A Complementary Approach to Strategic Information Systems Planning

Jaemin Han, Young J. Shin, Taesoo Moon
Research Institute of Industrial Science and Technology
Pohang, Kyong-buk

and
Jeong-Sik Yang
College of Business Administration
Korea University
Seoul, Korea

Abstract

The information revolution is sweeping through the global economy. The strategic significance of the information and information technology have been somewhat underestimated. Now they are transforming the structure of competition. Information technology must be applied to improve and sustain an organization's competitive advantage. The successful implementation of information technology is dependent on the effectiveness of information systems planning. However, the selection of the right methodology still remains an open question. This paper describes the existing methodologies for information system planning. A complementary approach to strategic information systems planning, which was developed for a steel company, is suggested. The approach attempts to combine Business Systems Planning of IBM and Critical Success Factors Analysis for effective information systems planning. Although this approach is in the experimental stage it looks to be of benefit to large organizations which require information planning for managerial level.

Introduction

Traditionally, information systems have been regarded as tools for facilitating operational and managerial functions. More recently, organizations have begun to create information systems that can provide a strategic impact and earn substantial competitive advantage. It is becoming recognized that the unconscious installation of hardware can not carry out such a role in the organization.

While it is clear that management needs understandable and action-oriented information, it is still unclear how to identify this information and implement information systems that provide it in an easy-to-use form. Managers in many organizations complain that while they are receiving more information than ever before, the quality of that information is lacking.

To be able to provide appropriate information to managers, the planning process must be well executed in developing information systems. The need for planning processes is well supported by a survey on corporate attitudes to information systems planning carried out by Datasolve in conjunction with the magazine *IBM Computer Today* [Datasolve86]. The results were published in *IBM Computer Today* in 1986. The survey showed that senior information systems managers in over two thirds of replying companies rated the lack of a consistent corporate information systems strategy as one of the four most important constraining factors to their performance.

Various approaches to information systems planning have evolved [Bowman,1983], [Carlson,1979], [Holland Systems Corporation,1986], [IBM,1984], [Martin,1982], [McFarlan,1981], and [Wetherbe,1982]. Some of these are documented and employed in the development of information systems in the real world. In this paper, it is emphasized

that information system planning should be carried out strategically so as to make information systems more effective and strategically useful; a practical methodology for the strategic information systems planning is suggested.

Why Strategic Information Systems Planning?

There is little disagreement on the importance of planning in the developement of information systems. And also few argue that good planning is difficult. Even though the value of planning is well understood in the development of information systems, many organizations do not plan or do it poorly.

Information systems have been developed in a piecemeal fashion rather than under an organization-wide master plan; each business unit developed and operated its own system. Although the individual systems carried out similar functions, they could not be used interchangeably and could not communicate with each other since they differed in design and performance. The result was a high cost in processing data and a low performance in providing appropriate information: data redundancy, inappropriate information, incompatibility of systems, high maintenance cost, and so on. Little coordination was possible to help the organization integrate individual systems scattered over the organization. A case study with a steel company shows a similar result as seen in Figure 1 [Park,1989].

Furthermore, the necessity for effective information systems planning should be well understood. Since all systems can not be developed and implemented concurrently, priorities must be set. Information resources are scarce and an organization is often so dynamic that it requires the development of new application systems. Therefore, it becomes increasingly important for the organization's strategic plan to be the basis for the information systems plan.

The definition of strategic information systems planning (SISP) encompasses two different views. One view of SISP refers to the process of identifying a portfolio of computerized systems that will support and assist an organization in executing its business strategies and thus in achieving its business goals. This includes databases and application systems. The other view refers to searching for applications with a high impact and ability to create an advantage over competitors. SISP can help organizations use information systems in innovative and creative ways such as building entry barriers, changing the basic structure of competition, generating new product, and/or gaining bargaining power against suppliers.

For our study, the first view is adopted as the definition of SISP. There are a number of methodologies for SISP. In the next section existing methodologies for SISP are briefly described.

Previous Methodologies

Processes in SISP usually go through three stages [Bowman et al,1983]: Strategic Planning, Organizational Information Requirements Analysis (OIRA), and Resource Allocation (see Figure 2). In the Strategic Planning stage, information systems planning is aligned with the overall strategies and objectives of the organization. In the OIRA stage, an information architecture and system structure are designed for the organization as an information management skeleton so that appropriate applications can be developed. Allocation of resources for the development of information systems is studied in the last stage.

In each stage of Figure 2 there are several competing methodologies which are not

directly equivalent. Also, there is little guidance in the literature on how to make a selection taking into account the contingencies an organization is facing.

In this paper our interest focuses mainly on the second stage of the model. It is assumed that the resource allocation problem is considered only after the blueprint for information systems is revealed. Methodologies for the second stage are briefly described next. For more detailed explanation on methodologies, [Bowman et al,1983] or [Davis,1985] can be used as entry references.

1. Business Systems Planning (BSP)

Business Systems Planning (BSP) [IBM,1984] is a comprehensive and structured methodology developed by IBM establishing the direction of system planning toward a set of organizational strategies to integrate information systems and to assign responsibilities for the development of the systems. This approach addresses the operational, functional, and general management needs for information through better management of information system resources.

The basic concepts of BSP is top-down information system planning with bottom-up implementation (see Figure 3). With this strategy, information systems can be implemented without possibly causing the many problems associated with a "bottom-up" evolution of systems such as data inconsistencies, nonintegrated system design, expensive resystemizing, and priority difficulties.

The top-down part of BSP focuses on developing a broad overall understanding of the organization and identification of business processes requiring information systems. Then, a long-range plan is developed for the design, development, and implementation of a set of information systems for identified business processes. The bottom-up part of BSP is the process which implements the plan designed in the top-down part.

The fundamental thrust of the BSP approach is toward identifying the information necessary to run the organzation. Information concerning the organizational processes is obtained via observation and interviews. The information requirements are finally summarized in *Information Architecture* by mapping the business processes to the associated information requirements in matrix form. Information Architecture enables the evaluation of data sharing within the organization. The architecture also provides the foundation for follow-on resource and tactical planning which enables the orderly implementation of information architecture into databases.

However, this approach can be effective only when explicit strategic plans and objectives of the organization exist. Extensive information collection and analysis can be achieved through interviewing a sizable number of managers, which requires a lot of time and effort, and thus is regarded as a drawback of BSP and makes information systems managers hesitate in applying BSP to their organization.

2. Critical Success Factors (CSF) Analysis

Critical success factors are the few areas of activity that must go well to ensure the success of an organization. Because these areas of activity are critical to organizational success, the manager should have the appropriate information to allow him to determine whether events are proceeding sufficiently well in each area. The CSF approach is designed to provide a structured technique which can be used by an interviewer to assist managers to identify their critical success factors and to determine the resulting information needs.

The CSF concept was developed by Daniel who identified CSFs in the U.S. automotive industry [Daniel,1961]. Later,

MIS Planning by John Rockart [Rockart,1979]. The CSF approach has been continuously refined while being applied to a number of case studies ([Munro,1980], [Bullen,1981], [Martin,1982], [Shank,1985], [Jenster,1986-87], [Bergeron,1989]).

The CSF approach first visualizes the strategy, objectives, and goals of a corporation. The strategy, objectives, and goals developed of the corporate level lead to the development of a particular set of critical success factors for the corporation. Given its strategy and objectives, as well as the other factors in its specific environment, each corporation will develop a set of CSFs unique to its own circumstances. In turn, corporate CSFs become an input into a similar CSF determination process for each sub-organization in the corporation. The process can be continued for as many levels of organizational hierarchy as exist (see Figure 4).

The CSF approach can be summarized into following four major activities:

- understand (or identify if do not clearly exist yet) business unit objectives,
- dentify Critical Success Factors,
- identify specific performance measures and standards, and
- identify data required to measure performance.

3. Other Methodologies

Besides BSP and CSF Analysis, firms might choose Method/1 [Arthur Andersen and Co.,1985], Strategic Systems Planning [Holland Systems Corporation,1986], Information Engineering [Martin,1982], Business Information Analysis and Integration Technique [Carlson,1979], or Ends/Means Analysis [Wetherbe,1982].

The steps in the Strategic System Planning (SSP) procedure are similar to those in BSP. A major difference from BSP is SSP's automated storage, manipulation, and presentation of the data collected during the SISP process.

Information Engineering (IE) provides techniques for building enterprise models, data models, and process models. These form a comprehensive knowledge base which can create and maintain information systems.

Business Information Analysis and Integration Technique (BIAIT) is distinct from other methodologies. Most planning approaches tend to use open-ended questions that allow managers to articulate their information needs. However, in BIAIT seven close-ended questions are used to determine a normative set of information requirements. These questions require only a binary (yes or no) response from managers. From the responses to these questions overall information requirements can theoretically be defined. This procedure works independently from organizational characteristics.

Ends/Means Analysis (E/M), developed by Wetherbe and Davis, focuses on the ends (goods, services, and information) generated by an organizational process and the means (inputs and processes) used to accomplish the ends. The ends from one process can be regarded as the input (or means) to other processes. The required information produced by E/M is of two types: effectiveness information and efficiency information to evaluate effectiveness for outputs and efficiency for inputs and processes.

Each SISP methodology has its advantages as well as disadvantages, and different characteristics. For more explanation on their comparison, [Lederer,1988] is a good entry reference.

A Complementary Approach

Earlier, the importance of planning was well emphasized. Good planning results from right selection of the methodology. Unfortunately, there has been almost no research to evaluate the comparative

research to evaluate the comparative advantages of one technique, or combination of techniques, over another.

One of several criteria by which the appropriate SISP methodology can be selected is whether or not it provides a concrete tool for implementing information requirements. For example, BSP, E/M and IE suggest how to draw information architecture leading to the

implementation of data required, while CSF Analysis delivers only "what information is needed".

In the SISP project of the Pohang Iron and Steel Co., Ltd. (POSCO), a large and well established steel company in South Korea, we had to find the answers to:

- what information is needed for top and middle managers,
- what business data are needed to construct the necessary information, and
- where are the business data generated?

No methodology is appropriate to deliver the output for all of the above problems, particularly in such a large organization as POSCO. BSP seemed appropriate for the last problem while CSF looks more effective for the first. No methodology is available to map information to data in the second problem. Thus, we have developed an approach that uses BSP as a complement to CSF Analysis: BSP is employed to identify data needed to generate information defined by CSF Analysis and to define information architecture.

An attempt has already been made to combine planning methodologies [Wetherbe83]. Wetherbe and Davis used BSP, CSF, and E/M to develop a framework for the information requirements interviews. Three different types of questionaires from each methodology were combined into one. Our approach to combining planning methodologies is different from that of [Wetherbe83] in that we combined CSF and BSP to use BSP in more efficient and effective way. That is, in the complementary approach the output of CSF guides BSP in that the output of CSF should be used as the input to BSP. This approach keeps the BSP approach from requiring too much effort in information collection and analysis and focuses on only the information defined by CSF.

Our new complementary approach is portrayed in Figure 5. Our complementary approach basically consists of "enforced" CSF Analysis and "shrunk" BSP. What it is meant by "enforced" CSF Analysis is that the original CSF Analysis may be vulnerable since it completely relies on the responses of managers [Davis, 1979], [Davis, 1980] and thus, it is strenghtened with Report Analysis. The possibilities of failure with the CSF method center on the abilities of managers to respond with CSFs that are correct, complete, and sufficient. Davis insists that possible failure is caused by at least three phenomena:

- bounded rationality,
- human ability to evaluate probabilities and to identify causality, and
- biasing effect of the availability of data.

The Report Analysis is used to increase the reliability of CSF Analysis. The responses of managers can be proved to be appropriate by analyzing the contents of reports generated for the managers in the past. Since the contents of past reports can represent most of the information needed for management, the responses of managers can be validated when a large portion of them is a subset of the contents of report. For example, in the POSCO case, about 80% of information required in CSF Analysis was included in the contents of reports. How to provide the other 20% must be determined.

The information required for management is generated from enforced CSF Analysis, then the necessary business data to generate the information and information architecture are defined. Connection of the output of CSF Analysis to the input of BSP is the most critical issue in this approach. Information defined from CSF is a set of aggregated data which can be generated

aggregated data which can be generated from each low functional area. Once business processes are defined, data classes, which are created and/or used in the business processes, should be identified to be aggregated into the information required by CSF.

Business processes and data classes (different from those in original BSP) are then associated to define Information Architecture. This enables the evaluation of data sharing within the enterprise. Then, a detailed Database plan can be initiated to design and implement the information model (Information Architecture).

This approach benefits managers involved in many perspectives:

- Interview process in CSF Analysis provides considerable enlightenment to the managers involved as they are usually not aware of the array of activities that occur in subsystems with which they are familiar.
- The output of CSF Analysis (CSFs, Performance measures, information required for the measure) makes management by objective (MBO) possible.

Conclusions

Improving SISP methodologies is one of many major challenges facing information systems researchers today. Effective planning is essential to the realization of the potential strategic impact of computer-based information systems. This paper has surveyed representative methodologies for SISP and described the motivation of the complementary approach.

The complementary approach is still in the experimental stage. However, it proved quite beneficial to the planning effectiveness of a large steel company. It can be expected that when a large organization needs to define "what information is critical to successful management" and "how to provide it", this new approach will be useful.

With this approach benefits can be obtained from the combination of CSF and BSP:

- Little effort is needed to define business data generated from all functional areas by concentrating on the narrower scope of data related to information for management.
- A visible information architecture can be defined as an implementation scheme.

References

Arthur Andersen and Co., *Executive Guide to Strategic Information Planning*, booklet #85-6129, 1985.

Bergeron, F. and C. Begin, "The Use of Critical Success Factors in Evaluation of Information Systems: A Case Study", *Journal of Management Information Systems*, Vol.5, No.4, Spring, 1989, pp.111-124.

Bowman, B.J., G.B. Davis and J.C. Wetherbe, "Three Stage Model of MIS Planning", *Information & Management*, Vol.6, No.1, 1983, pp.11-25.

Bullen, C.V. and J.F. Rockart, "A Primer on Critical Success Factors", Center for Information Systems Research, Working Paper No.69, Sloan School of Management, M.I.T., Cambridge, MA, June, 1981.

Carlson, W.M., "Business Information Analysis and Integration Technique (BIAIT): A New Horizon", *Data Base*, Spring, 1979, pp.3-9.

Datasolve Ltd., "Power Game Survey", *IBM Computer Today*, January, 1986.

Daniel, R.D., "Management Information Crisis", *Harvard Business Review*, September-Octorber, 1961, p.111.

Davis, G.B., "Comments on Critical Success Factors Method for obtaining management information requirements in article by John F. Rockart", *MIS Quarterly*, Vol.3, No.3, September, 1979, pp.57-58.

Davis, G.B., "Letter to the editor", *MIS Quarterly*, Vol.4, No.2, June, 1980, pp.69-70.

Davis, G.B., *Management Information Systems: Conceptual Foundations, Structures, and Development*, McGraw-Hill, New York, 1985.

Holland Systems corporation, *Strategic Systems Planning*, document #M0154-04861986, Ann Arbor, MI, 1986.

IBM Corporation, *Business Systems Planning - Information Systems Planning Guide*, Publication No. GE20-0527, 1984.

Jenster, P.V., "Firm Performance and Monitoring of Critical Success Factors in Different Strategic Contexts", *Journal of Management Information Systems*, Vol.3, No.3, Winter, 1986-87, pp.17-33.

Lederer, A.L.and V.Sethi, "The Implementation of Strategic Information Systems Planning Methodologies", *MIS Quarterly*, Vol., No., September, 1988, pp.445-461.

Martin, E.W., "Critical Success Factors of Chief MIS/DP Executives", *MIS Quarterly*, Vol.6, No.2, June, 1982, pp.1-9.

Martin, J., *Strategic Data-Planning Methodologies*, Prentice-Hall Inc., Englewood Cliffs, NJ, 1982.

McFarlan, F.W., "Portfolio Approach to Information Systems", *Harvard Business Review*, Vol.59, No.5, September-October, 1981, pp.142-150.

Munro, M.C. and B.R. Wheeler, "Planning, Critical Success Factors, and Management's Information Requirements", *MIS Quarterly*, Vol.4, No.4, December, 1980, pp.27-38.

Park, Y.H., Y.J. Shin, T.S. Moon, and C.H. Kim, "A Study to Improve the POSCO's Integrated Information Management (I)", Research Report #8112A, Research Institute of Industrial Science and Technology, Pohang, Korea, 1989.

Rockart, J.F., "Chief Executives Define Their Own Data Needs", *Harvard Business Review*, March-April, 1979, pp.81-93.

Shank, M.E. and A.C. Boynton, "Critical Success Factor Analysis as a Methodology for MIS Planning", *MIS Quarterly*, Vol.9, No.2, June, 1985, pp.121-130.

Wetherbe, J.C. and G.B. Davis, "Strategic Planning Through Ends/Means Analysis", MIS Research Center, Working Paper, University of Minnesota, 1982.

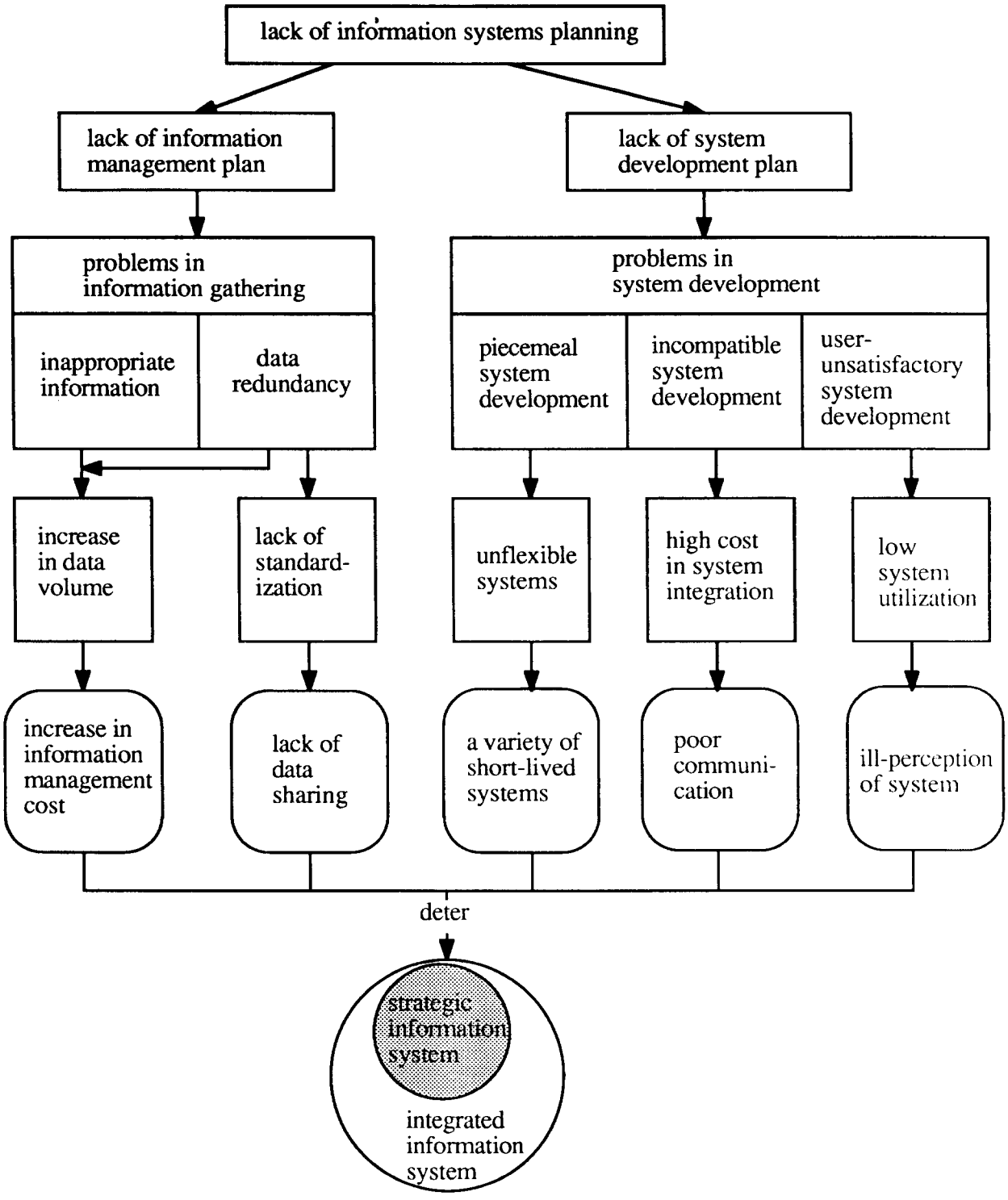

Figure 1. Impact of lack of planning on information systems performance.

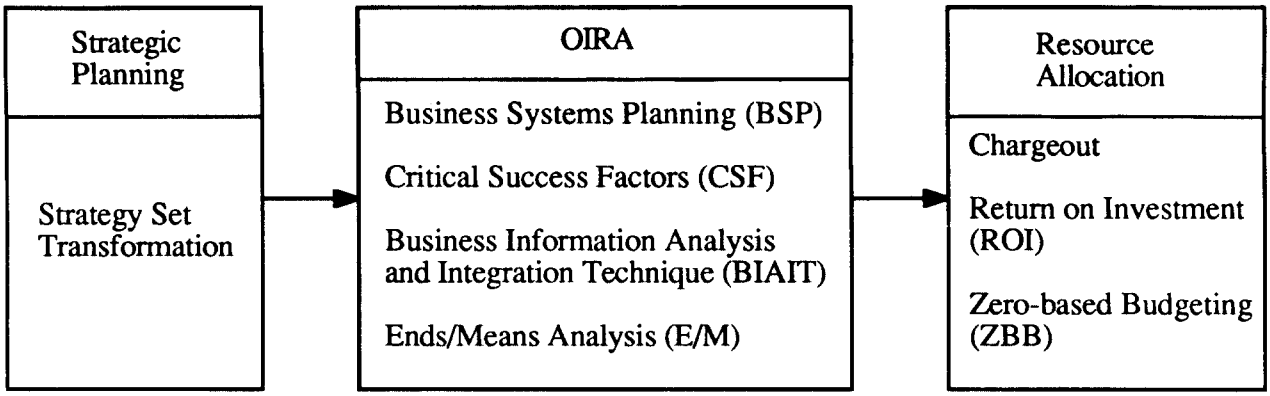

Figure 2. Three stage model and representative methodologies for each stage.

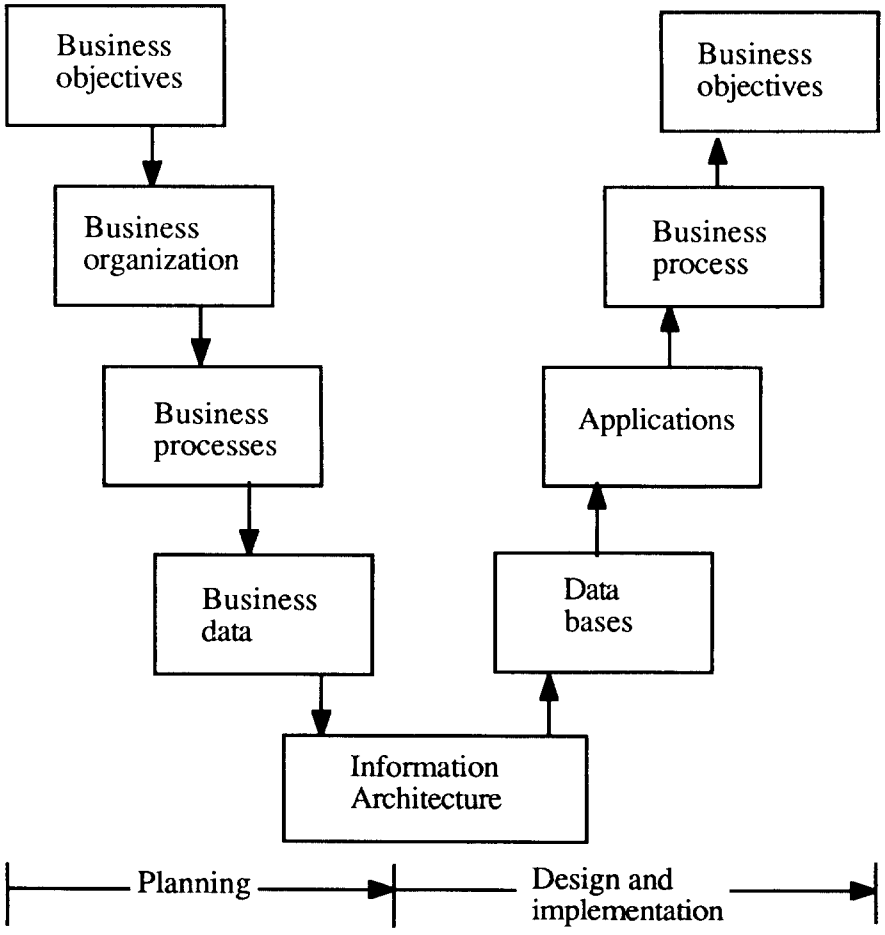

Figure 3. Top-down analysis with bottom-up implementation.

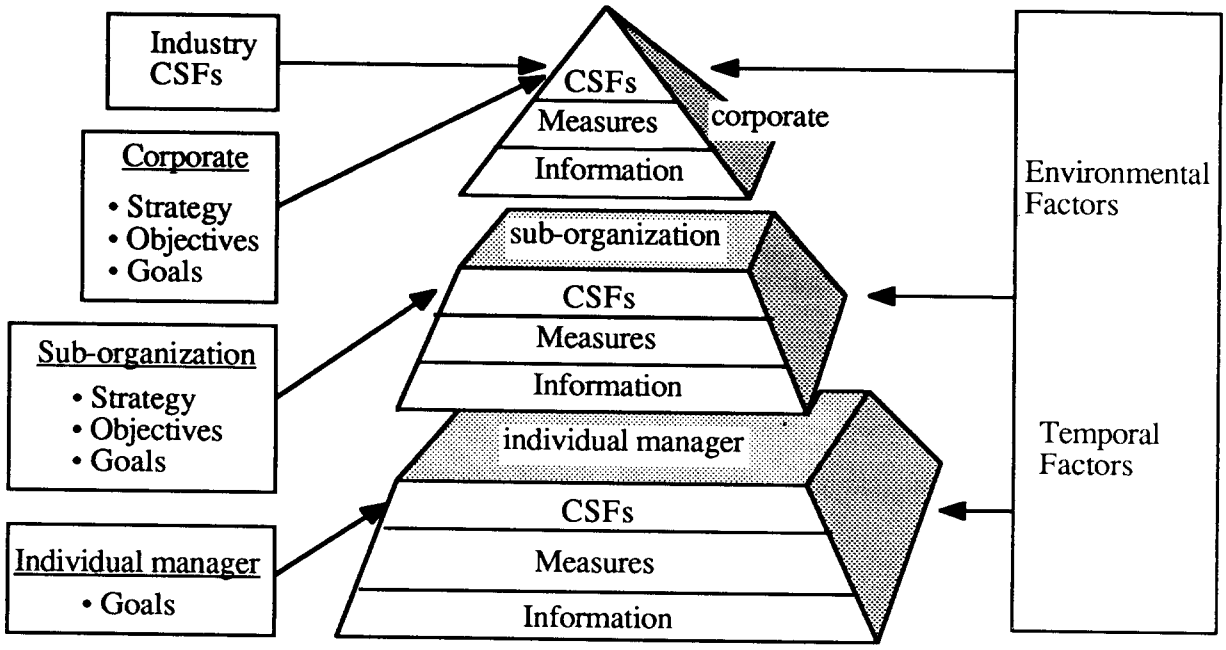

Figure 4. Hierarchical view of CSF approach.

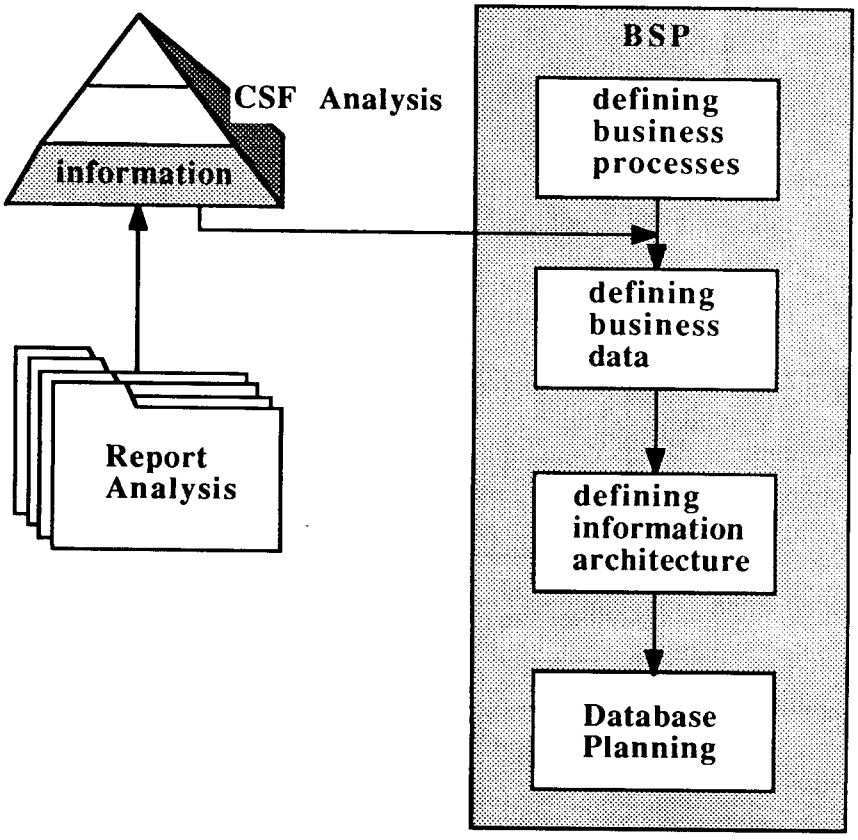

Figure 5. The complementary approach to SISP.