December 2003

Common Factors among Management Support Systems' Success

Radhika Santhanam
University of Kentucky

Edward Hartono
University of Kentucky

Clyde Holsapple
University of Kentucky

COMMON FACTORS AMONG MANAGEMENT SUPPORT SYSTEMS' SUCCESS

Radhika Santhanam
University of Kentucky
santham@uky.edu

Edward Hartono
University of Kentucky
ehart1@uky.edu

Clyde W. Holsapple
University of Kentucky
cwhols@uky.edu

Abstract

The objective of this research is to conduct a survey of empirical studies of various Management Support Systems with a view to consolidate results and identify core influencing factors that impact success. Management Support Systems include a variety of systems that support managerial work, such as, Management Information Systems, Decision Support Systems, and Executive Information Systems, etc. While surveys on measures of IS success (dependent measures) have been conducted, surveys that identify determining/ influencing factors (independent variables) that impact success have not been conducted. We intend to use our results to develop a framework that will be useful for researchers and practicing managers to easily identify core factors that influence the success of various types of Management Support Systems. Such a framework could provide interesting insight to researchers when they design and propose new types of IS. It could provide valuable guidelines to practicing managers on factors that they must monitor when they develop and implement various types of Management Support Systems.

Introduction

Both, researchers and practicing managers in information systems are interested in identifying and paying attention to those factors that foster the successful development and use of Information Systems (IS). In fact, a recent survey by Lai and Mahapatra (1997) indicate that studies investigating success/failure factors in technology implementation are among the most frequently researched topic, clearly attesting to the significance of this topic.

The term IS includes a variety of systems that differ in terms of their features, functionality, and characteristics of users. Our interest in this research is to examine a class of systems that support managerial activities and are commonly referred to as Management Support Systems (MSS) (Holsapple and Whinston 1996, p. 151). Holsapple and Whinston (1996) describe MSS as a class of computer-based information systems that can provide support for managerial work described by Mintzberg. According to them, these systems provide support for the informational, decisional, and interpersonal role of managers. For example, management information systems (MIS), which are categorized as belonging to the MSS class of systems, support the informational role of managers by using internal data from organizational transactions and perhaps some external data to provide managers status information on the organization's operations. Similarly, Decision Support Systems (DSS) provide the ability to look at decision alternatives and support the decisional role of managers.

Various frameworks to identify and classify computer-based business systems have been proposed. Forgionne (1991) suggests seven major types of such systems: Transaction Processing Systems, Decision Support Systems and Group Decision Support Systems, Management Information Systems, Executive Information Systems and Executive Support Systems, Expert Systems, Office Automation/Information Systems, and Idea Processing Systems. Flynn (1998) identifies and classifies computer-based business systems into: Transaction Processing Systems, Decision Support Systems, Real-Time Systems, Database Systems, Expert or Knowledge-Based Systems, and Office Information Systems. Barron, Chiang, and Storey (1999) reviewed six popular

frameworks of computer-based business systems and came up with the following classes: Transaction Processing Systems, Management Information Systems, Decision Support Systems, Group Support Systems, Knowledge Work Systems, Expert Systems, Office Automation Systems, Executive Information Systems, and Strategic Information Systems. Power (2002) further classifies decision support systems into: Communications-driven DSS, Data-driven DSS, Document-driven DSS, Knowledge-driven DSS, and Model-driven DSS. All of the systems above support decision making and problem solving activities at various management levels.

We use these frameworks to identify systems that should be included in our survey. While other terminologies may be used by different authors, in our study, we use the term MSS to include Transaction Processing Systems, Management Information Systems, Decision Support Systems, Office Information/Automation Systems, Expert Systems, Organizational Decision Support Systems, Executive Information/Support Systems, Data Warehouse, and Group Decision Support Systems. A list of systems and their definitions are provided in Table 1.

Because of the widespread use of these systems in business organizations, many empirical studies have attempted to identify factors that foster the successful deployment and use of these systems. For example, Yoon, Guimaraes, and O'Neal (1995) identify several factors that could lead to the successful implementation of expert systems (ES). They state that the characteristics of the expert from whom knowledge is obtained to build the ES, the characteristic of the shell used to build the ES, and the extent of user involvement in the development of the ES have a significant impact on the successful implementation of the systems. Based on this information, when practicing managers plan to develop and implement an ES, they can pay closer attention to the attributes of the expert, the type of shell they use, and also get users involved in the project. Similarly, Rainer and Watson (1995) identify the presence of a strong executive sponsor as a factor influencing the successful implementation of an Executive Information Systems (EIS). Note that each of these research studies focus on a specific type of MSS, such as ES, EIS, and MIS, etc. Each study identifies factors that lead to the successful deployment of that *specific system*. However, there has been no attempt to consolidate all these findings, identify common factors, and reconcile any differences in the recommendations.

DeLone and McLean (1992, 2003) conducted a study consolidating empirical findings relating to the different measures used to determine IS success (dependent measures). They concluded with a model of six categories of IS success. This model has been respecified and extended by Seddon (1997).

Regrettably, a study identifying factors that are critical to the deployment of IS (independent measures) has not been undertaken. Such a study could provide interesting insight to researchers when they design and propose new types of IS. It could provide valuable guidelines to practitioners on factors that they must monitor when they develop and implement various types of IS. It could also help in IS framework and theory building activities by identifying those few factors that are critical to MSS's success. The objective of this research is to conduct a literature survey and synthesize factors identified as being important to the development and implementation of various MSS

Research Method

Framework for Analysis

Critical Success Factors is a term used by researchers to identify those few things that must receive constant and careful attention from managers to improve organizational performance (Rockart 1979, 1982, Boynton and Zmud 1984, Ahituv and Neumann 1990, Ang, Sum, and Chung 1995). Based on this concept, IS researchers believe that a few factors can be identified as being the most significant and dominant among many factors in fostering the successful development and use of MSS. With this notion, researchers have conducted many field studies across various organizations to identify these critical success factors. To help us synthesize critical success factors from these field studies, we first need an overall category framework to help us group various critical success factors. Our reading of the research suggested that an overall framework would consist of these broad categories:

1. Organizational - This category would include factors, such as, competitive environment, management structure, and other factors that apply at an organizational level.
2. Technical factors - This would include systems-related factors, such as, type of software utilized, the development method, the extent of use of the systems, etc.
3. User related factors - This would include factors associated with the users of the systems, such as, user attitudes, their level of experience, their level of involvement, etc.

4. Task Related factors - This would include factors such as, the level of task difficulty, the type of task, the extent of task standardization, etc.

Selection of Journals

Journals listed in ISWORLD publication website were included. Note that our primary purpose was not to conduct a survey of articles, but instead to focus on the identification and consolidation of findings. Hence, this was not meant to be an exhaustive survey of IS-related journals. We included journals that we felt were relevant to IS. We also conducted a key word search in electronic databases by typing in various terms such as names of various MSS systems (e.g., Decision Support Systems, Expert Systems), "success", and "development factors". This was to identify if there were research studies in non-IS related journals that might be relevant. We did not find many articles in this manner.

Type of Research Studies

Because we were interested in identifying common factors across systems and across organizations, we focused solely on empirical, cross-organizational field studies. Such studies identify factors common to several organizations and hence provide a more robust set of factors. For GDSS, we could not find any empirical, cross-organizational field study. In such situations, we utilized case studies to identify factors that were considered to be critical success factors.

Categorization of Factors

Two senior authors independently read these papers, identified and categorized the factors into the overall framework. Discrepancies were discussed and resolved.

Current Results

Our results thus far indicate that the overall framework is useful in identifying and categorizing factors. We present Tables 2, 3, 4, which describe the categorization of some of the technical, task, managerial, and organizational factors. Please note that these tables are provided just to demonstrate how we categorize and pool the factors and this is not complete at this stage. Thus far, it appears that one User level factor, namely, extent of user involvement and one Organizational factor, namely top management support is a critical success factor across many systems (the exception being Office Automation Systems). For example, top management support has been identified as a critical success factor in six types of MSS and in nine field studies. Results thus far suggest that among all factors, it is extent of user involvement and extent of top management support that must be paid close attention to during development and implementation of any new MSS. Hence, organizational mechanisms to ensure user involvement and to convey the level of top management support to all stakeholders must be put in place.

Our goal is to complete this research, identify common factors across systems, and develop a framework of these factors. The goal of this framework is not only to show core success factors that are common to all systems but also to group factors that are common to certain sub-classes of systems and to certain sub-classes of IS success measures according to DeLone and McLean's (1992, 2003) model. We are also trying to use quantitative analysis to determine the strength of correlations of these critical success factors on implementation success. We hope to have all the factors, the framework, and the quantitative analysis ready for presentation at AMCIS.

References

Ahituv, N., and Neumann S., Principles of Information Systems for Management, Third Edition, Dubuque, United States of America: William C. Brown Publishers, 1990.

Aiken, M., and Vanjani, M., "Group Decision Support Systems," *Review of Business*, (16: 3), Spring 1995, pp. 38-52.

Ang, J.S.K., Sum, C.C., and Chung, W.F. "Critical Success Factors in Implementing MRP and Government Assistance: A Singapore Context," *Information and Management* (29), 1995, pp. 63-70.

Awad, E.M. Management Information Systems: Concepts, Structure, and Applications, Menlo Park, CA: Benjamin Cummings, 1988.

Barron, T.M., Chiang, R.H.L., and Storey, V.C. "A Semiotics Framework for Information Systems Classification and Development," *Decision Support Systems* (25: 1), 1999, pp. 1-16.

Boynton, A.C., and Zmud, R.W. "An Assessment of Critical Success Factors," *Sloan Management Review* (25), Summer 1984, pp. 17-27.

DeLone, W., and McLean, E. "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research* (3: 1), March 1992, pp. 60-95.

DeLone, W., and McLean, E. "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update," *Journal of Management Information Systems* (19: 4), Spring 2003, pp. 9-30.

DeSanctis, G., and Gallupe, R.B., "A Foundation for the Study of Group Decision Support Systems," *Management Science*, (33: 5), May 1987, pp. 589-609.

Fedrowics, J., and Konsynski, B.R. "ODSS Technology and Decision Processes," in E.A. Stohr, B.R. Konsynki (Eds.), Information Systems and Decision Processes, Los Alamitos, CA: IEEE Computer Society Press, 1992, pp. 143-145.

Flynn, D. Information Systems Requirements: Determination and Analysis, McGraw-Hill, 1998.

Forgionne, G.A. "Decision Technology Systems," *Information Systems Management* (8: 4), Fall 1991, pp. 34-43.

Grohowski, R., and McGoff, C. "Implementing Electronic Meeting Systems at IBM: Lessons Learned and Success Factors," *MIS Quarterly* (14:4), December 1990, pp. 369-383.

Holsapple, C.W., and Whinston, A.B. Decision Support Systems: A Knowledge Based Approach, St. Paul, Minnesota: West Publishing Company, 1996.

Jarred, D. The Electronic Office, Aldershot, England: Gower, 1984.

Jih, W.J.K. "Comparing Knowledge Based and Transaction Processing Systems Development," *Journal of Systems Management*, (21: 5), May 1990, pp. 23-28.

Lai, V.S., and Mahapatra, R.K. "Exploring the Research in Information Technology Implementation," *Information and Management* (32), 1997, pp. 187-201.

McLeod, R. Management Information Systems, Chicago: SRA, 1986.

McLeod, R., and Jones, J.W. "A Framework for Office Automation," *MIS Quarterly*, (11: 1), March 1987, pp. 86-104.

Post, G.V., and Kagan, A. "A Modeling Approach to Evaluating Strategic Uses of Information Technology," *Journal of Management Information Systems*, (12: 2), Fall 1995, pp. 161-187.

Power, D.J. Decision Support Systems: Concepts and Resources for Managers, Westport, CT: Greenwood/Quorum Books, 2002.

Rainer, R.K., and Watson, H.J. "The Keys to Executive Information System Success," *Journal of Management Information Systems* (12: 2), Fall 1995, pp. 83-98.

Rockart, J. F. "The Changing Role of the Information Systems Executive: A Critical Success Factors Perspective," *Sloan Management Review*, Fall 1982, pp. 3-13.

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

Seddon, P.B. "A Respecification and Extension of the DeLone and McLean Model of IS Success," *Information Systems Research* (8: 3), September 1997, pp. 240-253.

Senn, J.A. Information Systems in Management, 3 rd edition, Belmont, CA: Wadsworth, 1987.

Turban, E., Rainer, R.K., and Potter, R. Introduction to Information Technology, New Jersey: John Wiley & Sons, Inc., 2001.

Yoon, Y., Guimaraes, T., and O'Neal, Q. "Exploring the Factors Associated with Expert Systems Success," *MIS Quarterly* (19: 1), 1995, pp. 83-106.

Table 1. Systems and Definitions

Systems	Definition
Transaction Processing Systems	Computer-based systems that capture detailed transactions, organize data, and retrieve information for users (Forgionne 1991).
	Management information systems that are developed to address transaction-based applications (Post and Kagan, 1995).
	Basic business systems that serve the operational level of the organization to perform and record the daily routine transactions necessary to conduct the business (Post and Kagan, 1995).
	Computer-based systems that are designed to expedite and automate transaction processing, record keeping, and business reporting (Post and Kagan, 1995).
	Computerized information systems that support an organization's core operations, such as purchasing, billing, and payroll, by collecting, monitoring, storing, processing, and disseminating the organization's basic business transactions (Turban, Rainer, and Potter 2001).
Management Information Systems	Computer-based systems to provide managers with periodic reports that recap certain predetermined aspects of an organization's past operations (McLeod, 1986; Senn, 1987; Awad, 1988).
	Business computing systems that have capabilities to keep the records up to date in light of incoming transactions (e.g., record keeping) and to use the stored descriptive knowledge as a base for generating recurring standard reports (Holsapple and Whinston, 1996).
Office Automation Systems	The application of electronic and electro-mechanical devices for the purpose of increasing the productivity of office workers (Jarred, 1984)
	A means of communicating data and information (McLeod and Jones, 1987).
	Computer-based systems that capture, manipulate, retrieve, and transmit oral and written communications for and between users (Forgionne 1991).
	Support systems that improve office efficiency through such functions as communications, word processing, and document management (Turban, Rainer, and Potter 2001).
Executive Information Systems	Computer-based systems that are primarily used by either CEOs or a member of the senior management team reporting directly to them (Rainer and Watson, 1995).
	Computerized systems intended to provide current and appropriate information to support executive decision making for managers using a networked workstation (Power 2002).
Decision Support Systems	A business computing systems that include a body of knowledge capable of describing some aspects of the decision maker's world (e.g., specify how to accomplish various tasks, indicate what conclusions are valid in various circumstances, and so forth), acquiring and maintaining descriptive knowledge (i.e., record keeping) and other kinds of knowledge (i.e., procedure keeping, rule keeping, and so forth), presenting knowledge on an ad hoc basis in various customized ways as well as in standard reports, selecting any desired subset of stored knowledge for either presentation or deriving new knowledge in the course of problem recognition or problem solving, and interacting directly with a decision maker or a participant in a decision maker in such a way that the user has a flexible choice and sequence of knowledge management activities (Holsapple and Whinston, 1996).
Group Support Systems	Systems that combine communication, computing, and decision support technologies to facilitate formulation and solution of unstructured problems by a group of people (DeSanctis and Gallupe, 1987).
	Interactive computer-based systems that support group work, including, but not limited to, decision making for semi-structured problems (Forgionne, 1991).
	Computer-based systems that support groups of people engaged in a common task and that provides an interface to a shared environment (Aiken and Vanjani, 1995).
Expert Systems	Systems that comprise at least a knowledge base, an inference engine, an explanation module, and a user interface in order to mimic expert decision-making (Jih, 1990).
Data Warehouse	A specially prepared repository of data created to support decision-making. Data are extracted from source systems, cleaned/scrubbed, transformed, and placed in data stores (Gray and Watson, 1998).
	A centralized repository of corporate data, needed mainly for internally-oriented decision support, extracted from the transaction processing systems, corporate suppliers' data, and external database (Turban, Rainer, and Potter 2001)
	A database designed to support decision making in organizations, usually batch updated and structured for rapid online queries and managerial summaries (Power 2002).
Organizational Decision Support Systems	Large decision aiding systems, which provide organization wide support for business processes. They provide an organization wide platform to enhance, facilitate, and enable the work of organizational members (Federowics and Konsynski, 1992).

Table 2. Success Factors –Technical

Technical Factors	
Factors	**Systems**
Data source systems characteristics	Data Warehouse
Development technology characteristics	Data Warehouse
Organization resource quality and availability	Data Warehouse
Information source characteristics	Decision Support Systems
Providing and managing required data by executives	Executive Information Systems
Managing additions and/or modifications to systems capabilities required by executives	Executive Information Systems
Utilizing appropriate development technology	Executive Information Systems
Domain expert characteristics	Expert Systems
Development systems characteristics	Expert Systems
Experience and length of usage	Expert Systems
Having aesthetic and comfortable dedicated facilities	Group Support Systems
Software usage flexibility	Group Support Systems
Facilitation support	Group Support Systems
Fast iteration of software changes	Group Support Systems
Online application implementation	Management Information Systems
Systems characteristics	Organizational Decision Support Systems
User friendliness of the systems	Organizational Decision Support Systems
Technical compatibility	Transaction Processing Systems/Electronic Data Interchange

Table 3. Success Factors – Task Factors

Task-Related Factors	
Factors	**Systems**
Task newness	Decision Support Systems
Task difficulty	Decision Support Systems
Task predictability	Decision Support Systems
Task interdependence	Decision Support Systems
Task standardization	Decision Support Systems
Task authority	Decision Support Systems
Task uncertainty	Decision Support Systems
Defining information requirements	Executive Information Systems
Problem difficulty	Expert Systems
Problem importance	Expert Systems
The number of administrative applications	Management Information Systems

Table 4. Success Factors – Managerial Factors

Managerial Factors	
Factors	**Systems**
Management support	Data Warehouse
Top management support	Decision Support Systems
The level of managerial activity supported by the systems	Decision Support Systems
Having an operating sponsor	Executive Information Systems
Having an executive sponsor	Executive Information Systems
Having top management support	Executive Information Systems
Management support	Expert Systems
An executive sponsor commitment	Group Support Systems
An operating sponsor involvement	Group Support Systems
Meeting managerial expectations.	Group Support Systems
Management attitude toward scientific approach	Management Information Systems
Management support	Management Information Systems
Management priority	Management Information Systems
Management support	Organizational Decision Support Systems

Table 5. Success Factors – Organizational Factors

Organizational Factors	
Factors	**Systems**
Having an appropriate IS staff	Executive Information Systems
Linking systems to specific business requirements	Executive Information Systems
Managing organizational resistance	Executive Information Systems
Having IS staff who work closely with executives	Executive Information Systems
Having IS staff who sell concept, then technology	Executive Information Systems
Organizational commitment	Group Support Systems
Having IS function situated at higher organizational level	Management Information Systems
The use of systems in central department cite instead of in local department cite	Office Automation Systems
A project champion existence	Organizational Decision Support Systems
The extent of institutionalization of the systems	Organizational Decision Support Systems
The extent of external competition	Organizational Decision Support Systems
Organizational compatibility	Transaction Processing Systems/Electronic Data Interchange
Relative advantage of the new systems to the current methods/systems	Transaction Processing Systems/Electronic Data Interchange
Organizational support	Transaction Processing Systems/Electronic Data Interchange
The rigor of implementation process	Transaction Processing Systems/Electronic Data Interchange
The presence of control procedures	Transaction Processing Systems/Electronic Data Interchange
The level of integration with the current methods/systems	Transaction Processing Systems/Electronic Data Interchange
The level of imposition by business partners	Transaction Processing Systems/Electronic Data Interchange