interface of the PLEXCenter hardware with either the University of Arizona MIS department Forum conference system or the University of Arizona CoSy system, an inhouse capability is desirable. An inhouse capability will better support the distributed environment necessary in the theater and tactical IS planning processes. With the development of the Electronic Mail capability at the PLEXCenter, a computer conferencing system is a natural, second step. The conferencing system can also support automation of other information gathering techniques. The

Delphi method is a prime example of a survey technique that will benefit from the conference system.

The alternative generation and ranking tool is an extension of the EBS, IA and IC techniques used in problem solving. The tool finds its roots in the problem solving techniques Huber discusses (Huber, 1980). The new tool can be seen as a new type of voting where voting criteria is developed and then displayed on screen along with an alternative. The ranking of the alternatives is generated based on a tabulation and comparison of the votes for each criteria. This tool can support a number of applications at PLEXCenter and as stated earlier can be used throughout the IS planning process.

There are a few modifications necessary to some of the PLEXCenter tools to support the IS planning framework presented in this paper. These minor modifications amount to making files generated by one tool available to another and developing an individual use capability for existing tools. One example of the file transfer requirement are the files generated in the strategic IS planning process by the EBS sessions for each strategic IS issue. These individual files must be transferred to the Policy Formulation tool and be analyzed in that process as an external file. This file handling process is similar to the method used by IA. In general, these file transfer modifications are for the convenience of the users. The individual use of the PLEXCenter tools was briefly discussed in the section

describing the framework for the tactical IS planning process. These modifications are described in Appendix A.

The new tools and the modifications to the existing tools will not only support the IS planning process described in this paper, but will add a flexibility to the PLEXCenter environment that may be beneficial to other applications.

## CHAPTER IV

### SCENARIO EXAMPLES

There are several methodologies of system development that may fit into the planning framework described above. The Critical Success Factor (CSF) method for Management Information System (MIS) development is a prime example and one for which the frameworks are specifically applicable.

Before describing how the frameworks will support the CSF method of system development there is one remaining facet of the IS planning process frameworks that must be discussed. The PLEXCenter is specifically designed for the support of the group environment. This characteristic fits only one of the planning frameworks in an absolute sense. That framework is the strategic IS planning framework. The entire process can be accomplished in the planning room in one session. The other frameworks, as stated in the section describing both theater and tactical IS planning, prescribe a new usage of the tools. There is still the requirement for the group decision environment at specific points in these planning process, however, the majority of the planning activity is conducted in a distributed planning

environment. The following scenario example will serve to illustrate this point.

The IS planning framework fits the CSF method in the following manner. The first step in the development of a MIS is the development of the concept of how a system can support the organization. Here, the IS organization, through theater IS planning and supported by the tactical IS planners, can take a strategic lead. An analysis of the current IS technology available with consideration for the potential competitive advantage offered by that technology, will reveal any number of potentially fruitful developmental paths for the organization. This environmental scanning can be requested by the strategic IS planners or be part of the IS organizational planner's ongoing effort to improve organizational IS capabilities. For whichever reason, the first developmental effort begins at the theater IS level. This first step will identify the advantages of developing a MIS. This information is submitted to the strategic IS planners for analysis and with a request for approval to proceed with system development. The approved or modified proposal is returned to the IS organization for further planning and system implementation.

The next step in the developmental effort is at the tactical IS planning level. A theater tasking directs the tactical planners to explore the specific requirements of the MIS. It is at this point that the procedures for gathering the CSFs becomes part of the IS planning process.

The tactical IS planner must devise a questioning strategy to elicit from the user those factors that describe the success of the organization (Rockart, 1979). In doing this there are several points that must be kept in mind. The foremost of which is to draw out of the user the factors essential to perceived organizational success. The tactical planner through the PLEXCenter tools, has several ways to explore this information.

Perhaps the most promising method is to first gather information from the users through a computer conference. The use of a computer conferencing capability in the gathering of CSF information at the tactical IS planning level can definitely enhance the overall analysis process. The computer conference will save the time of the personal interviews and allow the group to interact and to gather more pertinent and timely information. The personal interview process may take months while the conference may be complete in as little as a week with good cooperation from the users. The conference can be directed to the target group with the stated conference goal to generate CFSSs. Following a specified amount of time, the target group may be invited to fine tune the CFSSs in an EBS session. The conference information can be combined with information gathered in an EBS session to develop a rank ordered list of CFSSs through IA and IC. With The CFSSs identified the group can then identify the organizational goals that address the CFSSs.



The more traditional method of determining the goals in the CSF method is through personal interviews. The problem here is that the planner must then transfer the information gathered to some electronic media to be supported by the PLEXCenter tools. Although this method may be just as effective as the electronic method, the overall inefficiency of the manual method may be of some concern to the planners.

The next step in the CSF method is to identify the specific piece of information that can convey the essence of the organizational goal. If for example the goal is to increase profits, the piece of information that conveys that information is the organizational balance sheet. Information to determine where this information may be found is part of the IS Master Plan. From the IS Master Plan, the planner can specify which automated product will best support the final aspect of CSF method, measurement of the goal. The tactical planner is now armed with the necessary information to support the MIS requirement of the user in question. Developing the device to allow the user to measure the success parameter follows the IS planning process described below. In summary, the tactical IS planner has first identified the success goals of the organization through the success factors identified by the target group. The planner then discovered which piece of information in the organization describes that goal. Finally, through new system development, the IS planner will make that information available to the user to allow

measurement of success for that goal.

The CSF method described above is supported at the tactical IS planning level and references the IS Master Plan developed at the theater IS planning level. The entire process can be carried out electronically using the frameworks developed for the PLEXCenter tools. Beginning in the computer conferencing system, information is collected from user interviews. This information is then downloaded with data from an EBS session for issue development by the user group. Analysis of the user generated information together with a download of IS Master plan information from the Knowledge Base tool can then be explored by the tactical IS planners in computer conferencing, under EBS, and with alternative generation and ranking.

The IS planning process continues from this point with the generation of a proposal at the tactical IS planning level which is a response to the initial theater tasking. This proposal, which is sent to the theater IS planners through the computer conferencing system, is analyzed at the theater IS level. The proposal may be rejected at this level, sent back to the tactical planners for further work or incorporated directly as is into the IS master plan. The criteria for disposition of the tactical proposal is determined by the theater IS planners and is based on strategic and theater IS constraints. The tactical proposal in its modified form is used to update the IS Master Plan and goes through translation by the Knowledge Base Input

System and is input to the Knowledge Base. Although not a specific part of the theater IS process, the alternative generation and ranking tool would be an effective analysis tool at this level and at the strategic level as well.

The theater IS planners will next develop from the IS Master Plan an executive summary which will be sent to the strategic IS planners. The strategic planners will analyze the theater proposals under the constraints of the strategic IS and strategic business constraints using IA as the initial screening step. If the proposal from the tactical planners is selected for implementation, the flow of information and tasking turns downward in the organization. The proposal is included in the Strategic IS Plan, which will then be included in the Theater IS Plan and a developmental tasking is sent to the tactical IS planners. This downward flow follows the IS planning framework described in the previous sections.

The process described above for the CSF identification can be viewed as the typical process for any IS development work. The framework is generic enough to suit any method used to describe requirements for any type of IS from a standard financial accounting system to an expert system. The process is also used to implement a proposed system and, as seen in the CSF method, to develop a proposal for a system. One important point that needs to be emphasized is that the IS organization must be the focal point in the IS planning process. Tasking and filtering of requirements

must be done at this level to encourage effective planing  
for improved IS support to the organization.

## CHAPTER V

### RESEARCH OPPORTUNITIES

The research opportunities for the use of the IS planning Frameworks described in this paper are somewhat limited at this point. There has been a modest amount of experimentation at PLEXCenter. That experimentation has been limited to the exploration of individual versus group performance using various PLEXCenter tools (George and Gridley, 1987, and Nelson, 1987). There are many studies concerning computer conferencing systems (Hiltz and Turoff, 1981, and Hiltz, 1984). The experiments and studies cited above have tried to determine the most effective environment for the tool in question. The PLEXCenter tools seem to be best at unstructured problem solving and the computer conferencing tool seems best at gathering and disseminating information. Experiments and studies are continuing with these two classes of tools.

The major source of data concerning the PLEXCenter and computer conferencing tools has been gathered in the form of user satisfaction surveys (Applegate, et al, 1986, and Hiltz, 1984). The results from these surveys have been

generally favorable because the users, although they may make some suggestion to improve the tool that they are using, are satisfied with the use derived from the tool. This is the major potential research opportunity available with the framework prescribed in this paper. Since there is no other existing framework using automated tools for IS planning, the survey approach will be the only source of research data.

The first problem with the framework in its relation to any research question is the need to gather several teams of users. These teams of users must include a large spectrum of organizational personnel from the top executives to the systems analysts. The second is need to support a distributed group environment with the PLEXCenter tools. This cannot be done in the PLEXCenter and has not yet been attempted. Once these two issues are resolved survey data can be gathered.

The final problem in research may deal with the very nature of the framework itself. The framework may not lend itself to the type of solid experimentation desired by empiricists. The question to be asked is does the framework work better than the old manual method. This difficult question is only answered by surveys and case studies and will only be answered to the satisfaction of the user and not the empiricists.

## CHAPTER VI

### CONCLUSION

The IS planning process has tremendous impact to an organization. The current market forces indicate that automation can have an impact that can effect not only the organization but also the industry of that organization. A significant competitive edge can be realized by the organization through the effective development of an information system.

The central problem facing the IS planning process is the fact that it is seldom done by the organization. The reason for this seems to be that the entire process is long, cumbersome and expensive. This framework attempts to overcome the reason for an organization not doing IS planning. Through the use of the frameworks described, an organization may realize both a time and expense saving in IS planning. Planning itself will remain cumbersome because solutions will not appear from the computers. The various aspects of the plan must be molded by the user with the help of the computer. The frameworks were developed with these thoughts in mind.

The frameworks that have been developed fit into the larger IS planning model that has been referred to throughout this paper and was shown in Figure 1. The three levels, strategic, theater and tactical, all play together within the overall model for IS planning. Any given layer cannot be effective without the functions of the others. This was shown in the case example.

The true test of the effectiveness of the frameworks developed here is in the implementation in an organization. IS planning will help create a competitive edge for the organization and the framework for IS planning will help create the competitive edge in IS planning.



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APPENDIX A  
CHANGES TO EXISTING PLEXCENTER TOOLS

This appendix will provide the design specifications to the existing PLEXCenter tools that are required by the frameworks supporting the IS planning model. The extent of the changes required involve the ability of the tools to either produce or accept an output file and the ability to interface with the PLEXCenter network.

I. Purpose:

The changes specified in this appendix are intended to enhance the effected PLEXCenter tools by adding a capability required by the IS planning frameworks. The capabilities specified are also intended to help reduce any manual handling of the data that is generated. This means that the transfer of information from one tool to the next has been made simpler or made possible. The tools effected in this appendix are Policy formulation, IA, and IC. IA and IC will be handled together.

II. Policy Formulation:

To effectively support policy making, the policy maker must have information about the subject of the policy. The changes proposed for policy formulation will strengthen the tools ability to draw in outside information. The process for policy formulation will change to become an iterative process where the facilitator must exert more control over the creative process in order to reach a consensus. The changes recommended for policy formulation include using a window to display the contents of an external file, and returning a compilation of group generated policy statements for synthesis.

The process for policy formulation now becomes a interactive process for PLEXCenter. The participants are presented with an external file containing information to be considered in policy formulation. This may be a set of issues developed through an EBS session or any information file. The participant creates on screen the text of his policy statement. All policy statements are then combined by the system and returned to each participant as the new information file. The process repeats itself to develop a second set of policy statements based on the first set. The facilitator must now take a more active role in the process. The facilitator will display the second set of policy statements to the group and begin the process of directing the group toward consensus on a single policy statement. This final process is similar to Issue Consolidation. As is obvious, policy formulation has taken on the general



appearance of Issue Analysis and Issue Consolidation. The processes are very similar but the goals are different. In policy formulation the goal is a policy statement.

### II.1. System Features:

Facilitator control: Policy formulation is called from the facilitator control menu. The tool requests the name of the external information file (none is acceptable). The tool will collect the policy statements from the participants and create a new information file containing those statements. The tool will then present a menu giving several options. The first will be to start a new session with the newly created policy statement file. The next will be to display the policy statement file for editing. A third option will be to append the policy statement file, either edited or unedited, to another file. The final option will be to return to the facilitator control menu.

User control: The user has a split screen which allows text editing in the top screen and read only scrolling in the bottom screen. The user can exit the tool using Alt-F9.

### II.2. System Design:

Figure A1 is the system structure diagram describing the changes to the policy formulation tool.

### II.3. Operating Instructions:

Facilitator operations: The facilitator calls policy

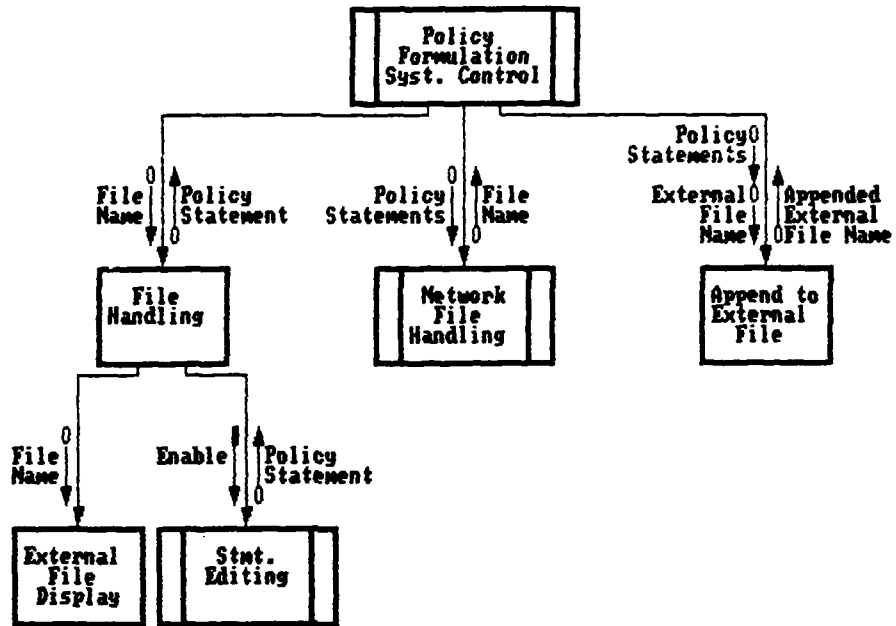


Figure A1. System Structure Diagram for the changes to the Policy Formulation Tool.

formulation from the facilitator control menu and specifies the information file to be used. The policy statements generated by the participants are collected and sent out as the next information file used by the participants. The next set of policy statements are gathered and displayed for modification from the facilitator's screen. The final statement is saved as a policy statement file or appended to an existing file. The tool finally returns control of the session to the facilitator control menu.

User Operations: The user is presented with a split screen. The bottom portion displays the information file to be used in policy formulation. The user can page-up and page-down through this information file. The upper screen is used by the user to type in the policy statement. This screen has screen editing capability. When the user is finished, Alt-F9 is pressed and the network server collects the policy statement.

#### II.4. Summary:

The new capability for the policy formulation will be used by the IS planning process and specifically by the Strategic IS planners in developing the Strategic IS Plan. The enhanced tool will find usage in other planning areas as well.

#### III. Issue Analysis and Issue Consolidation:

Each of these tools effectively support the group

decision environment at PLEXCenter. These tools also effectively support the major planning requirements described in this paper. The only modification seen necessary is the need to support the individual problem solver. This individual usage of these tools is required by the Tactical IS planner in the development of the requirements specified by the Theater IS plan. Meeting these requirements involves individual problem solving in some instances. To do this, the planner will use EBS/Individual to generate ideas, alternatives and rating criteria. The individual IA and IC tools will help the individual planner to more effectively develop problem solutions.

The only modification required to these existing tools is the removal of the network interface modules in those systems. Since the tools are already operable on the individual terminal, the programming changes required should be minimal. For these reasons, no further systems design specifications will be presented.

APPENDIX B  
COMPUTER CONFERENCING SYSTEM

This appendix will develop the design specifications for a Computer conferencing system. The tool is intended to be implemented at PLEXCenter. The tool will have connections to the current E-Mail system, and will have the capability to upload and download files to the other PLEXCenter tools. The tool will find its greatest use in supporting PLEXCenter operation in a distributed planning environment.

I. Purpose:

The computer conferencing system has been shown to be a valuable tool in the gathering and dissemination of information in a distributed environment. This ability can be used at the PLEXCenter to augment the planning environment by offering a pre-session discussion of the topic at hand. It can also be used as an interactive storage point for the orientation information that is being gathered for the Strategic IS planning session. Also it can be used as a tool to disseminate other types of information to the planners and the planning support staff.

## II. Introduction:

The computer conferencing system is an outgrowth of the electronic bulletin board and Electronic Mail (E-Mail). Several systems are available to the mainframe user but none known for use on a network of personal computers like the PLEXCenter configuration. This proposal will highlight the advantages and disadvantages of implementing such a system in the PLEXCenter environment. Further, the desired features of the system will be listed and described.

The computer conferencing system will first encourage a pre-planning session discussion of the planning task. For example, in the strategic IS planning process, although the use of the computer conference was not prescribed, the planners can accomplish some coordination of political issues that may be stumbling blocks to the planning process. A computer conference may be set up to examine and reach concurrence on a particular issue prior to developing the Strategic IS Plan. This effort can nullify potentially conflicting points of view that may stall the IS planning process.

The main purpose of the computer conferencing system is the use by the theater IS planners in developing the IS Master plan, the Theater IS plan, and developing the orientation information that is prepared for the strategic IS planners. The use of the system in this instance is similar to the proposed use described for the strategic IS

planners. The system provides a gathering point for information and a forum for the discussion or analysis of that information. Although the system is not effective at developing a consensus, the system can be used to combine various points of view and produce a usable information file. These information files can be formatted for use as the orientation information files for the Strategic IS planning process, or downloaded to a word processing program to be converted into the formalized IS Master Plan or the Theater IS Plan.

The computer conferencing system can also be used to support the tactical IS planners in manners similar to those used at the strategic and theater IS planning levels. The system will find its widest but least organizationally visible use at this level. Here, the tactical planner can coordinate with other tactical planners and also with the IS user through the conferencing system. The tactical planner can also use the system to develop formal plans and prepare orientation information files for the higher planning levels.

The computer conferencing system can also be used as a system for administrative control to the IS planning process. Schedules, information bulletins, status reports, and tasking instructions are a few of the items that can be disseminated through the conference system.

One final use of the system is the dissemination and

collection of questionnaires. A potential use for this questionnaire capability is in a Delphi decision technique. In this usage, the questionnaire is placed in the computer conference that is targeted to a specific group of conferees. This is described later as a closed conference. The users places the questionnaire in the user work space where the questions are answered. The completed questionnaire is then returned to the Delphi conference moderator using E-Mail for consolidation and re-broadcast in the computer conference. This use demonstrates the most versatile usage of both the conferencing system and E-Mail.

The advantages of the system is seen in its strength to gather and disseminate information in a distributed environment. Its disadvantage is the inability to reach a consensus. This disadvantage is overcome through the use of the PLEXCenter decision tools. The combined usage gives a strong capability for a planning environment.

### III. System Features:

Facilitator control: Since the computer conferencing system is installed on the PLEXCenter network, The facilitator must activate the system.

Conference security: Conference members have a unique user password associated with the conference account.

Comment notification: The conferee is notified of the various conferences in which he/she is a member and the



number of unread comments in each conference.

Comments: The conference member may add a comment to a conference and delete a comment that he/she made to the conference. The comment can be attached as a branch to a conference comment or stand alone in the conference. The comment is tagged with the time and date. It is also tagged with the information about any attached comments, and information on the comment to which it is attached. This feature will help the conference member follow the chain of comments in the conference.

Comment editing: A member of a conference may extract the contents of a comment into a working area where he/she may edit that comment. The new comment may be added as a comment to the current conference or placed into different conferences.

E-Mail interface: The conference member may extract an E-Mail file and place it into a conference. Also the member may create a E-Mail message send the message and place a copy of the message in a conference.

External file handling: The conference system can accept an external file into a conference as a comment through a file transfer protocol such as Kermit.

Internal file handling: The conference system can produce an internal file that can be transferred to another PLEXCenter tool, another system, or printed. This can be

accomplished through either a file transfer protocol such as Kermit or copied to an external storage device for transfer.

**Moderator utilities:** The conference moderator can get a listing of conference participants. The moderator can specify an open or closed conference. The moderator can rearrange the order of comments in the conference by changing the comment attachments. The moderator can obtain a printout of all conference comments. The moderator can prepare a conference output file that has been stripped of comment headers and other comment identifiers. Finally, the moderator can delete or edit any comment in the conference.

**Open Conference:** The open conference is a general interest conference that is accessible by any user of the system. The conference moderator establishes the conference using a specific subject heading. The moderator may provide introductory information for the subject of the conference.

**Closed Conference:** The closed conference is a general or specific interest conference that is accessible by only specified conference members. The conference moderator established the conference using a specific subject heading and may include introductory information. The moderator also specified who are the members of the conference and thus grants access to the conference to those members. The moderator may add and remove members to the conference at any time.

Conference help: Help menus are available to the conference members describing the features available, how to use the features and examples of their use. There is also a moderator's help menu available only to the conference moderator and describes the features, use, and examples of those features available to the moderator.

#### IV. System Design:

Figure B is the system structure diagram describing the computer conference system.

#### V. Operating instructions:

Facilitator operations: The Facilitator will activate the system at the facilitator's console. System activation can be independent of E-Mail use, but E-Mail is necessary for effective use of the conference system in a distributed planning environment.

User operations: The user enables the conference system and types in user name and password. This will cause the system to check whether that user is a valid conference member, develop the list of conferences that the user is a member of and show the number of unread comments in each conference. The user specifies which conference he/she wishes to join. The system will present the heading to the selected conference along with user options for activity in the conference. The user leaves the conference using the exit user option. This returns the user to the main

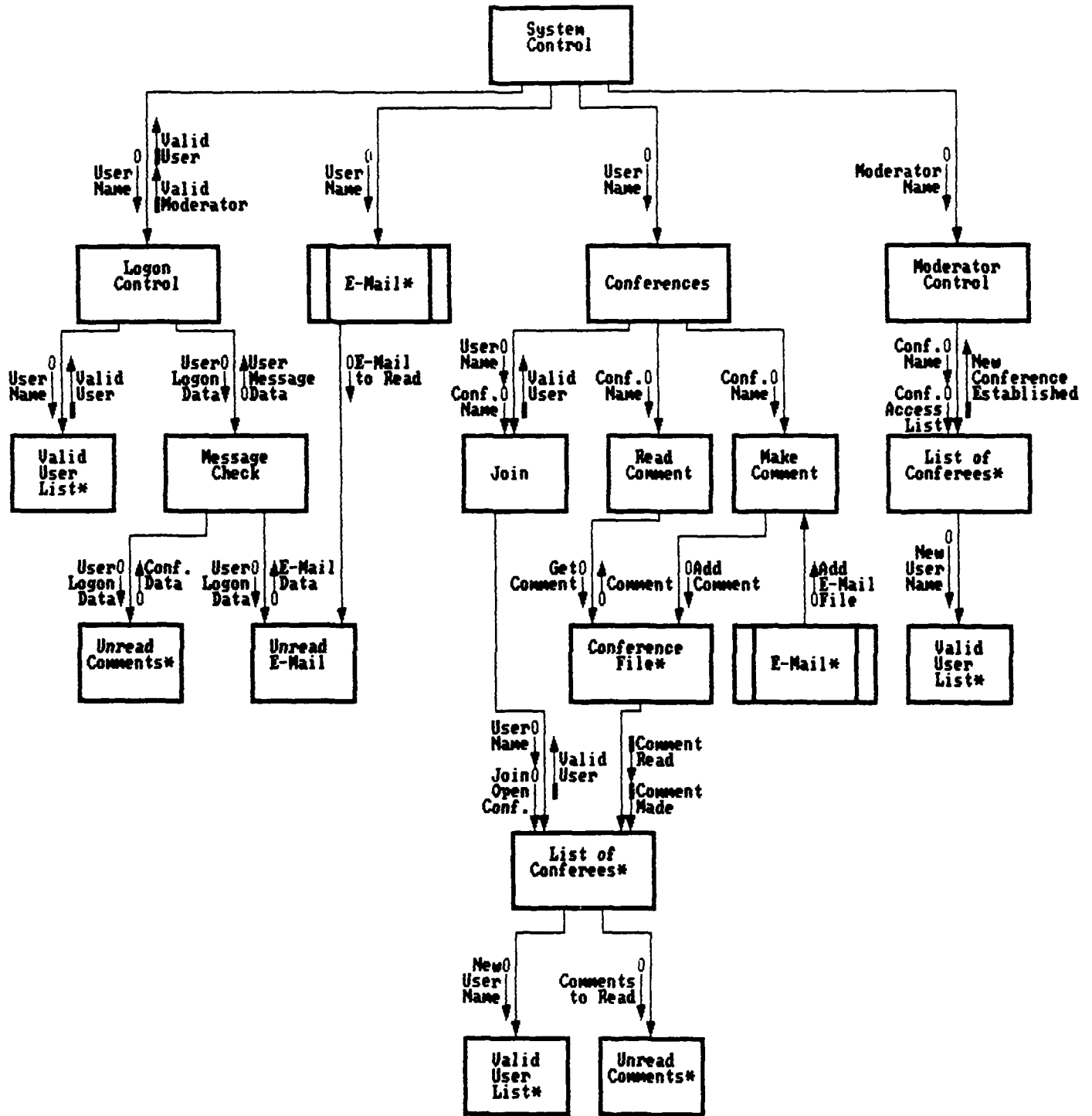


Figure B1. System Structure Diagram for the Computer Conferencing System. (\* indicates duplicated module)

computer conferencing menu or to the PLEXCenter network.

Moderator operations: The moderator accesses the conferencing system as a user. The system will check user name and password and develop the same information described for the user. The exception is that the system will show that this user is the moderator for certain conferences. This allows the moderator to access the moderator's options list from which the moderator's features can be accessed. The moderator can exit the moderator operation and enter the user operations. The moderator can exit the system just like a user.

VI. Summary:

The computer conferencing system offers a unique capability to the planning environment. It will serve to enhance the pre-planning analysis of the planning task. It offers a capability to discuss and synthesize information prior to the decision making process. Finally it can serve as a storage location for organizational information.

APPENDIX C  
ALTERNATIVE COMPARISON AND RANKING

This appendix will develop the design specifications for an alternative comparison and ranking tool. The tool is intended for implementation at the PLEXCenter. The tool will receive inputs from the Issue Consolidation tool and, when used in the individual mode, will accept external text files as inputs. The tool will support group problem solving at the PLEXCenter and will have an individual capability.

I. Purpose:

The alternative comparison and ranking tool is an outgrowth of the voting tool and addresses the need for an automated system to support the alternative selection step in the problem solving model proposed by Huber. The tool is intended to support both the group and individual problem solving environments. The tool uses multiple voting techniques to support the ranking of the alternatives based on the given criteria and will output a rank ordered listing of the alternatives.

## II. Introduction:

In the problem solving environment, a critical step in the decision making process is the generation of alternative solutions to the problem at hand. This alternative generation step is followed by making a choice among the various alternatives based on criteria that is determined to be appropriate for both the problem and the solution. This process is performed by both group and individual problem solvers.

There is currently no support of this nature at PLEXCenter. There is, however, a voting capability which can support the rating module of the alternative comparison tool. Using this existing tool as a model can hopefully ease the software development burden for this new tool.

The alternative comparison and ranking tool will find use in an EBS session by adding the analysis capability to the consolidated list of issues that are normally developed. This analysis gives a more objective approach to the ranking of the issues. This does not imply that the voting tool should be discarded. The voting tool has the advantage of speed over the new tool and is useful where developing a rating criteria would be meaningless. A case in point is in strategic planning. Voting is more appropriate here because of the potentially endless list of criteria that can be developed to rate an issue. The new tool is appropriate specifically to the problem solving EBS session as was

described for the tactical IS planning process. In this instance, a finite number of alternatives and rating criteria can be developed. The tool can then be used to show the group opinion on the ranking of the alternatives.

In the individual use of the tool the same process of generating alternatives and rating criteria is followed. The use is, however, by an individual problem solver. The tool will help add structure to the individuals problem solving work and, as with the group use, presumably lead to better problem solutions.

### III. System Features:

Facilitator control: The tool will be under the control of the session facilitator and will be called from the menu of PLEXCenter tools. The facilitator must input from external files, the list of alternatives and the list of criteria. This can be done by specifying labels for the external files when those files are generated from Issue Consolidation. The files may be loaded using a batch command when the new tool is called. When the rating has been completed, the facilitator will call a routine that will consolidate all the ratings and present a display of the results in rank order.

User Control: At the users console, the system will present the first alternative. The system will then present the criteria and the ranking criteria in a window below the alternative. The user can then vote as appropriate for the



alternative based on the presented criteria. Each criteria is successively presented until that alternative is fully rated. The next alternative is then presented and the process continues in the above manner until all alternatives have been rated.

Output: The rank ordered list of alternatives is displayed on screen. By selecting one of the on screen alternatives, the individual criteria ranking can be viewed for that alternative. Through the PLEXSYS report generating program, a hardcopy output of the results of the ranking can be prepared for the participants. Also, the output file should be in a format acceptable to the computer conferencing system. The output should also be in a format that can be used by the Issue Analysis tool as an external information file.

Individual use: The tool must be portable, that is, able to run on an individual PC from either the network or standalone. This use of the tool requires that the program prompt the user for a list of alternatives and a list of rating criteria. The user must also determine the means of rating each criteria. The subsequent use of the tool follows that described for user control. The output is the same as that described above.

#### IV. System Design:

Figure C1 is the system structure diagram describing the alternative comparison and ranking tool.

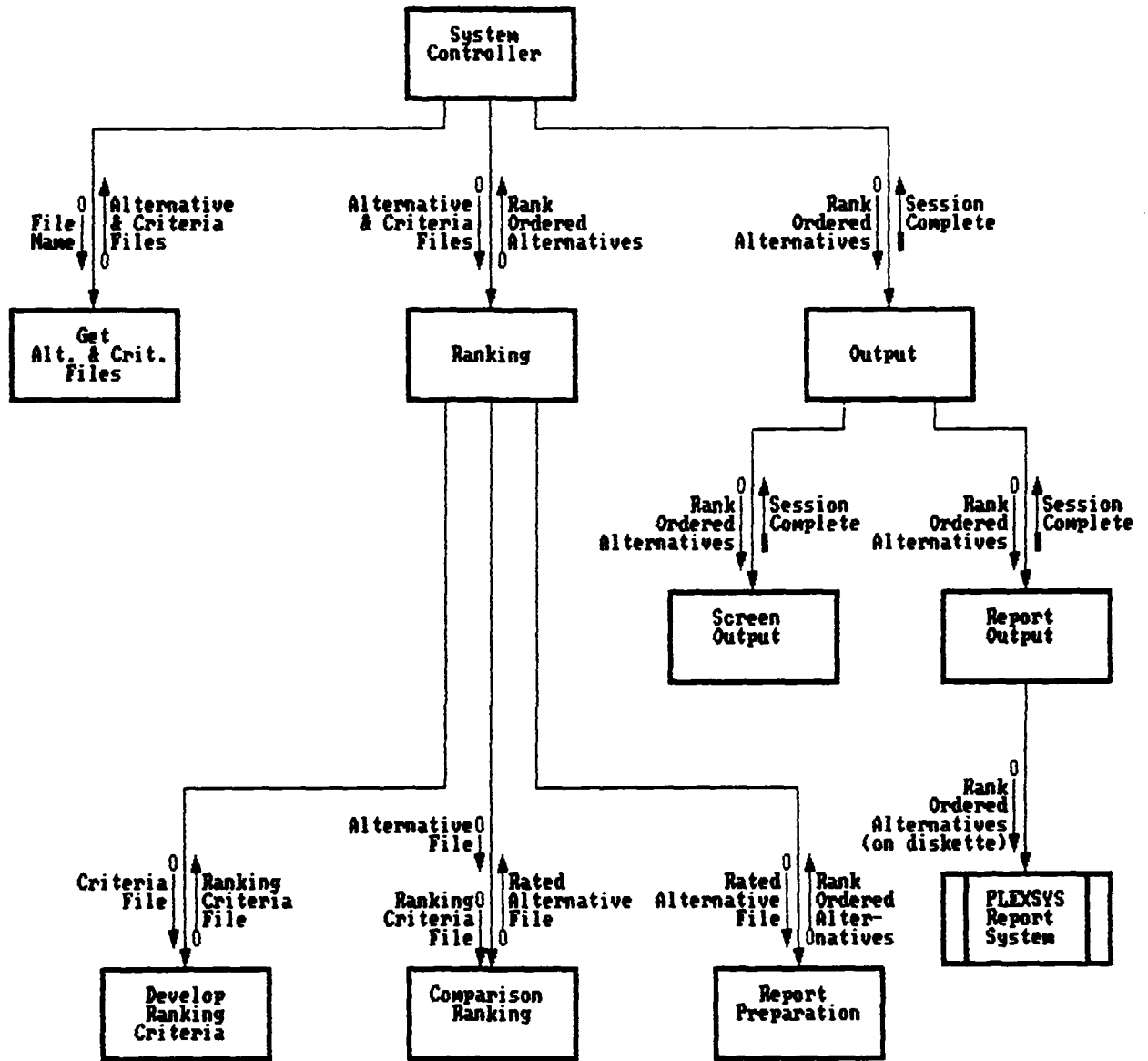


Figure C1. System Structure Diagram for the Alternative Comparison and Ranking Tool.

V. Operating Instructions:

Facilitator operations: The facilitator will call the tool from the main facilitator's menu. The facilitator will specify which files contain the alternatives and which file contains the rating criteria. For each criteria, the facilitator will specify what type of rating criteria will be used. The facilitator will then make the alternatives and criteria available to the users for rating. Following the rating the facilitator will gather and consolidate the ratings from the users. The system will then prepare and present a report based on the rating criteria for each alternative. The system will present the criteria first as a rank ordered listing and then as a supporting file showing the consolidated criteria ratings of the individual alternatives.

User operations: From the users perspective, the user will rate each alternative on the same set of criteria. The rater may review his ratings for each alternative before completing the rating for that alternative. When the ratings on the alternative is complete, the user goes on to the next alternative. The user may go back and change a criteria rating on any alternative by recalling that alternative. The user ends a session in the usual method by pressing Alt-F9. The individual use of the tool is similar to the group use except the user must first input the list of alternatives. The user must also develop the list of criteria and determine how those criteria are to be rated.

VI. Summary:

The alternative comparison and ranking tool is a much needed tool in the PLEXCenter's problem solving environment. The process supports the problem solving model described for the tactical IS planning process and will find use in other PLEXCenter applications. The new tool will enhance the EBS sessions by allowing a more objective assessment of the issues generated through Issue Consolidation. The tool also offers the advantage of adding structure to the problem solving efforts of the individual. Alternative comparison and ranking offers a powerful alternative to Voting where rating criteria can be developed.